

SPECIFICATIONS

Drilling and installation of three (3) test
pumping wells, one (1) injection well and
pumping tests

2nd Canadian Division Support Base Valcartier, Quebec

PSPC Project No.: R.120388.840

July 2022

TABLE OF CONTENTS

| | | |
|-------|---|----|
| 1. | BACKGROUND..... | 5 |
| 2. | OBJECTIVES..... | 6 |
| 3. | MANDATE DESCRIPTION | 7 |
| 4. | GENERAL INFORMATION | 8 |
| 4.1. | Definitions..... | 8 |
| 4.2. | General..... | 8 |
| 5. | REGULATORY FRAMEWORK | 9 |
| 5.1. | Applicable standards, codes, and guides..... | 10 |
| 5.2. | Federal acts and regulations..... | 10 |
| 5.3. | Provincial and territorial acts and regulations..... | 11 |
| 6. | DESCRIPTION OF WORK SITE | 12 |
| 7. | CONTRACTOR RESTRICTIONS AND USE OF THE SITE | 12 |
| 8. | SCHEDULE, WORK SCHEDULE, AND CONSTRAINTS..... | 14 |
| 8.1. | Project Schedule..... | 14 |
| 8.2. | Hours of work..... | 15 |
| 8.3. | Constraints in performing the work..... | 15 |
| 9. | DETAILED DESCRIPTION OF THE WORK..... | 16 |
| 9.1. | Drilling work | 16 |
| 9.2. | Installation of test pumping and injection wells..... | 18 |
| 9.3. | Materials for the installation of test pumping and injection wells..... | 22 |
| 9.4. | Well development | 23 |
| 9.5. | Management of water generated during well development | 24 |
| 9.6. | Observation well installation..... | 24 |
| 9.7. | Materials for the installation of the observation wells..... | 28 |
| 9.8. | Well development | 29 |
| 9.9. | Pumping tests | 29 |
| 9.10. | Step drawdown pumping test (4 steps) | 30 |
| 9.11. | Long-term pumping tests (5 days/120 hours)..... | 31 |
| 9.12. | Management of the water generated during pumping tests..... | 32 |
| 9.13. | Recommissioning of the existing pumping well (PO-390)..... | 34 |
| 9.14. | Electricity | 34 |
| 9.15. | Site restoration..... | 35 |
| 10. | COMMUNICATIONS | 36 |
| 11. | MEETINGS | 36 |
| 11.1. | Kick-off meeting | 36 |
| 11.2. | Other meetings | 36 |
| 12. | DELIVERABLE DOCUMENTATION..... | 37 |
| 13. | DOCUMENTS REQUIRED AT WORK SITE | 38 |
| 14. | HEALTH AND SAFETY | 39 |

| | |
|--|----|
| 14.1. Compliance requirements | 39 |
| 14.2. Liability..... | 39 |
| 14.3. Occupational Health and Safety Program (OHSP)..... | 40 |
| 14.4. Status and conditions of project/site..... | 42 |
| 14.5. Site control and access..... | 42 |
| 14.6. Accident and incident reporting..... | 43 |
| 14.7. Documents and elements to submit | 43 |
| 15. ENVIRONMENTAL PROTECTION | 44 |

ANNEXES

ANNEX A – Figures

Figure 1 – General Work Locations

Figure 2 – Location of installations for boreholes and pumping tests – West Area

Figure 3 – Location of installations for boreholes and pumping tests – East Area

Figure 4 – Location of installations for pumping existing well – PO-390 Area

ANNEX B – Photographs

ANNEX C – Forms – DRDC-Valcartier

ANNEX D – Diagrams of wells to be installed

Diagram 1a – Diagram for Projected Pumping Well PPE-1 (East Area)

Diagram 1b – Diagram for Projected Pumping Well PPE-2 (East Area)

Diagram 1c – Diagram for Projected Pumping Well PPO-1

Diagram 2 – Diagram for Projected Injection Well IP-9

Diagram 3a – Diagram for Projected Observation Wells PO-803 and PO-804 into the upper unconfined aquifer (East Area)

Diagram 3b – Diagram for Projected Observation Well PO-805 into the semi-confined aquifer (East Area)

Diagram 3c – Diagram for Projected Observation Well PO-801 into the regional unconfined aquifer (West Area, Upper part)

Diagram 3d – Diagram for Projected Observation Wells PO-799, PO-800 and PO-802 into the regional unconfined aquifer (West Area, Lower part)

ANNEX E – Example – Emergency Response Plan in Accordance with DND Procedures

ANNEX F – Environmental Protection

ANNEX G – Environmental Monitoring Form

1. BACKGROUND

- 1.1** The Valcartier area is located 30 km northwest of downtown Quebec City. This area is east of the Jacques Cartier River and is bordered by Keable Mountain to the north, Brillant Mountain to the east and Rolland-Auger Mountain to the south. Two (2) administrative entities of the Department of National Defence (DND) share this territory: 2nd Canadian Support Base Valcartier (Valcartier Base) and Defence Research and Development Canada (DRDC) Valcartier. The DRDC site is separated into two (2): DRDC-North – located north of road QC-369 and DRDC-South – located south of road QC-369. The Société Immobilière Valcartier Inc. (SIVI) property is located south of Valcartier Base and of DRDC-North but north of DRDC-South. Three (3) municipalities border the DND properties: the Municipality of Saint-Gabriel-de-Valcartier and Quebec City (Val-Bélair Area) to the east, and the City of Shannon to the west.
- 1.2** Contamination of groundwater with trichloroethylene (TCE) on DND properties in Valcartier was identified in the fall of 1997. Source areas identified in DRDC-North's locality and on SIVI property contribute to TCE contamination that migrates in part to the west (to the City of Shannon) and to the east (to the Municipality of Saint-Gabriel-de-Valcartier and the Val-Bélair area of Québec City). TCE, its degradation by-products (1,2-dichloroethylene (DCE) and vinyl chloride (VC)) and 1,4-dioxane are present in dissolved form in the groundwater.
- 1.3** The approach used to manage groundwater contamination is the implementation of an Integrated Regional Solution (IRS) to intercept TCE, DCE, VC and 1,4-dioxane contaminated groundwater plumes at the respective DND and SIVI properties. The IRS will consist of implementing and operating a pump and treat system (P&T) for a period of 15 years. Hydraulic barriers consisting of one or more pumping wells (as applicable) are planned to be installed at specific locations on the respective DND and SIVI properties.
- 1.4** Three (3) hydraulic barriers are currently being considered on DND property in the following areas, respectively: 1) West Barrier – located near the property boundary between the Valcartier Base and the City of Shannon; 2) DRDC-North's West Barrier – located directly west of DRDC-North's property; 3) DRDC-North's East Barrier – located directly east of DRDC-North's property.
- 1.5** Pumping tests are to be performed to confirm the site's hydrogeological conditions at the planned locations for two (2) out of the three (3) planned hydraulic barriers for DND's P&T system, that is, at the planned location for DRDC-North's West Barrier and DRDC-North's East Barrier. A test well has already been installed, and pumping tests were already conducted in 2012 and 2015 in the of the West Barrier area (PO-390).
- 1.6** This mandate includes the drilling and installation of three (3) test pumping wells (one (1) in the area west of DRDC-North and two (2) in the area east of DRDC-North); drilling and installation of one (1) injection well for the discharge of water pumped west of DRDC-North; drilling and installation of seven (7) observation wells; and three (3) step and long-period pumping tests.
- 1.7** The work also includes the recommissioning of existing pumping well PO-390 to allow sampling of the pumped water.
- 1.8** The Contractor shall schedule its work so that the maximum amount of work under this mandate is completed in the fall of 2022.
- 1.9** In the event that some drilling work must be carried out in winter conditions, the Contractor will be responsible for snow removal from access roads and work areas.

- 1.10** No pumping test work is planned in winter conditions. In the event that the weather conditions do not allow for all pumping tests to be completed in the fall of 2022, those pumping tests that could not be completed in 2022 will need to be completed in the spring of 2023. The PSPC Representative will determine whether or not the weather conditions allow the work to be carried out in 2022.
- 1.11** **Figure 1 of Annex A** presents the overall location of the work to be performed in the Valcartier territory. **Figures 2, 3 and 4 of Annex A** provide the location of the three (3) respective areas covered by the work (West, East and PO-390 areas) as well as the respective locations of the test wells and observation wells to be developed.

2. OBJECTIVES

- 2.1** Public Services and Procurement Canada (PSPC) Environmental Services (ES), on behalf of DND, requires the services of a drilling contractor to perform drilling and installation work on pumping test wells, observation wells and one (1) injection well, as well as to conduct pumping tests.
- 2.2** The mandated Contractor shall drill and install three (3) test pumping wells at the superficial deposits (specified flow rates of 2000 m³/d, 700 m³/d and 100 m³/d) at the locations shown in **Figures 2 and 3 of Annex A** and develop the installed wells. The installation of the test pumping wells shall be done according to the specifications detailed in section 9.2 of the document.
- 2.3** The Contractor shall drill and install seven (7) observation wells in the superficial deposits that will be used to monitor water levels during pumping tests, etc. The installation of the observation wells shall be performed at the locations shown in **Figures 2 and 3 of Annex A** and as specified in section 9.6 of the document.
- 2.4** The Contractor shall drill and install one (1) injection well in the superficial deposits for the removal of the pumped water during the pumping test at one of the test pumping wells (west of DRDC-North). This injection well will also be used to release its water from installation and the water from the installation coming from the test pumping well (west of DRDC-North). The installation of the injection well shall be performed at the location shown in **Figure 2 of Annex A** and according to the specifications detailed in section 9.2 of the document.
- 2.5** To allow for groundwater sampling, the Contractor shall recommission existing pumping well PO-390. Further details are provided in section 9.13 of the document. **Figure 4 of Annex A** illustrates the location of existing pumping well PO-390.
- 2.6** On completion of the drilling work, the Contractor will be required to rehabilitate the work site, including the disposal of the drill cuttings at a location authorized by the DND Representative. Further details are provided in sections 9.1.16 and 9.1.17 of the document.
- 2.7** Pumping tests must be performed sequentially and shall not be performed concurrently. The order of completion of the pumping tests in the three (3) test wells will be specified by DND.

- 2.8** The drilling and well installation, pumping testing and the recommissioning of well PO-390 will be supervised by the DND-mandated engineering consultant (DND Engineering Consultant).
- 2.9** The Contractor shall provide for the presence of an on-site technician throughout the pumping tests (day and night) to ensure proper operation of the equipment during testing.
- 2.10** The Contractor will be responsible for providing the electricity required for this project. Further details are provided in section 9.14 of the document.

3. MANDATE DESCRIPTION

- 3.1.** This document describes the services that the Contractor will be required to provide to PSPC as part of this mandate. The Contractor shall be responsible for providing all necessary equipment and materials, including electrical power, for the proper performance of these services. This mandate consists of five (5) components, which include the following and are detailed in section 9 of the document:

1) Installation of three (3) test pumping wells (PPO-1, PPE-1, PPE-2)

- Drilling and installation of test pumping wells PPO-1, PPE-1 and PPE-2.
- Development of the three (3) test pumping wells and preparation for commissioning.
- Management of drill cuttings and water from the development of test pumping wells.

2) Installation of an injection well (PI-9)

- Drilling and installation of one (1) injection well.
- Development of injection well and preparation for commissioning.
- Management of the drill cuttings and water from the development of the injection well.

3) Installation of seven (7) observation wells

- Drilling and installation of four (4) observation wells near test well PPO-1 (PO-799, PO-800, PO-801, PO-802).
- Drilling and installation of two (2) observation wells near test well PPE-1 (PO-803, PO-804).
- Drilling and installation of one (1) observation well near test well PPE-2 (PO-805).
- Management of drill cuttings.
- The development of installed observation wells will be done by the DND Engineering Consultant, including the management of generated water.

4) Performance of pumping tests on the three (3) test pumping wells installed

- Perform pumping tests, independently, on test wells PPO-1, PPE-1 and PPE-2.
- Step drawdown tests (four (4) steps, up to one (1) hour each).
- Long-term tests (continuous constant rate pumping tests for up to five (5) days (120 hours)).
- Each pumping test also includes an estimated upwelling period of five (5) days (120 hours).
- Providing temporary equipment for conducting the pumping tests and reading water levels in pumped wells, including, but not limited to, submersible pumps, feeder and discharge lines, valves, flow metres, etc.
- Managing the pumped water.
- Continuous monitoring (day and night) of pumping test work (resident supervisor).

5) Recommissioning of existing pumping well (PO-390)

- Providing temporary equipment for the recommissioning of PO-390, including, but not limited to, submersible pump, feeder and discharge lines, valves, flow metres, etc.
- Pumping water from the existing well.
- Managing the pumped water.

4. GENERAL INFORMATION

4.1. Definitions

- 4.1.1. DND: Department of National Defence
- 4.1.2. PSPC: Public Services and Procurement Canada is the organization in charge of managing the contract in relation to the work described in this document on behalf of DND.
- 4.1.3. Contractor: The corporations or individuals hired under this Contract to perform the work ordered by the PSPC Representative, including drilling and pumping testing.
- 4.1.4. Drilling Team: A drilling team consists of the Contractor's personnel and equipment and/or its drilling subcontractors.
- 4.1.5. DND Engineering Consultant: A corporation or individual under contract with DND who will oversee drilling and pumping testing.

4.2. General

- 4.2.1. At all times, the work shall be performed in accordance with applicable legislation, regulations, policies, codes, directives or requirements applicable to the field of work, including specific safety requirements and directives required by DND in the Valcartier Base and DRDC territory (described in section 7).
- 4.2.2. The Contractor is responsible for the drilling and installation work for the testing pump wells, the observation and injection wells, the installation of the equipment to conduct the pumping

tests, and the recommissioning of the existing pumping well (PO-390). The Contractor shall ensure that its employees and subcontractors, if applicable, are qualified and hold the necessary permits and tools and that they comply with each of the items in this specification, including the corrigenda.

- 4.2.3. During the Contractor's field work, the DND Engineering Consultant will provide ongoing supervision during well drilling and installation, as well as partial and no-residence supervision during the pumping tests and the recommissioning of the existing pumping well (PO-390). A representative for the DND Engineering Consultant will prepare the drilling logs. A representative for the DND Engineering Consultant will be present during the pumping step tests and at the start and stop of the long-term pumping tests. It will also provide partial monitoring during long-term pumping tests and the recommissioning of existing pumping well (PO-390) and will be in charge of collecting water samples for all pumping tests. The Contractor will be responsible for ongoing supervision during the pumping tests (step drawdown tests and long term) and during the recommissioning of PO-390.
- 4.2.4. The DND Engineering Consultant will be responsible for the sampling and analysis of drill cuttings for transportation and management purposes and/or disposal by the Contractor.
- 4.2.5. To avoid delays, all materials will need to be available on site for each stage of the work. The Contractor will be required to perform the work using the materials described in this document. Any use of materials not mentioned in this document will require prior approval by the PSPC Representative. Furthermore, the Contractor shall provide the equipment and materials necessary to carry out the work requested in this specification. Installation and connection of materials, pipes and accessories shall be in accordance with the manufacturer's requirements.
- 4.2.6. The Contractor will note that no compensation will be awarded for stoppages caused by the nature of the work and/or military activities on the site; for example, sampling of drill cuttings, water treatment, water sampling, inability to access certain areas in connection with military activities, etc.
- 4.2.7. Should the Contractor notice a discrepancy between this document and the other documents in this call for tenders, the Contractor must bring it to the attention of PSPC. If there is an ambiguity or a difference between different parts of the call for tender documents, the Contractor shall refer to the contracting authority who will decide on the interpretation to be given to them, to which the Contractor must comply.
- 4.2.8. The Contractor must ensure that it has sufficient knowledge of the site prior to bidding. Insufficient knowledge of where the work will take place will not result in any claim from the Contractor. Section 6 presents the location of the various tasks under this mandate and access to the work areas and is to be read in conjunction with **Annex A Figures 1 to 4** and **Annex B** photos.

5. REGULATORY FRAMEWORK

The Contractor must perform its work in accordance with applicable federal, provincial or municipal laws, regulations, codes, guides and standards, including the specific requirements required by the Valcartier Base and DRDC (described in section 7).

Although the work sites are on federal lands, all work must be carried out in accordance with the laws and regulations applicable in Quebec.

The Contractor must ensure, at its own expense, that it uses the most recent version of the various applicable regulations, codes, standards, and legislation applicable to the project.

5.1. Applicable standards, codes, and guides

Generally, and not exclusively, the most recent version of the standards and codes published by the following organizations will need to be met within the scope of this mandate:

- National Building Code of Canada
- National Plumbing Code
- Canada Labour Code
- Quebec Construction Code
- Standards of the Bureau de normalisation du Québec (BNQ)
- American National Standards Institute (ANSI)
- Canadian Standard Association (CSA)
- American Institute Steel Construction (AISC)
- Bureau des examinateurs des électriciens (BEE) Standards
- Canadian Standards Association (CSA)
- Canadian Electrical Code and Quebec Amendments (CEC)
- Electrical Equipment Manufacturers Association of Canada (EEMAC)
- National Electrical Manufacturer's Association (NEMA)
- American Society for Testing and Material (ASTM)
- American Iron and Steel Institute (AISI)
- American Standard Association (ASA)
- Canadian Government Specification Boards (CGSB)
- International Electrical Commission (IEC)
- Institute of Electrical and Electronics Engineers (IEEE)
- American Water Work Association (AWWA)
- National Sanitation Foundation (NSF)
- Workplace Hazardous Materials Information System (WHMIS)
- International Organization for Standardization (ISO)
- Occupational Safety and Health Administration (OSHA)
- Applicable local codes and regulations and municipal by-laws
- Quebec Plumbing Code
- Quebec General Specifications and Specifications (CCDG)
- Intervention Guide – MELCC's Protection des sols et réhabilitation des terrains contaminés
- Safety Code for the Construction Industry
- Underwriters Laboratory of Canada (ULC)

In the event of a discrepancy between different regulations, codes, standards, and legislation, the strictest requirement will have to be followed. If equivalent standards are used, they must be equal to or more restrictive than the standards listed above.

5.2. Federal acts and regulations

The Contractor must comply with the following federal Acts and Regulations (non-exhaustive list):

- *Canadian Environmental Protection Act*

- *Canadian Fisheries Act*
- *Canada Water Act*
- *Canadian Transportation of Dangerous Goods Act*
- *Canada Occupational Health and Safety Regulations*

5.3. Provincial and territorial acts and regulations

In the event that a federal act or regulation does not exist, or if otherwise mentioned in this specification, the following provincial Acts and regulations (non-exhaustive list) shall be complied with by the Contractor:

- *Act respecting occupational health and safety*, R.S.Q. c. S-2.1
- *Quebec Environment Quality Act (EQA)* (L.R.Q., c. Q-2)
- *Water Withdrawal and Protection Regulation* (Q-2, r. 35.2)
- *Regulation respecting the regulatory scheme applying to activities on the basis of their environmental impact* (Q-2, r. 17.1)
- *Regulation respecting the quality of drinking water (RQE)* (Q-2, r. 40)
- *Regulation respecting hazardous materials* (c. Q-2, r. 32)
- *Regulation respecting the burial of contaminated soils* (c. Q-2, r. 37)
- *Regulation respecting contaminated soil storage and contaminated soil transfer stations* (Q-2, r.46)
- *Regulation respecting the traceability of excavated contaminated soils* (Q-2, r.47.01)
- *Regulation respecting pressure installations* (Chapter B-1.1, r. 6.1)
- Provincial workers compensation legislation (including, but not limited to *Act respecting occupational health and safety* (chapter S-2.1) and *Act respecting industrial accidents and occupational diseases* (chapter A-3.001)) and related regulations

6. DESCRIPTION OF WORK SITE

- 6.1** The work described in this document will be carried out on Base Valcartier and DRDC land. The work will be carried out in three (3) separate areas (hereinafter referred to as the East area, the West area, and PO-390 area), all three (3) being within a radius of approximately two (2) kilometres from the main entrance to the Valcartier Base (intersection of De la Bravoure Boulevard (QC-369) and Général TL Tremblay Street). The East area is located within DRDC-North boundaries and includes test pumping wells PPE-1 and PPE-2 to be constructed. The West area is located within the boundaries of Valcartier Base and includes test pumping well PPO-1 and injection well PI-9, both of which are to be constructed. The PO-390 area is located within the boundaries of Valcartier Base and includes existing pumping well PO-390 that will need to be recommissioned as part of this mandate. The location of the work is shown in **Annex A, Figures 1 to 4**.
- 6.2** Gravel access roads and work areas have been constructed following deforestation (clearing), allowing access to the locations of test wells PPE-1, PPE-2, and PPO-1 and nearby observation wells.
- 6.3** The drilling of the observation wells will be carried out in deforested and accessible areas.
- Drilling of observation well PO-799 (West area) will be conducted in a gravel work area, accessible by a gravel access road from Grande Hermine Street.
 - Drilling of observation wells PO-800 and PO-801 (West area) will take place in a parking lot (asphalt surface), accessible from Grande Hermine Street.
 - Access to observation well PO-802 (West area) requires crossing area that is deforested and uncultivated. The surface soil in this area is sandy and well-drained.
 - Drilling of observation wells PO-803 and PO-805 (East area) will be conducted in gravel work areas, accessible through dirt and/or gravel paths from DRDC-North.
 - Drilling of observation well PO-804 (East area) will take place in a gravel work area, accessible by a dirt and/or gravel access road from the guard house to the ammunition storage area (MAG).
- 6.4** The drilling of the injection well will be carried out in a field west of Général T.L. Tremblay Street. This area is accessible via an existing path with vegetation. The surface soil in this area is sandy and well-drained.
- 6.5** Photographs demonstrating the work areas are included in **Annex B**.

7. CONTRACTOR RESTRICTIONS AND USE OF THE SITE

- 7.1** The Contractor's use of the work site is limited to work areas, access roads and other locations specified by the PSPC Representative. Arrivals to and departures from the Base and DRDC-North are subject to restrictions imposed, if any, by military operations in these areas.
- 7.2** The Contractor and its subcontractors will be required to provide the PSPC Representative with a list of employees associated with the project and who need to access the site (including subcontractor employees, if applicable). No unauthorized person shall enter the site unless specifically authorized to do so by the PSPC Representative. The list of employees must also

include the list of vehicles used on site as well as electronic equipment (see items below). The Contractor must complete and submit, at least one (1) week prior to the commencement of fieldwork, the *Notice of Visit* table provided in **Annex C** with information from its employees and its subcontractor employees, if applicable.

- 7.3 Personal vehicles are not permitted on DRDC-North property. Any vehicle, whether for a company or a rental vehicle, entering DRDC-North must be registered in the name of the company.
- 7.4 The use of cellular phones in DRDC-North and in the ammunition storage area (MAG) (for access to PO-804) is strictly prohibited. The use of a cellphone is permitted at the work site (outside the DRDC-North fence and ammunition storage area for safety purposes during the work, after authorization has been issued by the Security Office. Certain computer equipment (e.g. GPS, iPad) can also be used in local mode, and after authorization has been issued. To do so, the Contractor must complete the *Declaration of electronic equipment for Valcartier Research Center Visitor(s)*. All electronic equipment shall be reported to the guard house allowing access to the ammunition storage area (for access to PO-804). No photos are permitted in DRDC's compound or in the ammunition storage area. A copy of the *Declaration of electronic equipment for Valcartier Research Center Visitor(s)* is included in **Annex C**.
- 7.5 The Contractor's personnel who are to work on the site (including subcontractors who are to work on the site) will be required to be informed of specific safety rules and measures, including procedures for accessing the site, prohibited material on the site, emergency measures to be known in the event of an evacuation from the site, contacts in the event of an emergency, such as fires, accidents, etc. Specific safety rules and measures will be explained at the start-up meeting (videoconference). The Contractor must ensure, as a minimum, that its site superintendent and project authority assigned to the project are present. The Contractor will be responsible for informing its personnel (including its subcontractors) who are required to work on site of the specific safety rules and measures that will have been discussed at the start-up meeting.
- 7.6 As the site work is to be performed exclusively outdoors, no reliability status is required for personnel who must access the site under this mandate. However, support may be required by a Commissionaire for access to work areas located in DRDC-North and south of the ammunition storage area (MAG) (PO-804). Specific instructions for access to these sites (padlock management, access to restrooms) will be provided at the first entry to the site.
- 7.7 During long-term pumping tests, which are to be performed 24 hours a day (day and night), the Contractor may bring a trailer to the work site. A chemical toilet shall be provided as no access to the buildings will be permitted outside normal working hours. The Contractor will be responsible for providing electrical power and drinking water to the trailer. DND will not provide any drinking water or electricity. In the western area of the work, the trailer and chemical toilet shall be installed, if applicable, north of the parking lot located on Grande Hermine Street (see **Figure 2 of Annex A**). At the DRDC-North site (East area), the trailer and chemical washroom, if applicable, will be installed outside the fenced enclosure, in the work area (see **Figure 3 of Annex A**).
- 7.8 Prior to the commencement of fieldwork, the Contractor must determine the location of underground public utilities within the work areas from Info-Excavation.
- 7.9 Checking for the presence of unexploded explosive ordnance (UXO) will have been carried out in advance by DND in the work areas.
- 7.10 The DND Representative will be responsible for making requests to identify existing underground

infrastructure within DND, within the work areas, to the appropriate authorities. Confirmation of digging clearance will be forwarded by the DND Representative to the Contractor. Should unidentified utilities be discovered during the work, the Contractor will be required to temporarily cease the work, immediately notify the PSPC Representative and provide a written report on the findings.

- 7.11** The Contractor must maintain a record of underground networks (maintained in service, diverted or abandoned) within the work areas. An updated copy of this record shall be included in the Contractor's daily reports.
- 7.12** No disconnection and/or connection to existing networks is possible on the site.
- 7.13** The Contractor must not unduly accumulate materials so as not to clutter the premises.
- 7.14** At the end of each work day and prior to leaving each work area, the Contractor must ensure that the site is safe and cleaned to ensure it is clean and free from debris, residues, materials or other objects. The Contractor must also clean the site of the equipment and materials it has provided (solvents, various containers, sampling equipment, etc.).

8. SCHEDULE, WORK SCHEDULE, AND CONSTRAINTS

8.1. Project Schedule

- 8.1.1. The Contractor must prepare a work schedule and ensure that it meets the schedule outlined below. The work schedule will need to be agreed upon with the PSPC Representative, DND and the DND Engineering Consultant at the start-up meeting.
- 8.1.2. The Contractor shall notify the PSPC Representative of any known and anticipated delays that may affect the completion date of the mandate and shall keep accurate records of the causes of the delays. Any delays anticipated by the Contractor must be immediately reported and justified in writing to the PSPC Representative.
- 8.1.3. The Contractor shall schedule its work so that the maximum amount of work under this mandate is completed in the fall of 2022.
- 8.1.4. The work included in this mandate must, at a minimum, meet the timelines outlined in the following table:

| Activity | Deadlines |
|--|-------------------------------------|
| Kick-off meeting | Seven (7) calendar days after award |
| Delivery of the Occupational Health and Safety Program including Emergency Measures Plan | Kick-off meeting |

| | |
|---|---|
| Delivery of work schedule | Two (2) calendar days following kick-off meeting |
| Completion of drilling - West Area (including drilling of pumping test well PPO-1, injection well PI-9 and four (4) monitoring wells (PO-799, PO-800, PO-801, PO-802) | Mid-October, 2022 |
| Completion of pumping tests – West Area | Mid-November, 2022 |
| Completion of drilling - East Area (including the drilling of test wells PPE-1, PPE-2 and three (3) monitoring wells (PO-803, PO-804 and PO-805) | End of November, 2022 |
| Recommissioning of existing pumping well PO-390 | End of November, 2022 |
| Completion of pumping tests – East Area | End of November, 2022 * |
| Field work ends | July 28, 2023 |
| Submission of daily reports | At the end of the day or, at the latest, the next morning before 11:00 a.m. |

* In the event that this work cannot be completed during the fall of 2022, pumping tests in the East Area cannot take place until June 26, 2023 due to the restricted periods for discharge to the ditch (fish habitat).

8.2. Hours of work

- 8.2.1. Unless otherwise specified, the work must be performed during normal business hours. The hours of work authorized at the Valcartier Base and on DRDC Valcartier land are from 7:00 a.m. to 6:00 p.m., Monday to Friday. The Contractor may access the work site only as directed by the PSPC Representative.
- 8.2.2. For conducting and monitoring the long-term pumping tests that will involve the presence of a supervisor at the work site outside of normal hours (day and night) and possibly on the weekend, the Contractor will be required to make a request for authorization to the PSPC Representative.
- 8.2.3. If the Contractor is planning to perform any other work on weekends, holidays and outside of normal business hours, the Contractor must first apply to the PSPC Representative for authorization.

8.3. Constraints in performing the work

- 8.3.1 The Contractor will be required to coordinate its activities based on the military activities on

the Valcartier Base and at DRDC Valcartier. The PSPC Representative will inform the Contractor if any military activities that may prevent the Contractor's work are planned.

9. DETAILED DESCRIPTION OF THE WORK

9.1. Drilling work

9.1.1. The Contractor will be responsible for drilling, well installation and pumping testing under the supervision of the DND Engineering Consultant. The latter will oversee the work and write the drilling logs.

9.1.2. For the purpose of bidding, the Contractor must consider the "double rotation" method for:

- Three (3) test pumping wells.
- One (1) injection well.
- Seven (7) observation wells.

Another drilling method previously approved by the PSPC Representative may be used for the work. The method of drilling shall facilitate the description of intercepted soils, but no soil sampling is required when the new wells are installed. **Table 1** provides an overview of the drilling work to be performed. The characteristics of each of the drillings and wells to be constructed are presented in the next sections of the document:

Table 1 – Diameter and approximate depth of drilling to be conducted

| Well identifier | Drilling depth (m) | Drilling diameter (m) | Hydrostratigraphic Unit |
|---------------------------|--------------------|-----------------------|-------------------------------------|
| Test pumping wells | | | |
| PPE-1 | 12 | 0.406 | Upper deltaic unconfined aquifer |
| PPE-2 | 21 | 0.406 | Deltaic semi-confined aquifer |
| PPO-1 | 35 | 0.406 | Deltaic regional unconfined aquifer |
| Injection well | | | |
| PI-9 | 35 | 0.508 | Deltaic regional unconfined aquifer |
| Observation well | | | |
| PO-799 | 35 | 0.152 | Deltaic regional unconfined aquifer |
| PO-800 | 35 | 0.152 | Deltaic regional unconfined aquifer |
| PO-801 | 18 | 0.152 | Deltaic regional unconfined aquifer |
| PO-802 | 35 | 0.152 | Deltaic regional unconfined aquifer |
| PO-803 | 12 | 0.152 | Upper deltaic unconfined aquifer |
| PO-804 | 12 | 0.152 | Upper deltaic unconfined aquifer |
| PO-805 | 21 | 0.152 | Deltaic semi-confined aquifer |

- 9.1.3. The Contractor shall ensure that its subcontractors comply with each item of the specification including the corrigendum.
- 9.1.4. No drilling will be performed until the methodology and sequence of work is accepted by the PSPC Representative.
- 9.1.5. The superficial deposits on the site consist mainly of sand with a little gravel and a few deep stones and blocks. A layer of clay silt is also present in the East area (PPE-1, PPE-2 and associated observation wells). The superficial deposits are generally low compactness (loose) with high potential for sand upwelling during drilling (boiling).
- 9.1.6. Given the depth of the wells, the low density of the superficial deposits and the presence of the water table over a significant length of drilling, the use of a casing during the drilling process will be required for drilling and the injection of fluids will need to be minimized. Only drinking water can be used as a drilling fluid, but in minimal quantities. Drilling mud will not be accepted. The PSPC Representative may suspend the drilling if, during the drilling, a quantity of fluids deemed too large is used. The Contractor will then need to adjust its drilling methodology to meet the PSPC Representative's requirements.
- 9.1.7. Drinking water used during drilling (including cleaning of equipment) shall be taken from the Valcartier Base at the thermal power plant (located at a maximum distance of 2.5 km from the work areas). At the kick-off meeting, the PSPC Representative will advise the Contractor of the specific location where the water supply will be located at the thermal power plant.
- 9.1.8. The Contractor shall ensure that the tanks used for transporting water are clean prior to use. Water samples will be taken (1) at the source and (2) in the tanks used by the Contractor when it is first used to validate the cleanliness of the tank. Water samples will be collected by the DND Engineering Consultant and submitted to the analytical laboratory for a 24-hour analysis for the following parameters: dissolved metals, volatile organic compounds (VOCs), petroleum hydrocarbons (C10-C50), and polycyclic aromatic hydrocarbons (PAH). The Contractor will not be required to wait for the results of the analyses before starting the drilling work. The Contractor may be held liable if contaminants are introduced into the groundwater with the use of water from its reservoirs during drilling operations.
- 9.1.9. The Contractor shall measure the quantities of water used for each drilling and record these quantities in its daily reports.
- 9.1.10. Prior to the start of the work at the site and between each drilling, the casing must be cleaned by steam jet with a soapy solution (phosphate-free Alconox®-type detergent), followed by a water vapour rinse. These precautions will prevent the possible spread of contamination from one well to another. All wash water and sludge generated shall be recovered and stored in a watertight container (barrel, tank, watertight container, etc.). The Contractor must purchase or lease the container, manage the wash water and sludge generated during washing, and clean/decontaminate the container.
- 9.1.11. The drill string and drill bit must be rinsed with water vapour and must also be cleaned with a soapy solution (phosphate-free Alconox® type detergent) prior to commencement of work at the site and between each drilling. These precautions will prevent the possible spread of contamination from one well to another. All wash water and sludge generated shall be recovered in the watertight container used by the Contractor.
- 9.1.12. Wash water and sludge generated shall be managed and disposed at a location authorized under the applicable regulations. The Contractor will be required to provide proof of disposal at the authorized location upon completion of the work. The Contractor shall provide for the

required chemical analyses for disposal at an authorized disposal site.

- 9.1.13. The Contractor will be required to provide steam jet cleaning equipment (water tank if required, compressor, hose, etc.) as well as cleaning products such as detergent, solvents, and water.
- 9.1.14. In the event of any complications associated with equipment and materials during drilling, any additional drilling will be at the Contractor's expense, including the costs of monitoring by the DND Engineering Consultant.
- 9.1.15. The drilling work must be strictly vertical. The Contractor will implement the appropriate techniques to achieve this verticality. The Contractor shall measure, under the supervision of the DND Engineering Consultant, for verticality and straightness of each well. In the event of a drilling deviation that does not permit the normal descent of a submersible pump or the instrumentation of the wells to be installed, the borehole shall be redrilled by the Contractor at its own expense (including the monitoring fee by the DND Engineering Consultant), unless otherwise authorized in writing by the PSPC Representative.
- 9.1.16. Prior to leaving each drilling site, samples of the drill cuttings will be taken by the DND Engineering Consultant and then subjected to chemical analysis to determine how the cuttings should be managed/disposed of. The DND Engineering Consultant will be responsible for sampling drill cuttings and submitting samples for chemical analyses, i.e. metals, VOCs and PAHs with a regular analysis delays.
- 9.1.17. Drill cuttings shall be left in a pile near the boreholes in an accessible location for loading pending the results of sample analyses. Piles of soil being temporarily stored must be placed on a waterproof surface (e.g. waterproof tarp) and covered with a properly secured waterproof tarp. Once the results of drilling spill analyses are available, the PSPC Representative will provide a copy of the analytical results to the Contractor, and according to these results, the representative will authorize the Contractor to proceed with the loading of the drill cuttings at the drilling sites. The drill cuttings shall be loaded by the Contractor and/or its subcontractors and then sent to the location designated by the DND Representative. Drill cuttings may be transported in bulk by the Contractor. If the Contractor chooses to use barrels/containers for the recovery and transportation of drill cuttings, these shall be provided by the Contractor. Soils may need to be transported on the Valcartier Base land, but may also need to be disposed of off-site, in a location authorized to receive them based on the environmental quality of the soils. For bidding purposes, provide for a total volume of 18 m³ of drilling cuttings to be recovered from the various drilling sites and then that the cuttings shall be transported to Valcartier Base land (administrative area) within a radius of approximately 2 km of the drilling sites. Once transported to the designated location on Valcartier Base land, the drill cuttings must be placed in a pile.
- 9.1.18. At any time and as the work progresses, the Contractor shall dispose of the accumulation and waste resulting from the work.
- 9.1.19. Upon completion of the work, after inspection by the DND Engineering Consultant, the Contractor shall clean up any dirt, scrap, and debris caused by its work and leave the work area clean.

9.2. Installation of test pumping and injection wells

- 9.2.1. The Contractor will be responsible for the installation of three (3) test pumping wells and one (1) injection well according to the characteristics presented in **Tables 2 to 5** below as well as in **Diagrams 1a, 1b, 1c, and 2** of **Annex D**. It is important to note that the characteristics

presented for the wells to be installed are preliminary and subject to change. The characteristics of the wells to be installed shall be confirmed by the PSPC Representative prior to the Contractor's purchase of the materials.

Figures 2 and 3 of Annex A indicate the location of the wells to be installed.

Table 2 – PPE-1 Test Pumping Well (East area of DRDC-North)

| PPE-1 (East area of DRDC-North): | | |
|---|-------------|--------------|
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 311853.34 m | 5194963.52 m |
| Ground elevation (Z) | 172.20 m | |
| Borehole depth (m) | 12 m | |
| Borehole diameter (m) | 0.406 m | |
| Length of screen | 5 m | |
| Diameter of screen | 0.254 m | |
| Screen openings | 0.762 mm | |
| Gravel pack (grade of silica sand) | #2 | |

Table 3 – PPE-2 Test Pumping Well (East area of DRDC-North)

| EPP-2 (East area of DRDC-North): | | |
|---|-------------|--------------|
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 311922.82 m | 5194906.23 m |
| Ground elevation (Z) | 171.2 m | |
| Borehole depth (m) | 21 m | |
| Borehole diameter (m) | 0.406 m | |
| Length of screen | 4 m | |
| Diameter of screen | 0.254 m | |
| Screen openings | 1.27 mm | |
| Gravel pack (grade of silica sand) | #3 | |

Table 4 – Test Pumping Well PPO-1 (West area of DRDC-North)

| PPO-1 (West area of DRDC-North): | | |
|---|-------------|--------------|
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 310424.81 m | 5195571.92 m |
| Ground elevation (Z) | 175.68 m | |
| Borehole depth (m) | 35 m | |
| Borehole diameter (m) | 0.406 m | |
| Length of screen | 8 m | |
| Diameter of screen | 0.254 m | |
| Screen openings | 1.27 mm | |
| Gravel pack (grade of silica sand) | #3 | |

Table 5 – Injection Well PI-9 (West area of DRDC-North)

| PI-9 (West area of DRDC-North): | | |
|---|-------------|--------------|
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 310174.17 m | 5195485.17 m |
| Ground elevation (Z) | 175.37 m | |
| Borehole depth (m) | 35 m | |
| Borehole diameter (m) | 0.508 m | |
| Length of screen | 15.40 m | |
| Diameter of screen | 0.305 m | |
| Screen openings | 1.27 mm | |
| Gravel pack (grade of silica sand) | #3 | |

- 9.2.2. The work includes all the work involved in the provision and installation of well components including standard black steel casings, drive shoes, stainless steel screens, annular space fill and sealing materials (bentonite or bentonite cement) and lockable protective covers.
- 9.2.3. The joints between the steel casings must be welded to form a seal and to prevent further corrosion.
- 9.2.4. Pumping wells PPE-1 and PPO-1 will be constructed according to the procedures described below and according to the characteristics presented in **Tables 2 and 4**, and in accordance with **Diagrams 1a and 1c from Annexe D**:

- Drill (as per expected diameter) to the designated depth to allow a 0.6 m (24") long casing to be installed under the screen.
- Assemble the well column (casing, screen, centralizers, ...) according to the expected characteristics and gradually introduce it into the outer casing (of adequate diameter).
- Fill the annular space with silica sand, bentonite pellets, and cement-bentonite grout as follows:
 1. The sand will be inserted 1) into the borehole at a thickness of 0.3 m (12 inches) prior to the introduction of the casing and screen, 2) into the annular space up to 5 m (16 ft) from the surface.
 2. Raise the outer casing as the silica sand is put in place. Raising this casing shall be done step by step as the annular space is filled. Unless otherwise stated, this raising in steps shall not exceed one (1) metre at a time.
 3. Add a 1-m (36 inches) thick bentonite pellet cap over the silica sand.
 4. Add a cement-bentonite grout above the bentonite pellet cap to the ground level. The cement-bentonite grout will be injected using an injection casing. The outer casing will be gradually removed as the grout is injected.
 5. Raise the outer casing to the ground surface.

- 9.2.5. The installation of pumping well PPE-2 shall be done according to the procedures described below and according to the characteristics shown in **Table 3** and in accordance with **Diagram 1b of Annex D**:

- Drill (as per expected diameter) to the designated depth to allow a 0.6 m (24") long

casing to be installed under the screen.

- Assemble the well column (casing, screen, centralizers, ...) according to the expected characteristics and gradually introduce it into the outer casing (of adequate diameter).
- Fill the annular space with silica sand, bentonite pellets, and cement-bentonite grout as follows:
 1. The sand will be inserted 1) into the borehole at a thickness of 0.3 m (12 in.) before the casing and screen are introduced, 2) into the annular space up to 15 m (49 ft) from the surface.
 2. Raise the outer casing as the silica sand is put in place. Raising this casing shall be done step by step and as the annular space is filled. Unless otherwise stated, this raising in steps shall not exceed one (1) metre at a time.
 3. Add a 1-m (36 inches) thick bentonite pellet cap over the silica sand.
 4. Add a cement-bentonite grout above the bentonite pellet cap to the ground level. The cement-bentonite grout will be injected using an injection casing. The outer casing will be gradually removed as the grout is injected.
 5. Raise the outer casing to the ground surface.

9.2.6. The installation of the PI-9 pumping well will follow the procedures described below and the characteristics presented in **Table 5** as well as those illustrated in **Diagram 2 of Annex D**:

- Drill (as per expected diameter) to the designated depth to allow a 0.6 m (24") long casing under the screen.
- Assemble the well column (casing, screen, centralizers, ...) according to the expected characteristics and gradually introduce it into the outer casing (of adequate diameter).
- Fill the annular space with silica sand, bentonite pellets, and cement-bentonite grout as follows:
 1. The sand will be inserted 1) into the borehole at a thickness of 0.3 m (12 inches) before the casing and screen are introduced, 2) into the annular space up to 5 m (16 ft) from the surface.
 2. Raise the outer casing as the silica sand is put in place. Raising this casing shall be done step by step and as the annular space is filled. Unless otherwise stated, this raising in steps shall not exceed one (1) metre at a time.
 3. Add a 1 m (36 inches) thick bentonite pellet cap over the silica sand.
 4. Add a cement-bentonite grout above the bentonite pellet cap to the ground level. The cement-bentonite grout will be injected using an injection casing. The outer casing will be gradually removed as the grout is injected.
 5. Raise the outer casing to the ground surface.
- Install the well column head with a 305-mm (12 inches) diameter steel well seal with a 152mm (6 inches) diameter opening for the installation of a 152-mm (6 inches) diameter and 30-m long discharge line with seal for injecting water. The well column head shall be so installed as to allow access to the well for water level measurements.

- 9.2.7. All materials shall comply with the requirements set out in this section and shall be approved by the DND Engineering Consultant. Furthermore, the installation of the wells will be subject to the MELCC's *Règlement sur le prélèvement des eaux et leur protection*.
- 9.2.8. On the surface, the soil will be levelled to avoid the pooling of stagnant water and to prevent water from filtering into the soil within a radius of one (1) m of the well.
- 9.2.9. The Contractor shall ensure that the well's outer casing (as per the expected diameter) exceeds the ground by a height of approximately 0.45 m (1.5 ft) and that the well column casing exceeds the ground by a minimum height of 60 cm (2 feet) and a maximum height of 1 metre.
- 9.2.10. Once the drilling and commissioning work for the test pumping wells and the injection well has been completed, the Contractor shall provide the following information in its daily reports for each well:
- Date/duration of construction.
 - Drilling method.
 - Location and identification.
 - Borehole and casing diameter.
 - Drilling depth.
 - Casing material.
 - Sealing materials (type and volume/quantity) used and installation levels.
 - Development and construction.
 - Installation procedure (method, duration).
 - Cleaning procedure.
 - Protective cover.
 - Special remarks.

9.3. Materials for the installation of test pumping and injection wells

- 9.3.1. All materials shall comply with the requirements set out in this section and shall be approved by the PSPC Representative. A summary of minimum material requirements is provided in the following paragraphs. The following equipment will be used for the development of test pumping and injection wells.

Temporary casing for well drilling and the drive shoe

The standard black steel casing (according to diameter and length) will be made of new material according to ASTM A-53/53M99b (Grade B) standard. The joints shall be welded in accordance with AWWA and ASTM standards. The casing shall be fitted with a drive shoe at its end.

Well casing

The standard black steel casing (according to the expected diameter and length) forming the well column will be made of new material according to ASTM A-53/53M99b (Grade B).

The joints shall be welded in accordance with AWWA and ASTM standards. The thickness of each casing will be a minimum of 4.8 mm (3/16"). Regardless of the expected length of each well, allow for a mandatory casing length of 1.0 m above ground level and a length of 0.6 m below the base of the screen.

Screens

The features of the perforated section of each well are presented above (Tables 2 to 5). The perforated screen will be composed of SS304 stainless steel according to ASTM A-53/A53M-99b. The joints will be welded in accordance with AWWA and ASTM standards. The thickness of the casing shall be at least 6.3 mm (1/4").

Annular space sealing and filling materials

Sealing of surface wells will be done with standard granular bentonite and bentonite powder and normal Portland cement, type 10, according to CSA Standard A-5. The annular space will be sealed with grout consisting of water, cement powder and bentonite as follows: 27 litres of clean water, 42.7 kg of Portland cement and 1.5 kg of bentonite powder. The mixture will be homogenized before it is introduced in the borehole using an injection casing. A waiting time defined by the supervisor (DND Consulting Engineer) shall be respected after the granular bentonite has been placed to ensure the seal is watertight, before the cement-bentonite grout is introduced.

The gravel pack around the screened section will consist of rounded silica sand. The characteristics of the gravel pack of each well are presented above (**Tables 2 to 5**).

Centralizers

Three (3) standard steel centralizers will be installed along the column of each well. If possible, they will be located at the base of the screen (on the 0.6-m casing section) and above the perforated screen, at the casing level. They will ensure the vertical position of the column in the borehole.

Protective cover

Each well, except the injection well, will be provided with an (1) aluminum protective cover (with handle and padlock) that will be installed on the protective casing (of appropriate diameter). The required locks will be provided by the PSPC Representative.

9.4. Well development

- 9.4.1. Each well shall be cleaned by air injection to remove fine particles from the well and reduce water turbidity. Each well will be cleaned for a minimum of eight (8) hours or until the water is free of fine particles. The well capacity assessment (flow estimate) must also be completed by the Contractor at this stage.
- 9.4.2. The development of each well will be accompanied by a double packer type of double jiggling accompanied by an air injection (air-lift). The jiggling shall be done in 1-m sections of screen at a minimum rate of 30 strikes per minute.

- 9.4.3. Upon completion of the development, the sediments at the bottom of each well will need to be removed (using the air lift method or using a bailer pump).
- 9.4.4. The DND Engineering Consultant will determine when the development of each well has been completed.

9.5. Management of water generated during well development

Test pumping wells PPE-1 and PPE-2 (East area of DRDC-North):

- 9.5.1. When developing test pumping wells PPE-1 and PPE-2, the Contractor must discharge the water to the ground without prior treatment. However, the area where the water will be released must allow the water to flow on the ground and infiltrate so that it cannot reach the ditch along the access road.
- 9.5.2. The work area shall not be flooded with the release of water during development. The Contractor must provide for a pipe approximately 50 m in length to discharge development water into the wooded area downstream of the developed pumping well (to the southeast).

Test pumping well PPO-1 (West area of DRDC-North):

- 9.5.3. During the development of test pumping well PPO-1, the Contractor shall discharge the water to the ground without prior treatment. However, the area where the water will be released must allow the water to flow on the ground and infiltrate so that it cannot reach the parking lot located east of the work area, neither the surrounding roads.
- 9.5.4. The work area shall not be flooded with the release of water during development. The Contractor must provide for a pipe approximately 30 m in length to discharge water into the wooded area downstream of the developed pumping well (to the southwest).

Injection Well PI-9 (West area of DRDC-North):

- 9.5.5. When developing the PI-9 injection well, the Contractor shall discharge the water to the ground without prior treatment. However, the area where the water will be released must allow the water to flow on the ground and infiltrate so that it cannot reach the parking lot located west of the work area, nor the ditch bordering the road QC-369, to the South.
- 9.5.6. The work area shall not be flooded with the release of water during development. The Contractor must provide for a pipe approximately 30 m in length to discharge water into the open area of the site downstream of the developed injection well (to the southwest).

9.6. Observation well installation

- 9.6.1. The Contractor will be responsible for the installation of seven (7) observation wells according to the characteristics presented in **Tables 6 to 8** below as well as in **Diagrams 3a, 3b, 3c, and 3d** of **Annex D**. It is important to note that the characteristics presented for the observation wells to be installed are preliminary and subject to change. The characteristics of the wells to be installed shall be confirmed by the PSPC Representative prior to the Contractor's purchase of the materials. **Figures 2 and 3** of **Annex A** indicate the location of the observation wells to be installed.

Table 6 – Observation well for test pumping well PPE-1

| PO-803 (East area of DRDC-North): | | |
|---|---------------|--------------|
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 311849.26 m | 5194966.41 m |
| Approximate distance from well PPE-1 | 5 m northwest | |
| Ground elevation (Z) | 172.09 m | |
| Drilling depth (m) | 12 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |
| PO-804 (East area of DRDC-North): | | |
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 311873.06 m | 5195025.07 m |
| Approximate distance from well PPE-1 | 65 m north | |
| Ground elevation (Z) | 171.40 m | |
| Borehole depth (m) | 12 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |

Table 7 – Observation well for test pumping well PPE-2

| PO-805 (East area of DRDC-North): | | |
|---|---------------|--------------|
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 311918.14 m | 5194907.00 m |
| Approximate distance from well PPE-2 | 5 m northwest | |
| Ground elevation (Z) | 171.30 m | |
| Borehole depth (m) | 21 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |

Table 8 – Observation well for test pumping well PPO-1

| | | |
|---|-------------|--------------|
| PO-799 (West area of DRDC-North): | | |
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 310429.77 m | 5195571.31 m |
| Approximate Distance from Well PPO-1 | 5 m east | |
| Ground elevation (Z) | 175.23 m | |
| Borehole depth (m) | 35 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |
| PO-800 (West area of DRDC-North): | | |
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 310477,26m | 5195561,11m |
| Approximate Distance from Well PPO-1 | 85 m east | |
| Ground elevation (Z) | 175.02 m | |
| Borehole depth (m) | 35 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |
| PO-801 (West area of DRDC-North): | | |
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 310481,65m | 5195563.52m |
| Approximate Distance from Well PPO-1 | 85 m east | |
| Ground elevation (Z) | 175.00 m | |
| Borehole depth (m) | 18 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |
| PO-802 (area west of DRDC-North): | | |
| Coordinates (X,Y - NAD83 SCRS UTM Z19N) | 310593.58 m | 5195551.38 m |
| Approximate Distance from Well PPO-1 | 175 m east | |
| Ground elevation (Z) | 175.02 m | |
| Drilling depth (m) | 35 m | |
| Borehole diameter (m) | 0.152 m | |
| Length of screen | 2 m | |
| Diameter of screen | 0.051 m | |
| Screen openings | 0.254 mm | |
| Gravel pack | #1 | |

9.6.2. The work includes all the work involved in the provision and installation of well components including standard black steel casings, drive shoes, polyvinyl chloride (PVC) screens, fill and sealing materials (bentonite or bentonite cement) and lockable protective covers and caps.

9.6.3. No glue or adhesive shall be used on the components of the observation wells that are to be

permanently attached (tubing, screen, bottom cap). The connection and attachment of these parts shall be done only by threaded connections.

9.6.4. The installation of the observation wells, with the exception of well PO-805, will be done according to the procedures described below and according to the characteristics presented in **Tables 6 and 8** and **Diagrams 3a, 3c and 3d** presented in **Annex D**:

- Drill (according to expected diameter) to the designated depth.
- Assemble the well column (casing, screen, centralizers, ...) and gradually introduce it into the outer casing.
- Fill the annular space with silica sand, bentonite pellets, and cement-bentonite grout as follows:
 1. The silica sand will be inserted 1) into the borehole at a thickness of 0.3 m (12 inches) before the screen is inserted, 2) into the annular space in contact with the screen for the entire length of the screen, and 3) in the annular space up to 5 m (16 ft) from the surface.
 2. Raise the outer casing as the silica sand is put in place. Raising this casing shall be done step by step and as the annular space is filled. Unless otherwise stated, this raising in steps shall not exceed one (1) metre at a time.
 3. Add a 1-m (36 inches) thick bentonite pellet cap over the silica sand.
 4. Add a cement-bentonite grout above the bentonite pellet cap up to the ground level. The cement-bentonite grout will be injected using an injection casing. The outer casing will be gradually removed as the grout is injected.
 5. Raise the outer casing to the ground surface.
 6. Place the casing protector above ground.

9.6.5. The installation of observation well PO-805 shall be done according to the procedures described below and according to the characteristics shown in **Table 7** and in accordance with **Diagram 3b** of **Annex D**:

- Drill (according to expected diameter) to the designated depth.
- Assemble the well column (casing, screen, centralizers, ...) and gradually introduce it into the outer casing.
- Fill the annular space with silica sand, bentonite pellets, and cement-bentonite grout as follows:
 1. The silica sand will be inserted 1) into the borehole at a thickness of 0.3 m (12 inches) before the screen is inserted, 2) into the annular space in contact with the screen for the entire length of the screen, and 3) in the annular space up to 14 m (46 ft) from the surface.
 2. Raise the outer casing as the silica sand is put in place. Raising this casing shall be done step by step and as the annular space is filled. Unless otherwise stated, this raising in steps shall not exceed one (1) metre at a time.
 3. Add a 1-m (36 inches) thick bentonite pellet cap over the silica sand.

4. Add a cement-bentonite grout above the bentonite pellet cap up to the ground level. The cement-bentonite grout will be injected using an injection casing. The outer casing will be gradually removed as the grout is injected.
 5. Raise the outer casing to the ground surface.
 6. Place the casing protector above ground.
- 9.6.6. All materials shall comply with the requirements set out in this section and shall be approved by the DND Engineering Consultant. Furthermore, the installation of observation wells must comply with the MELCC's *Guide for Sampling for Environmental Analyses, Groundwater Sampling* workbook.
- 9.6.7. On the surface, the soil will be levelled to avoid the pooling of stagnant water and to prevent water from filtering into the soil within a radius of one (1) m of the well.
- 9.6.8. The Contractor must ensure that the observation well's casing exceeds the ground level by a height of one (1) m.
- 9.6.9. Once the drilling and fit-up work for the observation wells has been completed, the Contractor shall provide the following information in its daily reports for each well:
- Date/duration of construction.
 - Drilling method.
 - Location and identification.
 - Borehole and casing diameter.
 - Drilling depth.
 - Casing material.
 - Sealing materials (type and volume/quantity) used and installation levels.
 - Installation and construction.
 - Protective cover.
 - Special remarks.

9.7. Materials for the installation of the observation wells

- 9.7.1. All materials shall comply with the requirements set out in this section and shall be approved by the DND Engineering Consultant. A summary of minimum material requirements is provided in the following paragraphs. The following equipment will be used for the installation of observation wells in the granular aquifer.

Temporary casing for drilling observation wells and drive shoe

The standard black steel casing (according to diameter and length) will be made of new material according to ASTM A-53/53M99b (Grade B) standard. The joints shall be welded in accordance with AWWA and ASTM standards. The casing shall be fitted with a drive shoe at the end.

Observation well casing

The 0.051 m (2") diameter PVC casing, forming the well columns, will be made of new

material according to standards BNQ 3624-250, BNQ 3660-950, and AWWA C900. Allow a length of 1 m (39") above ground level. Make allowances for a screwed bottom cap (PVC).

Screens

The features of the perforated section of each well are presented above (Tables 6 to 8). The screen will be made of PVC according to standards BNQ 3624-250, BNQ 3660-950, and AWWA C900.

Annular space sealing and filling materials

Sealing of surface wells will be done with standard granular bentonite and standard powder and normal Portland cement, type 10, according to the CSA A-5 standard. The annular space will be sealed with grout consisting of water, cement powder and bentonite as follows: 27 litres of clean water, 42.7 kg of Portland cement and 1.5 kg of bentonite powder. The mixture will be homogenized before it is introduced in the drilling using an injection casing. A waiting time defined by the supervisor (DND Consulting Engineer) shall be respected after the granular bentonite has been placed to ensure the seal is watertight, before the cement-bentonite grout is introduced.

The gravel pack around the screened section will consist of rounded silica sand. The characteristics of the gravel pack of each well are presented above (**Tables 6 to 8**).

Centralizers

Three (3) centralizers will be installed along the column of each well. They will be located on top of the screening, at the casing level. They will ensure the squareness of the column in the drilling hole.

Protective cover and cap

The well's PVC casing will have a 0.051-m (2") diameter cap ("J-plug" type).

The above-ground portion of the well will be protected with a protective tube (0.152 m (6") in diameter) with a minimum height of 1.2 m (47") of high-density polyethylene (HDPE) equipped with (1) aluminum cover (with handle and lock). The protective tube shall be cast in concrete. The protective tube shall be secured with a lock that will be provided by the PSPC Representative.

9.8. Well development

- 9.8.1. Contractor-installed observation wells will be developed by the DND Engineering Consultant. No management of this development water will be required by the Contractor.

9.9. Pumping tests

- 9.9.1. The Contractor shall provide all equipment, piping, accessories, measuring and flow control equipment necessary for the proper performance of the various pumping tests.

- 9.9.2. The Contractor will be required to install the submersible pump and its electrical cable as well as the standard steel discharge line. The pump base shall be 1 m above the screen.
- 9.9.3. Pumping tests (by steps and long-term) shall be performed sequentially in each of the three (3) test pumping wells (PPE-1, PPE-2, and PPO-1).
- 9.9.4. The Contractor shall place (temporarily, for the duration of the pumping test) in each test pumping well a submersible pump sufficient to allow the pumping of groundwater at a maximum flow rate of 2,500 m³/day for PPO-1, 150 m³/day for PPE-1 and 1,000 m³/day for PPE-2. The installed pump shall be capable of pumping at varying flow rates from 1,000 to 2,500 m³/day for PPO-1, 25 to 150 m³/day for PPE-1, and 250 to 1,000 m³/day for PPE-2 to perform each of the step drawdown pumping tests.
- 9.9.5. The Contractor will be required to provide the necessary equipment (e.g., digital flow meter, shut-off valve, etc.) to be able to control and measure the pumping flow rate accurately and continuously (less than 2.5% variation throughout each test will need to be observed). A valve shall also be installed at the outlet of each well to allow for groundwater sampling and at least one check valve shall be installed on the pump well column.
- 9.9.6. The Contractor will provide ongoing field monitoring during the pumping tests.
- 9.9.7. The temporary wellheads shall allow for the installation of a 38-mm diameter (1^{1/2}") protective casing allowing for the installation of a pressure sensor (datalogger) and the manual measurement of the water level in the pumping well. The protective casing shall be installed from the head of the well to the top of the screen.
- 9.9.8. The DND Engineering Consultant will be responsible for providing, installing, and managing pressure sensors (dataloggers) in test pumping wells and observation wells as part of the pumping tests. Furthermore, the DND Engineering Consultant will be responsible for manual readings of water levels in test pumping wells and observation wells, as well as sampling and analysis of raw water pumped during pumping tests. It should be noted that the DND Engineering Consultant will provide partial monitoring (without residence) during pumping tests.
- 9.9.9. The Contractor is responsible for providing and maintaining equipment and tools that are free of any material that may contaminate wells and work sites. All pipes and fittings provided by the Contractor shall be in good condition, watertight and free of contamination. The Contractor shall take all necessary precautions in the field to avoid contamination of water samples with exhaust/smoke (e.g., generator, engine, cigarette, etc.).

9.10. Step drawdown pumping test (4 steps)

- 9.10.1. The Contractor shall carry out a step drawdown pumping test according to the following terms for each of the three (3) pumping wells:
 - The step drawdown pumping test shall include four (4) steps with a maximum duration of one (1) hour each, for a maximum total duration of four (4) hours.
 - Each step shall continue until the drawdown of the water in the pumping well is stabilized or shall be stopped after a maximum of 60 minutes (1 hour).
 - The pumping flows for each step for each of the pumping wells are set out in **Tables 9 to 11** below:

Table 9 – Test pumping well PPE-1

| PPE-1 (East area of DRDC-North): | |
|----------------------------------|-----------|
| Step 1 | 25 l/min |
| Step 2 | 50 l/min |
| Step 3 | 100 l/min |
| Step 4 | 150 l/min |

Table 10 – Test pumping well PPE-2

| PPE-2 (East area of DRDC-North): | |
|----------------------------------|------------|
| Step 1 | 250 l/min |
| Step 2 | 500 l/min |
| Step 3 | 750 l/min |
| Step 4 | 1000 l/min |

Table 11 – Test pumping well PPO-1

| PPO-1 (East area of DRDC-North): | |
|----------------------------------|------------|
| Step 1 | 1000 l/min |
| Step 2 | 1500 l/min |
| Step 3 | 2000 l/min |
| Step 4 | 2500 l/min |

- 9.10.2. These pumping tests will be used to determine the flow of long-term constant rate pumping tests (5 days).

9.11. Long-term pumping tests (5 days/120 hours)

- 9.11.1. The Contractor shall perform a continuous (day and night) long-term pumping test (5 days/120 hours) at the flow determined by the DND Engineering Consultant following the step drawdown test, at each of the three (3) test pumping wells.

For information purposes, the expected flows are as follows:

- PPE-1: 100 m³/day
- PPE-2: 700 m³/day
- PPO-1: 2000 m³/day

- 9.11.2. A period to allow the water level to rise (recovery of maximum 5 days/120 hours) following the end of pumping must be planned. While the water is rising (recovery) in the pumping well and the observation wells, the DND Engineering Consultant shall periodically measure the water levels.
- 9.11.3. The pumping equipment installed in the pumping well shall not be removed until the recovery of the water level is completed. The DND Engineering Consultant will inform the Contractor when the recovery is finished, and the next pumping test may be performed.

9.12. Management of the water generated during pumping tests

- 9.12.1. The management method for the water generated during pumping tests in the East area (PPE-1 and PPE-2) will be different than the management method used in the West area (PPO-1).
- 9.12.2. In the East area, for test pumping wells PPE-1 and PPE-2, the pumped water must be treated before being disposed of into a ditch.
- 9.12.3. In the West area, for test pumping well PPO-1, the pumped water shall be reinjected without prior treatment into injection well PI-9. The water shall be filtered before being reinjected into the injection well.
- 9.12.4. The DND Engineering Consultant shall be responsible for treating the water during the pumping tests at PPE-1 and PPE-2 wells and filtering the water during the tests at PPO-1.

The paragraphs that follow contain further information concerning the management of the water generated during pumping tests.

East area – PPE-1 and PPE-2 wells:

- 9.12.5. The DND Engineering Consultant shall be responsible for treating the raw water pumped during the pumping tests. The latter shall be responsible for supplying and operating a portable treatment unit. The DND Engineering Consultant shall be responsible for the installation (and dismantling) of the footings required for the treatment unit.
- 9.12.6. The DND Engineering Consultant shall supply and operate the transfer pumps between the surge tank upstream from the treatment unit and the portable treatment unit, and between the surge tank downstream from the treatment unit and the point of discharge into the ditch.
- 9.12.7. The DND Engineering Consultant shall be responsible for the installation (and the dismantling) of the treated water discharge point and erosion control measures in the ditch. The location of the treated water discharge point is presented in **Figure 3** of **Annex A**.
- 9.12.8. For the purposes of the pumping tests to perform in the East area (PPE-1 and PPE-2 wells), the Contractor shall be responsible for supplying and installing the following items:
 - Two (2) watertight containers (40 yards each) that will be used as surge tanks for the portable treatment unit (one upstream container and one downstream container);
 - Submersible pumps, pipes, connectors and other equipment/accessories required to transport the raw water pumped from the test pumping wells to the surge tank located upstream from the treatment unit;
 - Pipes, connectors and other equipment/accessories required to transport the water stored in the surge tank located upstream from the treatment unit to the treatment unit (transfer pump provided by the DND Engineering Consultant);
 - Pipes, connectors and other equipment/accessories required to transport water from the treatment unit to the surge tank located downstream from the treatment unit; and

- Pipes, connectors and other equipment/accessories required to transport water from the surge tank downstream from the treatment unit to the treated water discharge point into the ditch (transfer pump provided by the DND Engineering Consultant). The Contractor must plan a pipe with an approximate length of 175 m and a minimum diameter of 102 mm (4 inches) for this purpose. The last section of the discharge pipe (approximately 10 m before the discharge line) must have a minimum diameter of 152 mm (6 inches) and rigid sides in order to reduce the water speed and enable the anchoring of the pipe to the treated water discharge point.

- 9.12.9. The Contractor must plan to have CamLock-type pipe connectors with a minimum diameter of 102 mm (4 inches) to connect the pipes between the surge reservoirs (upstream and downstream) and the treatment unit.
- 9.12.10. The Contractor shall be responsible for supplying the electricity required to operate its equipment and the DND Engineering Consultant's treatment unit. Further information concerning the supply of electricity is included in section 9.14 of the specifications.
- 9.12.11. The temporary pumping equipment must allow for the collection of raw pumped groundwater samples upstream from the surge tank and downstream from the treatment unit for each of the pumping tests.

West area – PPO-1 well:

- 9.12.12. The raw water pumped from test pumping well PPO-1 will be injected into injection well PI-9 only after it is filtered. The filtration unit shall be supplied and operated by the DND Engineering Consultant.
- 9.12.13. For the purposes of the pumping tests to perform in the West area (PPO-1 well), the Contractor shall be responsible for supplying and installing the following items:
- One (1) watertight container (40 yards) that will be used as surge tank upstream from the filtration unit;
 - Submersible pumps, pipes, connectors and other equipment/accessories required to transport the raw water pumped from the test pumping well to the surge tank located upstream from the filtration unit; and
 - Pipes, connectors and other equipment/accessories required to convey water from the surge tank upstream from the filtration unit to injection well PI-9 (transfer pump provided by the DND Engineering Consultant). The pipe must follow the same route as the pipe used when pumping well PPO-1 was developed (i.e. approximately 300 m long), must have a minimum diameter of 152 mm (6 inches). Flow control valves (ball valves) must be installed on the pumping well and the injection well, and a vacuum breaker and exhaust valve (or air release valve) must be installed on the pipe upstream from the injection well. The valves and breakers must be installed on rigid sections of the pipes that can be anchored. **Diagram 2 of Annex D** contains details on the equipment required on the pipe leading to the injection well.
- 9.12.14. The Contractor must plan to have CamLock-type pipe connectors with a minimum diameter of 152 mm (6 inches) to connect the pipes between the surge reservoirs and the filtration unit.
- 9.12.15. The Contractor must supply the electricity required to operate its equipment and the DND Engineering Consultant's transfer pump. Further information concerning the supply of

electricity is included in section 9.14 of the specifications.

- 9.12.16. The temporary pumping equipment must allow for the collection of raw pumped groundwater samples from between the pumping well and the injection well, upstream from the surge tank, and the measurement of flow and pressure before injection (see **Diagram 2** in **Annex D** for details on the injection well).

9.13. Recommissioning of the existing pumping well (PO-390)

- 9.13.1. The Contractor must pump water into existing pumping well PO-390. This work will allow the DND Engineering Consultant to collect pumped water samples.
- 9.13.2. The Contractor must install the submersible pump and its electrical cable, along with the standard steel discharge pipe. A minimum of one check valve must be installed in the pumping well column. The base of the pump must be located 1 m above the screen. Furthermore, a faucet must be installed on the discharge pipe, near the well, to enable the collection of groundwater samples.
- 9.13.3. The existing pumping well PO-390 is installed in loose deposits (fine to coarse sands) and has the following characteristics:
- Depth of 31.85 m;
 - Casing diameter of 203.2 mm (8 in.);
 - Stainless steel screen of 6.0m in length and a diameter of 203.2 mm (8 in.), with opening of 1.27 mm. The screen is installed between 24.0 m and 30.0 m depth from soil surface;
 - Silica sand filter pack with effective diameter of 1.67 mm;
 - Above ground casing exceed soil surface of 0.68 m.
- 9.13.4. The Contractor must plan to have the equipment required (e.g. digital flowmeter, shut-off valve, etc.) to control and measure the pumping rate precisely and continuously.
- 9.13.5. The well must be pumped at a rate of 380 l/min for 48 hours. The pumped water must be discharged without prior treatment into the infiltration basin located approximately 200 m northeast of the well. **Figure 4** in **Annex A** shows the location of pumping well PO-390 and the infiltration basin.
- 9.13.6. The Contractor must supply and install a pipe with an approximate length of 200 m between well PO-390 and the infiltration basin where the water will be discharged. The Contractor must plan for the implementation of a speed bump given that the pipe must cross a municipal roadway (Vanier Street).
- 9.13.7. The Contractor must plan for a technician to be present on site for the duration of the pumping of well PO-390 (day and night) to ensure that the equipment is operating correctly.

9.14. Electricity

- 9.14.1. The Contractor shall be responsible for providing the electricity required for the purposes of this project for the entire duration of the work. No electrical services (Valcartier Base and DRDC) will be available on the site.
- 9.14.2. The Contractor must provide the electricity required by the DND Engineering Consultant for its work as part of this project in addition to meeting its own needs in electricity to complete

its work (and the needs of its trailer, if applicable).

- 9.14.3. The Contractor shall be responsible for supplying, managing, maintaining and filling the various equipment, materials and accessories with fuel (generators, transformers, etc.) in order to supply electricity to all of the equipment required to carry out the project, including those used by the DND Engineering Consultant.
- 9.14.4. The Contractor shall be responsible for all the electrical connections required for all the equipment needed for the project, including those used by the DND Engineering Consultant.
- 9.14.5. The Contractor shall be responsible for supplying, installing, managing, maintaining and dismantling the cables, outlets, circuit breakers, panels and other accessories/material needed for the electrical connections.
- 9.14.6. **Tables 12 and 13** below present the needs in electricity of the equipment that will be used by the DND Engineering Consultant during the pumping tests that must be performed in the East and West work areas.

Table 12 – DND Engineering Consultant’s electrical requirements for pumping tests in the East area (testing wells PPE-1 and PPE-2)

| Equipment | Electrical requirements – East area |
|---|-------------------------------------|
| Water treatment unit (150 GPM), including pumps, etc. | 100 A, 208 V, 3 phases |
| Transfer pump (downstream from the treatment unit) | 5 HP, 600 V, 3 phases |

Table 13 – DND Engineering Consultant’s electrical requirements for pumping tests in the West area (testing well PPO-1)

| Equipment | Electrical requirements – West area |
|---------------|-------------------------------------|
| Transfer pump | 15 HP, 600 V, 3 phases |

- 9.14.7. The Contractor shall plan for a sufficient capacity in electricity to power all of the equipment needed to continue the ongoing pumping tests without interruption (pumping and water treatment). If a pumping test is interrupted by an electrical outage, the test must be started over again from the beginning, and all expenses incurred to repeat the test by the Contractor and the DND Engineering Consultant must be covered by the Contractor.

9.15. Site restoration

- 9.15.1. The Contractor must leave the work sites in the condition they were in before the beginning of the work. The site must be cleared of any debris, waste, pieces of tubing and drilling residues. The work areas must be restored to their original condition.

10. COMMUNICATIONS

- 10.1. All communications required for the project may be in either official language (English or French).
- 10.2. Any correspondence or documents sent by the Contractor and its subcontractors for this project must be sent to the PSPC Representative.

11. MEETINGS

11.1. Kick-off meeting

- 11.1.1 Before the work begins, the Contractor must attend a kick-off meeting over videoconference (MS Teams). The Contractor must ensure that its site superintendent and project manager assigned to the project are in attendance at the kick-off meeting.
- 11.1.2 The PSPC Representative will inform the Contractor of the time and date of this meeting after the contract is awarded. An invitation will be sent by email within seven (7) calendar days following contract award.
- 11.1.3 At this meeting, the topics of contract terms, planning of work, scheduling of work, coordination of stakeholders, technical particularities, site-specific safety and access rules and administrative procedures will be covered.
- 11.1.4 The Contractor and its subcontractors must provide the following information during the kick-off meeting:

- An updated version of the availability calendar for carrying out the work that includes, among others, the following elements:
 - Projected start of work date
 - Final date of fieldwork completion
 - Deliverables submission date

It must be noted that the schedule of work shall be determined by the Contractor, PSPC Representative, DND and DND Engineering Consultant during the kick-off meeting.

- An Occupational Health and Safety Program specific to the work under this contract and a spill response plan (see section 14.3).
 - The names of the employees (Contractor and its subcontractors) responsible for enforcing the Occupational Health and Safety Program (one person per team is required, if more than one team is used at once).
 - A digital copy of these documents must be submitted to the PSPC Representative.
- 11.1.5 PSPC will write and distribute the minutes of the kick-off meeting. The parties present at the kick-off meeting must comment the preliminary version for final distribution.

11.2. Other meetings

- 11.2.1 The Contractor must hold periodic site-specific health and safety meetings as required by the Quebec *Act Respecting Occupational Health and Safety* and the regulations made thereunder. These daily meetings must be held with all workers present on the site in order to identify any potential dangers on the site. Daily meetings must be documented and

recorded on the site.

- 11.2.2 Ad hoc meetings may be organized, as needed. The method used (on the site or by videoconference (MS Teams)) and the required participants will be determined in advance and will depend on the topic for discussion.
- 11.2.3 PSPC will write and distribute the minutes for each of the meetings. The parties present at these meetings must comment the preliminary versions for final distribution.

12. DELIVERABLE DOCUMENTATION

All deliverables to be produced by the Contractor under this mandate and to be presented to the SPAC Representative shall be submitted in French.

12.1 Schedule of work

- 12.1.1 Considering that the drilling, well installation (test pumping well, injection well and observation well), pumping tests and recommissioning of the existing pumping well (PO-390) must be carried out under the supervision of the DND Engineering Consultant, the schedule of work must be agreed upon by the Contractor, the PSPC Representative, DND and the DND Engineering Consultant during the kick-off meeting.
- 12.1.2 Two (2) calendar days after the kick-off meeting at the latest, the Contractor must submit the agreed-upon schedule of work in writing (by email) to the PSPC Representative.
- 12.1.3 The Contractor must update the schedule of work when changes are required.
- 12.1.4 The Contractor must send the PSPC Representative all updates to the schedule of work by email, a maximum of 12 hours following the changes made.

12.2 Health and safety plan

- 12.2.1 The Contractor must prepare and submit a health and safety plan for the work to be carried out and must establish safe work plans that respect all aspects of health and safety set out in section 14 of this document. The plan must also describe the work performed by subcontractors and describe how the subcontractors will be informed. The Contractor must enforce the health and safety plan on the site.
- 12.2.2 The Contractor must make any changes deemed necessary by the PSPC's comments, if applicable, until it is accepted. Field work may only be carried out when this document is duly approved.

12.3 Daily reports

- 12.3.1 A daily report describing the Contractor's daily activities must be submitted by email every day, or the next morning at the latest (before 11:00), to the PSPC Representative during work on the site. This report must include but not be limited to:
 - The date.
 - All of the activities performed on the site including the number of drillings and tasks carried out during these drillings.

- Photographs showing any noteworthy issues that arose during the work day.
- Weather conditions.
- The items discussed in site meetings, if applicable.
- Equipment used.
- The quantities of materials used.
- The names of the Contractor and subcontractor's (if applicable) employees on the site, hours worked (start and end times).
- Any issues encountered, if applicable, and the solutions made, if applicable.
- Daily compilation of all unit-price items listed on the bid form, if applicable.
- Any incidents or accidents.
- Updated record of subterranean networks (maintained in service, diverted or abandoned) present inside the work areas.
- Any other relevant information.
- Each daily report, commented, approved and signed at the end of the work day by the DND Engineering Consultant and the Contractor, must allow the visualization of the work's progress as a whole.

13. DOCUMENTS REQUIRED AT WORK SITE

13.1. The Contractor must maintain at the job site, one updated copy of each of the following:

- Specifications (including Annexes);
- Amendments to the Specifications (if applicable);
- Schedule of work;
- Health and safety program, including emergency measures;
- Environmental monitoring form;
- Digging clearance provided by DND and answers from Info-Excavation; and
- Updated record of underground networks (maintained in service, diverted or abandoned) present inside the work areas.

14. HEALTH AND SAFETY

14.1. Compliance requirements

- 14.1.1 Comply with the latest version of the *Quebec Act Respecting Occupational Health and Safety* and the regulations made thereunder.
- 14.1.2 Observe and enforce construction safety measures required by (non-exhaustive list):
 - The *National Building Code of Canada* (latest version);
 - The *Quebec Safety Code for the Construction Industry*;
 - The CNESST; and
 - Municipal regulations and by-laws.
- 14.1.3 In the event of a conflict between provisions from the above-mentioned authorities, the more stringent provisions shall apply.
- 14.1.4 Provide and maintain worker's compensation board coverage for all employees for the duration of the contract. Before the beginning of the work, at the time of interim completion and prior to final payment, provide to PSPC a letter from the CNESST indicating that the Contractor's account is in good standing:
 - If Contractor is a sole proprietor, submit to PSPC acceptable documentary proof of other personal insurance protection that meets or exceeds the requirements for workers' compensation insurance listed above.

14.2. Liability

- 14.2.1 In accepting this contract, the Contractor agrees to assume all of the responsibilities that normally fall to the prime contractor under the *Quebec Act Respecting Occupational Health and Safety* and to act as the work site supervisor.
- 14.2.2 The Contractor must ensure the safety of persons and property on the work site and the safety of federal employees and the general public circulating in proximity to the work site, inasmuch as they may be endangered by any work being performed.
- 14.2.3 The Contractor must assume liability for any accident or damage caused on the work site by the Contractor's employees, subcontractors or equipment (including subcontractors' equipment).
- 14.2.4 The Contractor and its subcontractors must take the measures required to protect workers in accordance with the *Canada Labour Code* and the *Occupational Health and Safety Act*.
- 14.2.5 The Contractor and its subcontractors are entirely responsible for the health and safety of their employees, the DND and PSPC authorities, the DND Engineering Consultant and its subcontractors, in accordance with the applicable laws, regulations, directives, codes and standards.
- 14.2.6 The Contractor is responsible for the security of its equipment and materials during and after working hours. DND shall not be held liable for any act of vandalism, theft, loss, or breakage caused by weather or other conditions.
- 14.2.7 The Contractor shall possess all safety equipment in order to perform hot work (welding) in a safe and proper manner. A hot work permit shall be obtained before hot work is performed on the work site and an inspection by CFB Valcartier and/or DRDC-Valcartier personnel may

occur before hot work is performed. The Contractor will have to advise the PSPC Representative a minimum of 2 days in advance of the first hot work so that a work permit can be obtained for the Contractor. The Contractor will be responsible to have in his possession at the work site the required safety equipment and to use safe work methods in order to obtain the hot work permit. The Contractor shall also be responsible for complying with the conditions of the work permit issued.

- 14.2.8 If the Contractor is responsible for a delay in the progress of the work due to a violation of legal regulations or safety requirements, it must, at the discretion of the PSPC Representative and at no additional expense to DND, work overtime or provide for increased resources (human and material) to avoid delays in the completion of the work.
- 14.2.9 The Contractor must ensure that workers and other persons authorized to be present on the work site adhere to the safety requirements specified in the contract documents, in relevant federal, provincial and local statutes and in the Contractor's Occupational Health and Safety Program.
- 14.2.10 The Contractor and its subcontractors must commit to informing personnel on the rules and standards that are applicable to the work being carried out and ensuring that they are understood, observed and respected. The Contractor must ensure that its workers have received the training and information they need to carry out the work safely, and that the required protective equipment and tools are available, meet standards, and are in compliance with legislation and regulations.
- 14.2.11 The Contractor and its subcontractors must inform their workers that they have the right to refuse any work that entails a risk to their health or safety.
- 14.2.12 The Contractor must ensure that every vehicle used on the work sites by its employees and subcontractors is equipped with a back-up alarm and a portable fire extinguisher.
- 14.2.13 When unforeseen or peculiar risks or hazards occur while work is being carried out, immediate measures must be taken to address the situation and prevent damage and injury. Inform the PSPC Representative orally and in writing of the hazard or situation.
- 14.2.14 The Contractor and its subcontractors must comply with and enforce safety standards, namely with respect to CSA-certified (Canadian Standards Association) helmets and safety boots on the work sites. The same applies for safety equipment for hearing, eyesight and hands.
- 14.2.15 The Contractor must plan on supplying its employees and subcontractors with personal protective equipment if needed (namely TYVEK® coveralls, organic/solvent cartridge filter masks and others) to protect them from solvents, volatile compounds and other contaminants they may come into contact with during the work (drilling operations, well installation, well development, tests, etc.).
- 14.2.16 The Contractor and its subcontractors must have first aid kits and first responder services in accordance with the CNESST's regulations concerning minimum standards for first aid and first response.

14.3. Occupational Health and Safety Program (OHSP)

- 14.3.1. The Contractor must prepare and submit an Occupational Health and Safety Program (OHSP) for the work to be carried out and must establish safe work plans that align with all health and safety statements included in this document. The OHSP must also cover work performed by subcontractors, if applicable, and describe how the subcontractors will be informed. The Contractor is responsible for the OHSP application.

- 14.3.2. The Contractor must make any changes deemed necessary according to PSPC Representative comments, if applicable, until the application is accepted. Field work may only be carried out after this document has been duly completed in accordance with the comments provided by PSPC.
- 14.3.3. Under the *Quebec Act Respecting Occupational Health and Safety* and its regulations, the Contractor must have an OHSP. Compliance requirements for the content, details and implementation of this program are established by provincial or territorial authorities. For the purposes of this Contract, the OHSP must include a site-specific health and safety plan that recognizes, assesses and discusses known hazardous substances and conditions; recognizes, assesses and discusses ongoing risk assessments made while work is underway; and documents new or potential health and safety risks that may have been previously unknown and unidentified.
- 14.3.4. The Contractor must provide, at the kick-off meeting, an OHSP containing the measures that will be taken on and around the work sites to protect the health and safety of the public; the Contractor's employees and subcontractors; DND and PSPC authorities; and the DND Engineering Consultant and its subcontractors. The OHSP should also include an emergency response plan. The emergency plan must also indicate what actions will be taken in the event of a spill (spill response plan). A template that meets DND requirements is provided in **Annex E**.
- 14.3.5. In the event of an unforeseen incident, all necessary measures, including cessation of work, must be taken to safeguard the health and safety of workers and the public (contact the PSPC Representative immediately).
- 14.3.6. The Contractor must also provide a mechanical inspection certificate for the machinery used at the work site prior to the start of work. The certificate must have been issued within the last one (1) month before the start of work.
- 14.3.7. The OHSP submitted to the PSPC Representative must be used to review the program in accordance with contract requirements with regard to known hazardous substances and conditions. The review must not be interpreted to expect that PSPC will approve the program as being complete, exact and legally compliant with the *Quebec Act Respecting Occupational Health and Safety* and its regulations and does not release the Contractor from its legal obligations under such legislation.
- 14.3.8. The Contractor must designate at least one (1) person per work team (including its subcontractors) to be responsible for enforcing the Contractor's OHSP, as well as applicable legislation, regulations, directives, codes and standards. Each designated person must also ensure that unauthorized persons cannot access the area within or around the work site.
- 14.3.9. The Contractor will be responsible for implementing the OHSP when performing the work. A version bearing the signature of all workers must be kept at the work site while the fieldwork is under way and must be sent to the PSPC Representative after the fieldwork is completed.
- 14.3.10. For more information, the Contractor can consult the document entitled *Pour mieux exécuter les travaux de creusement, d'excavation et de tranchée - Aide-mémoire pour l'employeur* [French only] released by the Commission de la santé et de la sécurité du travail in 2000.

14.4. Status and conditions of project/site

- 14.4.1. The following hazardous conditions and substances known to be on the site must be considered health and environmental hazards and must be managed appropriately if they are encountered while work is being performed:
- **Volatile organic compounds (VOCs)** at potentially high concentrations can be released from the soil or groundwater during drilling, well development, pumping tests, recommissioning existing pumping well and sampling activities. For your information, the following maximum VOC concentrations for TCE were measured in groundwater in the fall of 2021 in the various work areas (within 150 m of the pumping wells):
 - Pumping well PPE-1: 14 µg/l
 - Pumping well PPE-2: 24 µg/l
 - Pumping well PPO-1: 26 µg/l
 - Injection well PI-9: 130 µg/l
 - Existing pumping well (PO-390): 54 µg/l
 - The Contractor shall consider the presence of hazardous substances and conditions into account and include in his quote all work that needs to be performed in or adjacent to an area of danger and in the presence of hazardous substances.
- 14.4.2. The above-mentioned list is not to be considered an exhaustive list of all health and safety risks present and resulting from the Contractor's activities during the work. Include the above-mentioned items in the risk assessment program described in these specifications.

14.5. Site control and access

- 14.5.1. The Contractor must consider that all rights of way, access and authorizations necessary to carry out the work must be obtained from the Valcartier Base and DRDC.
- 14.5.2. Control all points of access to work sites and work site activities. Mark off work sites and isolate them from adjacent or neighbouring areas by use of appropriate means so as to maintain control of all work site access points.
- 14.5.3. For the duration of the work, access to the work site will be prohibited to the public, civilians and military personnel who have no valid reason to enter or have not received such permission from the Contractor. DND will not be held responsible for accidents or injuries involving members of the public or workers in the work areas.
- 14.5.4. Implement measures to provide a system of work site access authorization for all persons who require access. Access authorization procedures must comply with the Quebec's *Loi sur la santé et la sécurité au travail* and its regulations and with the Contractor's Occupational Health and Safety Program.
- 14.5.5. Ensure that all individuals authorized to access the work site are in possession of and wearing the minimum personal protective equipment (PPE) specified in the Contractor's Occupational Health and Safety Program. Ensure that persons authorized to access the work site are provided with, trained in the use of, and wear appropriate PPE above and beyond the designated minimums previously noted and specifically intended for the work site activity that they are involved in. Ensure the effectiveness of the more protective PPE

provided.

- 14.5.6. Install signs at access points and other strategic locations around the site, clearly indicating that unauthorized persons are not permitted to enter the area(s) where work is proceeding. Signs must be made properly and contain universally understood graphic symbols. Signs must not serve as advertising, but be used specifically to indicate construction safety information and primary contact persons:
- 14.5.7. Information to be posted on signs:
- Project name and description
 - Contractor's name
 - Project superintendent's name/phone number
 - PSPC Representative's name and telephone number
 - DND Representative's name and telephone number
- 14.5.8. Ensure site security at all times to prevent unauthorized persons from gaining access.
- 14.5.9. The Contractor is responsible for procuring the equipment (e.g., water treatment unit, settling ponds, pipes) that the DND Consulting Engineer for the project will use. Such equipment will be considered as part of the Contractor's work areas.

14.6. Accident and incident reporting

- 14.6.1. In the event of an unforeseen incident, the Contractor must take all necessary measures, including stopping the work, to protect the health and safety of the workers and the public, and must immediately contact PSPC.
- 14.6.2. The Contractor must investigate and report accidents and incidents as required by Quebec's *Loi sur la santé et la sécurité au travail* and the regulations made thereunder.
- 14.6.3. For the purposes of this Contract, the Contractor must immediately investigate accidents and incidents involving the following situations and submit a report to the PSPC Representative:
- An injury that may or may not require medical attention but that makes it necessary for the injured person or persons to lose work time.
 - Exposure to toxic chemicals or substances.
 - Property damage.
 - An interruption to activities within or around the site that is likely to cause losses.
- 14.6.4. While investigating and reporting accidents and incidents, the Contractor must act quickly to correct actions that caused the accident or incident and provide written notice of measures taken to prevent the accident or incident from occurring again.

14.7. Documents and elements to submit

- 14.7.1. Submit digital copies of the following documents to PSPC, including published updates:

- Before work begins on the site, submit the notice of opening a construction site issued by the Commission des normes, de l'équité, de la santé et la sécurité au travail (CNESST);
- At the kick-off meeting, submit the Occupational Health and Safety Program including the emergency and spill response plan.
- During work, submit accident or incident reports within 24 hours of the accident or incident.
- When work is completed, submit the notice of closing a construction site issued by the CNESST.

15. ENVIRONMENTAL PROTECTION

15.1 The Contractor must comply with the environmental protection guidelines set out in **Annex F**.

15.2 In addition, throughout the course of its work, the Contractor must implement the environmental effects mitigation measures set out in the Environmental Monitoring Form included in **Annex G**. The DND Engineering Consultant will be responsible for ensuring that environmental mitigation measures are met and implemented by the Contractor. If the Contractor is found to be non-compliant, the Contractor must follow the instructions of the DND Engineering Consultant to properly comply with and implement environmental mitigation measures, all at its own expense and to the satisfaction of the DND Engineering Consultant. The SPAC Representative shall be promptly notified of the situation and the work being done to remedy the situation.

ANNEX A FIGURES

FIGURE 1
General Work Locations

FIGURE 2
Location of installations for boreholes and pumping tests – West Area

FIGURE 3
Location of installations for boreholes and pumping tests – East Area

FIGURE 4
Location of installations for pumping existing well – PO-390 Area

**ANNEX B
PHOTOGRAPHS**



Photo 1 – Entrance to the access road via rue de la Grande Hermine to the PPO-1 work area



Photo 2 – Acces road to PPO-1 work area



Photo 3 – Access road and work area for PPE-1 and PPE-2



Photo 4 – Access road and work area for PPE-1 and PPE-2



Photo 5 – Access road to PO-804 (East Area)



Photo 6 – Access road to PO-802 (West Area)



Photo 7 – Deforested and uncultivated land at the location of PO-802
(West Area)

ANNEX C
FORMS – DRDC-VALCARTIER

ANNEX D
DIAGRAM OF WELLS TO BE INSTALLED

ANNEX E
EXAMPLE – EMERGENCY RESPONSE PLAN
IN ACCORDANCE WITH DND PROCEDURES

ANNEX F
ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PROTECTION

F.1 Contractor's Emergency Response Plan in the event of a spill

- .1 The Contractor must establish an Emergency Response Plan (ERP) in the event of spills. A template ERP that meets DND requirements is presented in **Annex E**. The use of this model will ensure compliance with legislation and regulations and facilitate communication and response to spills on DND property.
- .2 The Contractor's ERP must be available at the work site.
- .3 The Contractor must have, at the work site, the appropriate response equipment to confine and recover a potential spill. The amount of response equipment required will be proportional to the size of the project and its associated spill risks. The response kit must be readily available at appropriate locations across the site to respond to any risk, at any time and at any location while the project is underway (heavy machinery, tank truck, generators, heating system, pump, etc.).
- .4 At a minimum, the emergency response kit must contain the equipment and devices needed to contain a spill, so as to minimize the risk of contamination caused by a spill of hydrocarbons, hazardous products or other contaminants. The emergency response kit must be labelled ENVIRONMENTAL EMERGENCY MATERIALS and must contain:
 - .1 Two pairs of rubber gloves;
 - .2 Two pairs of safety goggles;
 - .3 One epoxy stick;
 - .4 Duct tape;
 - .5 One absorbent boom, 3" in diameter and 12' in length;
 - .6 One absorbent boom, 3" in diameter and 4' in length;
 - .7 25 absorbent pads;
 - .8 Two bags of absorbent material (sphagnum moss, for example), 7 litres each;
 - .9 Three plastic recovery bags;
 - .10 Two shovels;
 - .11 Tools, including wire cutters and screwdrivers;
 - .12 One permanent marker;
 - .13 Two DANGER signs;
 - .14 Valcartier Base Environmental Incident Report forms provided by the PSPC Representative.
- .5 Employees working on the site must: (1) know the location of the equipment; (2) have access to it at all times; (3) know how to use it.
- .6 Contractors and subcontractors carrying out work that requires the use of motorized equipment, the transfer of fuel or the use of hazardous products must be familiar with the ERP and spill response procedures.
- .7 Ensure that any individual who may need to respond to a spill has received training and is prepared to act quickly and effectively in the event of a spill.

F.2 Procedures for handling spills of hydrocarbons, hazardous materials and other contaminants

- .1 In the event of a spill, follow the procedures outlined in the Emergency Response Plan (ERP) developed the Contractor in accordance with DND requirements. Take photos before, during and after the response.
- .2 The following is a summary of the key steps within an ERP. The Contractor must perform these steps:
 - .1 Ensure the safety of people and assess the situation (date, time, place, product spilled, quantity spilled, container or equipment involved, causes, damage and risks [human, material and environmental], human and material resources available or required to respond effectively, etc.)
 - .2 Contain and recover the spill substance.
 - .3 If the Contractor is unable to immediately recover or contain the spilled substance or if the substance is spilled in water, notify, depending on the work area:
Base Area: Base Fire Services (844-5333 or 911)
DRDC Valcartier: North Gate: 418-844-4000, ext. 4211 (North)
 - .4 Regardless of the quantity of substance spilled, report the spill immediately to DND and to the Support Base Environment Officer (cell phone: 418-563-2676).
 - .5 The Contractor must prepare and submit to the PSPC Representative the incident report within 24 hours. The PSPC Representative will make available the standard format for this report before the start of work.
- .3 The Contractor will be liable for any spill of material deemed harmful to the environment or DND property, and where applicable, the Contractor will immediately carry out at its expense the corrective measures prescribed by the PSPC Representative or the Support Base Environmental Officer.
- .4 If the Contractor is unable to respond appropriately and to the satisfaction of DND because of the quantity or type of spill, the cost of the additional response requiring DND personnel or equipment will be covered by the Contractor.

F.3 Work near water (East area – DRDC-Valcartier)

- .1 Do not disturb riparian vegetation along the channel.
- .2 Do not perform any work in the area between the existing road and the watercourse (channel where fish live). The only activity permitted is necessary pruning (cutting branches) carried out using manual specialized equipment for work along the edge of watercourses (e.g., mechanical saw with biodegradable oil).
- .3 Do not ford machinery in the ditch.
- .4 Plan work near water so that materials such as sediments, petroleum products or other chemicals do not enter the watercourse.

- .5 Maintain all machinery so it is clean and does not leak.
- .6 Do not wash, refuel or perform maintenance work on machinery; or store fuel or other materials used to operate machinery within 30 m of a watercourse and as far as possible from sewers (sanitary or storm) or ditches leading directly to a watercourse. When possible, carry out these activities off DND property.

F.4 Prevention of soil and water pollution

- .1 The Contractor must ensure that the machinery, tools and equipment that will be used to perform the work are safe, clean and in proper working condition. The departmental representative reserves the right to deny access to or remove from the site any machinery, tools or equipment that does not meet these requirements. Equipment that is visibly poorly maintained and shows signs of leaks or potential leaks will be returned from the site at the expense of the Contractor or the owner of the equipment and at no cost to the Crown.
- .2 Equipment that must be refuelled with petroleum products or other hazardous equipment (e.g., generators, heating systems, pumps) must be installed on a flat, impermeable surface that contains spills. All stationary equipment must be installed on a containment device or on an absorbent mat that extends at least one foot beyond the equipment in all directions. The area around the fuel filler cap must be given special attention. Equipment should be inspected regularly and absorbent products replaced as necessary.
- .3 When refuelling, an oil tray, absorbent product and/or rags must be placed under the spout.
- .4 Spills often occur when products are being handled. Educate all personnel who will handle petroleum products on the importance of avoiding any types of spills, including small ones that tend to be down played.

F.5 Protection of migratory birds and species at risk

- .1 To protect the various migratory bird species nesting on the property, avoid cutting down trees or making changes to large vegetated areas during the bird nesting period (April 15 to September 15).
- .2 If these activities must be performed during this period, enlist a bird specialist to inspect the area no earlier than 30 days before the start of the work to verify whether migratory birds are actively building or using nests for their offspring.
- .3 Avoid all work in the migratory bird or species at risk protection areas established by DND, regardless of whether the area was protected when the contract was awarded.
- .4 If an endangered species or migratory bird nest is observed during the work, the Contractor must immediately cease all disruptive activities and notify the PSPC Representative.
- .5 During the work, feeding, disturbing, chasing or touching wild animals (especially newborn animals) is strictly prohibited.

F.6 Air pollution prevention and ozone layer protection

- .1 The Contractor must control emissions from materials, equipment, vehicles and facilities in accordance with DND and federal, provincial and municipal requirements.
- .2 Vehicles must not be left idling unless there is a valid reason and authorization is granted by the PSPC Representative.
- .3 Keep dust production to a minimum and abate it with water if the amount produced could disturb employees and users of nearby properties.

F.7 Invasive exotic plants

- .1 Clean vehicles prior to arrival to ensure they are free of invasive exotic plants.

F.8 Temporary storage of hazardous products

- .1 When possible, store petroleum products or other hazardous materials off site. Containment devices and response kits must be supplied if the Contractor has to store hazardous materials and hydrocarbons to be used for the project.
- .2 Products stored on site should be stored in an enclosed area. Storage areas must be equipped with a liquid containment or holding system (Polyspill pallets, basins, waterproof tarps, berms, trenches, closed drains or drains connected to a recovery system).
- .3 Petroleum products or other hazardous materials must be stored at least 30 metres away from watercourses and sewers (sanitary or storm) or ditches leading directly to a watercourse.
- .4 Containers of flammable and combustible liquids must be stored in an upright position.
- .5 Containers in poor condition must be immediately removed from DND property in accordance with the most stringent environmental standards. The containers must be identified in accordance with WHMIS.
- .6 Temporary hazardous product storage areas must have transportation of dangerous goods (TDG) signs indicating the risks.
- .7 All enclosed containers that can store over 230 litres of petroleum products and related products must be double-walled and align with the *Transportation of Dangerous Goods Regulations* (TDGR) and be designed in accordance with CAN/CGSB 43.146-2002.

F.9 Management and disposal of equipment, waste and residual materials

- .1 Waste and material may not be dumped in watercourses, sewers, ditches, or be burned or buried on DND property.
- .2 Waste must be removed from DND property in accordance with federal and provincial

environmental protection regulations.

- .3 Any material or waste (non-hazardous or hazardous) generated by the project must be separated and stored in containers provided for this purpose in a sheltered area.
- .4 Locate storage areas more than 30 metres from the watercourse, ditches or sewers (rain and sanitary).

F.10 Protection of trees, shrubs and plants

- .1 The Contractor must protect trees, shrubs and plants on the site and adjacent properties. Any plant which the Departmental Representative deems to have been so damaged by the Contractor or its subcontractors that the ability of the plant to survive is questionable must be replaced by the Contractor with two (2) equivalent plants.
- .2 When excavation or earthwork is being performed, the Contractor must protect the roots of designated trees up to the drip line to ensure that the roots are not moved or damaged.
- .3 The Contractor must refrain from moving vehicles or unloading or storing materials in areas under which the roots of protected trees are located.
 - .1 To provide protection in areas with traffic, install a physical barrier:
 - .1 Short term \leq 1 month: Ramial chipped wood (RCW);
 - .2 Long term \geq 1 month: Geotextile and crushed rock (6 inches).
 - .2 The circulation of machinery and the deposit of materials or snow/soil is prohibited.
- .4 Keep the stripping of topsoil and vegetation to a minimum.
- .5 The Contractor must not remove trees other than in the areas designated by the PSPC Representative.

F.11 Protection of users' activities and facilities

- .1 Clearly mark off the work area. Avoid moving or disturbing soil outside work areas.
- .2 If the site includes observation wells, they must be located and marked off prior to the start of work to avoid damage. If work affects the integrity of the other wells, immediately notify the PSPC Representative, who will advise the DND Environment Section at the Valcartier Base.
- .3 Perform noisy work only during normal work hours, between 7 a.m. and 5 p.m. Monday through Friday. Do not idle engines.
- .4 Locate all underground utility lines (gas, water, sewer and electricity) on or near the site with the help of DND's info-excavation and Roads and Ground Service.
- .5 If old underground infrastructure (e.g., septic tanks, electric lines, oil tanks) is uncovered during the work, notify the PSPC Representative, who will decide next steps. If underground tanks of petroleum products are uncovered, the surrounding soil will need to be characterized

according to normal procedures to determine if it is contaminated.

F.12 Movement of vehicles carrying hazardous materials

- .1 All vehicles carrying dangerous goods must comply with the *Transportation of Dangerous Goods Regulations*.
- .2 All vehicles carrying hazardous materials that must be brought inside the Valcartier Garrison must pass through the main gate (Route de la Bravoure (QC-369)). The vehicle will then have to follow DND's directions to the work site.

F.13 Environmental Monitoring Form

- .1 At the start of work, read and complete the monitoring form. During the course of work, consult regularly and complete the other applicable sections depending on the progress of the work. When work is completed, submit the completed form to the PSPC Representative. The environmental monitoring form is available in **Appendix H**. The monitoring form covers the items established in this Specifications document.

ANNEX G
ENVIRONMENTAL MONITORING FORM