National Research Council Canada
Administrative Services and
Property Management Branch

Conseil national de recherches Canada
Direction des services administratifs et
gestion de l'immobilier

REQUEST FOR PROPOSALS
DEMANDE DE PROPOSITIONS

RETURN BIDS TO :
RETOURNER LES SOUMISSIONS À:

National Research Council Canada (NRC)
Procurement Services
1200 Montreal Road, Building M-22
Ottawa, Ontario
K1A 0R6
Bid Fax: (613) 991-3297

Title/Sujet **M24E: CCHT New Semidetached House**	
Solicitation No./N. de l'invitation **RFP15-22186**	**Date** **19-February-2016**
Solicitation Closes/L'invitation prend fin **at/à** **14 :00** **on/le** March 23rd, 2016	**Time Zone/Fuseau Horaire** **EST**
Address Enquiries To/Adresser demandes de renseignements à : Marc Bedard Telephone No./N. de téléphone : **(613) 993-2274** Facsimile No./N. de télecopieur : **(613) 998-5701**	

Instructions: See Herein

Instructions: Voir aux présentes

Proposal To:

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

Proposition aux:

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

Canada

Vendor/Firm Name and Address **Raison sociale et adresse du fournisseur/de l'entrepreneur** **Telephone No./N. de telephone** **Facsimile No./N. de télécopieur**
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) **Nom et titre de la personne autorisé à signer au nom du fournisseur/de l'entrepreneur (taper ou écrire en caractères d'imprimerie)** **Signature** **Date**

Request for Proposal for the Design and Construction of a Semi-detached House at the National Research Council, Ottawa

Daniel G. Booth & Robin Craig

16-February-2016

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EXECUTIVE SUMMARY

This is a design / build request for proposal (RFP). The following NRC requirements are to be read in conjunction with the RFP appendices. This RFP is for the design and construction of a new building as an upgrade to the Canadian Center for Housing Technology (CCHT).

Builders intending on submitting a proposal for this project are expected to submit existing or slightly modified plans for existing model homes. The experimental provisions and functionality necessary to complete this research facility are not expected to be detailed by the builder in response to this request for proposal. Experimental specifications and designs necessary to support research facility functionality will be developed during the design phase of this project.

However, evaluation of builder proposals will include an assessment of the ability to identify what aspects of the model home will require design / build modifications to accommodate the functionality necessary.

Please note that the conceptual plans presented in this RFP are for consideration only. Builders may suggest modifications to the conceptual plans so long as the intended functionality, costs, schedule and general scope of work (National Building Code of Canada, Part 9 Building) of the project is respected. If a builder feels that in order to meet the intended objectives of the project the proposal should be fundamentally different, such as building orientation, access routes, siting, and architectural design, then NRC will consider the merits of the proposal.

Builders may visit CCHT at a bidders conference at the date and time detailed in this RFP. **Multiple builders wishing to collaborate will be considered.**

1. INVITATION TO SUBMIT PROPOSALS

1.0 You are invited to submit four copies of a Technical Proposal and two copies of a Financial Proposal in two separate envelopes to fulfil the following requirement forming part of this Request for Proposals. One envelope **must** be clearly marked 'Technical Proposal' and the other envelope **must** be marked 'Financial Proposal'. All financial information **must** be fully contained in the Financial Proposal, and only in the Financial Proposal. Vendors who provide financial information in the technical proposal will be disqualified. **All proposals should include the front page of this RFP duly completed.**

1.1 The National Research Council (NRC) invites interested members of Canada's housing industry to submit a proposal in response to this Request for Proposal (RFP). Proponents are encouraged to form industry teams to submit a specific proposal for the design, construction, and commissioning of a semi-detached house research facility to be built on NRC's land near the intersection of Montreal Road and Burma Road, in the city of Ottawa.

1.2 The new facility is an upgrade to the existing Canadian Centre for Housing Technology (CCHT or The Centre), a jointly operated federal facility of the National Research Council, Natural Resources Canada, Canada Mortgage and Housing Corporation, and industry members. CCHT mission is to accelerate the development and commercialization of innovative and environmentally sustainable technologies for residential construction. The long-term goal is to improve the quality, affordability, and environmental sustainability of Canadian housing and, thereby, to support domestic and global market opportunities.

1.3 The existing Centre consists of two full-size Research Houses, a three-unit row house unit called the InfoCentre, and adjacent serviced building lots for additional Research Houses in the future. The Centre evaluates innovative, market-ready technologies and product prototypes in the Research Houses and displays new technologies and provide electronic linkages to other sources of information in the InfoCentre.

1.4 The Centre benefits the housing industry by providing performance data and research findings, by demonstrating new systems, components, and products to domestic and international audiences, and by providing potential customers with sources of information on Canada's housing industry.

1.5 Due to the unique opportunity to win national and international prestige as the builder expanding this world-class facility, members of the winning team are expected to contribute to the project in the form of materials, products, and services. A list of organizations with an expressed interest in participating in the Centre is provided in Appendix 2. Members of the team will be identified in the Centre's displays, publications and publicity campaigns.

1.6 Proponents are expected to be familiar with current federal activities in this area, including Natural Resources Canada's R-2000 and Advanced Houses Programs, with Canada Mortgage and Housing Corporation's Healthy Housing and Flex Housing design principles, and with the Centre's recent housing construction research findings (http://www.ccht-cctr.gc.ca/).

1.7 NRC has undertaken an Environmental Site Survey and has contracted a Geotechnical firm to investigate the lands where the project is to be constructed. The environmental and geotechnical reports will be made available for viewing on request.

1.8 A Site Plan has been completed and is included as Appendix 3. Proponents are advised that site development, including roadways, drainage, utility services, signage, and site landscaping will be concurrent with the construction of the semi-detached home proposed under this RFP. The proponent will be required to provide complementary landscaping for the lot similar to the existing CCHT. Some existing services provided to the three existing buildings will require some minor modification to accommodate the new build.

1.9 It is anticipated that the Semi-detached Research House will be completed and ready for performance monitoring by December 31, 2016, at the latest, and that the final commissioning will be completed by March 31, 2017.

2. SCOPE OF WORK

2.1 To provide Professional Services to design and construct a new semi-detached research house in accordance with the Design Brief attached as Appendix 5.

2.2 The project called for under this RFP includes the following five separate activities:

- 2.2.1 Design and Build a representative, identical two-unit semi-detached research house.
- 2.2.2 Finalize the design and build the *power-pad* based on preliminary concept drawings to be provided.
- 2.2.3 Incorporate additional features to meet NRC's research requirements
- 2.2.4 Document the construction with as-built diagrams, colour photos and video.
- 2.2.5 Document the construction costs for future comparison purposes, and

2.3 The two identical semi-detached Research House units should be representative of typical, currently available single-family semi-detached housing. They will serve as a benchmark for the best Canadian residential design and construction practices available in 2015. As a minimum, they will be built to full 2012 R-2000 and Healthy Housing requirements with state-of-the-art construction techniques, products, and systems, including control and communications technologies. Both houses should be fully equipped and ready for normal occupancy, including flooring, cabinets, and light fixtures but not including furniture. Kitchen and laundry Smart appliances will be purchased by NRC and provided to the proponent for installation.

2.4 To meet NRC's research requirements, the first unit, called the Reference Unit, will be operated as a control unit, while the second, called the Test Unit, will function as a laboratory, where components can be changed to allow their effect on performance to be assessed. Both units must be able to be 'up-graded" periodically from 2012 R-2000 to Net-Zero Energy performance levels and back again by allowing changes in insulation levels, windows, and airtightness of the building envelope.

2.5 NRC will undertake sophisticated monitoring of the two semi-detached units once construction and commissioning are completed. A separate, thermally isolated enclosure, on

an electrical meter separate from the units, is required in each garage to house the monitoring equipment. Each habitable room in each unit is required to have a 15 amp, 120 VAC circuit independent of the house wiring and on the separate meter. Although NRC will be supplying and installing all monitoring and home automation equipment, the builder and sub trades will be required to coordinate their work with NRC researchers who will be placing sensors within building assemblies during the construction process and running wiring during the pre-drywall phase. Some adaptation of a typical garage structure will be necessary to accommodate the data acquisition infrastructure. Unlike the existing detached homes, the garage will not be dedicated solely to data acquisition. The garage space will also be used to support the charging of electric vehicles. During the design phase of the project some adaptation of a typical garage may be necessary to support operations. Construction requirements to accommodate the monitoring equipment are included in Section 6.

2.6 The Semi-detached Research House will feature typical wood frame construction, with conventional cast-in place concrete basements. Additional Research Houses featuring other forms of construction are planned on other lots and will be compared to the detached and semi-detached houses.

2.7 NRC intends to use the Reference Unit to analyze the chemical emissions from building materials and their impact on indoor air quality in new construction. The builder and sub-trades will be expected to coordinate their work with NRC researchers who will be obtaining samples of materials during the construction process. Larger assemblies, such as kitchen and bathroom cabinets, will be tested in NRC's laboratories prior to their installation in the Research Houses, and therefore must be delivered to Building M24 two weeks prior to installation. The builder and sub-trades will be expected to supply background information on the sample materials such as manufacturer, model, supplier, batch or serial numbers, specification sheets, product literature, and MSDS information. A list of materials to be sampled is provided in Appendix 4.

2.8 NRC intends to use the Research House to assess a variety of HVAC equipment. The basement and ductwork of the Test House are required accommodate a variety of HVAC installations.

2.9 To allow future analysis of the performance of the Semi-detached Research House, detailed as-built construction drawings will be required. Construction and assembly processes should be fully documented with both digital photos and broadcast-quality video. Because this information will also be used by NRC for educational ·and promotional purposes, proponents are required to document the project in a format suitable for lecture presentations and documentaries. The copyright for this documentation will rest with NRC. The requirement for ″broadcast quality video″ does not mean that a professional videographer or other media production professionals must be engaged to produce the as-built records. Photographs should be taken by the builder throughout the construction process. In particular, construction details that are indicated on the plans that will be hidden will require photographs prior to cover up. These photos will be the responsibility of the builder and should be provided to the project team on a regular basis.

• NRC’s contract coordinator will supplement photographs, but this does not nullify the responsibility of the builder to photo-documenting the construction process.

• Any changes to the as-built plans or specifications must be communicated to the project team to ensure that certification requirements are not jeopardized. The energy model will be updated to reflect any changes in the construction details, but ideally the only change in the energy model should be the results of the air test. Photo documentation during building construction is valuable in verifying that designs have been followed or agreed upon variances properly captured and available for updating as-built diagrams.

• Good architectural detailing in the plans should help prevent failure, but site conditions may allow for mistakes to be made, photo documentation should help to communicate to the design team any deviations or mistakes in the build process.

• Effort required capturing these images and videos should not be so great as to slow down the construction process to any great degree. Hand-held photography, with a modern digital camera, will suffice for most construction update purposes. However, some images should be taken with the intent to capture images for reports and professional dissemination of information. Some reasonable effort should be made in taking periodic photos that capture the build process with the intent to present the image. Efforts including using a tri-pod mounted modern digital camera, and standard contractor flood lighting, should be sufficient to meet these needs.

• Recognized is that video recordings with audio commentary may be a preferred method for relaying information to the project team for some site issues. Photos should be taken in conjunction with any video recordings for documentation purposes.

• Any requirement for intensive photo documentation or video recording of a specific aspect of the building that becomes necessary due to specific NRC needs are beyond the scope of the project will be coordinated with the builder. The builder is not responsible for developing any substantial photo or video record (Editing, graphic, music, time lapse sequences etc.) that is for any specific expressed purpose beyond what is described above.

2.10 Proponents are required to propose a detailed costing methodology, including material, labour, overhead, and profit, that will be used to document the construction costs of the Reference Unit. Costs incurred to meet this requirement and NRC's research requirements should be costed separately. Because this information will be used to compare the cost and performance of additional Research Houses in the future, this procedure must be non-proprietary and readily usable throughout the industry. An example of a costing procedure is given in Appendix 5.

2.11 The *power-pad* will accommodate connection to new energy generating technologies such as PV and combined heat and power units. An electronic gateway to the existing houses is necessary for energy management and control. It will include gas, electrical and water / anti-freeze piping and conduits. Provisions for an electric vehicle car charging station will be incorporated. Preliminary concept drawings are presented in Appendix 5.

2.12 A construction waste management plan should be implemented.

3. PERIOD OF CONTRACT

3.1 NRC anticipates that the design work will begin upon award of contract and the construction work will be completed by March 31st, 2017.

4. ENQUIRIES

4.1 If you require clarification regarding any aspect of this RFP, address all queries to the Contracting Authority, identified below, at least 5 working days before the closing date. All queries must be in writing and queries received less than 10 working days prior to the closing date cannot be guaranteed a response. Information received verbally will not be binding upon the NRC.

Marc Bedard
Contracting Authority, Procurement Services
National Research Council Canada
1200 Montreal Road, Bldg. M-22
Ottawa, Ontario K1A 0R6 Telephone: **613-993-2274**
Facsimile: **613-998-5701**

4.2 To ensure the equality of information among Bidders, responses to general enquiries will be made available to all bidders unless such publications would reveal proprietary information. The bidder who initiates the question will not be identified. Technical questions that are considered proprietary by the bidder must be clearly identified. NRC will respond individually to the bidder if it considers the questions proprietary. If NRC does not consider the question proprietary, the bidder submitting it will be allowed to withdraw the question, or have the question and answer made available through the Open Bidding System (OBS) to all bidders.

4.3 Vendors who attempt to obtain information regarding any aspect of this RFP during the solicitation period through any NRC contacts other than the Contracting Authority identified herein, may be disqualified (for that reason alone).

4.4 It is the responsibility of the Bidder to obtain clarification of the requirement contained herein, if necessary, prior to submitting its proposal. The Bidder must have written confirmation from the Contracting Authority for any changes, alterations, etc., concerning this RFP.

5. PROPOSAL CLOSING DATE AND BID SUBMISSION INSTRUCTIONS

5.1 Proposals must be delivered not later than 2:00 PM EDT, **March 23rd , 2016**, to the following **Contracting Authority**:

Marc Bedard
Contracting Authority, Procurement Services
National Research Council Canada
1200 Montreal Road, Bldg. M-22
Ottawa, Ontario K1A 0R6 Telephone: **613-993-2274**

Proposals must not be sent directly to the Project Authority

5.2 Proposals must be delivered in a sealed envelope and the Bidder's name and the RFP No. should be clearly indicated on the Proposal Envelope. It is the vendor's responsibility to obtain date and time stamped receipt signed by the receptionist as proof that NRC has received their proposal within the prescribed time limit. All risks and consequences of incorrect delivery of bids are the responsibility of the Bidder.

5.3 Bid submissions must be in accordance with the Standard Instructions and Conditions (Applicable to Bid Solicitation) attached as **Appendix 14: General Conditions.**

5.4 Due to the nature of this solicitation, NRC will not accept any proposal documents by facsimile.

5.5 NRC will not accept any proposal documents by electronic mail or on diskette.

5.6 Proposals received after the closing date will not be considered and will be returned to the sender. The sender has the sole responsibility for the timely dispatch and delivery of a proposal and cannot transfer such responsibility to the NRC. No supplementary information will be accepted after the closing deadline unless NRC requests a clarification.

5.7 All submitted proposals become the property NRC and will not be returned to the originator.

5.8 **Response Requirements:** It is mandatory that Proponents respond to all subsections of this Article. Failure to do so will render the Proponents response non-compliant and will result in elimination from any further consideration. In order to facilitate analysis of the responses, Proponents are asked to format their response using the same sub-sections that follow.

5.9 **Official Languages:** Provide a statement of compliance that the Proponent has the ability to provide service in both official languages.

5.10 **Design and Build a Two-unit Semi-detached Research House:** Proponents are required to provide design drawings and specifications for the Research House, a description of how their proposed design will meet the intent of the project, and the rationale for addressing or modifying the Guidelines and Mandatory Requirements given in Section 6. The design should reflect an optimized package of innovative, efficient, marketable,

affordable, and environmentally responsible products and construction methods. At a minimum, the proposal shall include but not be limited to:

- Floor plans, elevations and sections
- Listing of interior finishes
- Mechanical, Plumbing, and Electrical schematics
- Hot-2000 computer simulation runs

Both Research Houses must be registered with the R-2000 Program. NRC requires the right to build one additional semi-detached Research House to the same basic design as required under this project.

5.11 **Meeting NRC's research requirements:** The proposal should indicate how the plans for the Research Houses address their intended research functions. Details should be provided showing how the Semi-Detached House can be changed back and forth from R-2000 to Net Zero Energy performance with regards to insulation levels, windows, and airtightness. NRC's requirements for monitoring and other unique functions of the Research Houses should be incorporated in the design as unobtrusively as possible.

5.12 **Document the construction:** Provide a full description of the process to document the construction of the Research Houses and the InfoCentre. This is for NRC's promotional, educational, and reference purposes.

5.13 **Construction Cost Analysis for Research House:** A costing methodology should be presented that can be readily replicated for comparison purposes by the builders of any future research or demonstration houses. Any costs attributed solely to conducting the costing analysis or to the Research Houses' research functions and not part of their normal construction in the marketplace should be clearly identified and separated out. Example in Appendix 5.

5.14 **Finalize the Design of the Power-Pad:** Provide design drawings and a detailed costing proposal for building the Power-Pad and include any additional items to improve its intended functions. The construction of the Power-Pad should maximize opportunities for demonstration of power generation technologies.

5.15 **Construction Mock-ups :** The builder will provide mock-ups of all major construction features of the Research House to be used for demonstration purposes in the display area of the InfoCentre.

5.16 **The Team:** Identify all key team members, including the project manager to be dedicated to the project. Describe each of their roles, responsibilities, and contribution of goods and services, the methodology proposed by the Proponent to deliver the project, and how the Proponent proposes to interact with NRC. Provide a profile of the lead organization to be involved in the delivery of the project. Include relevant experience and a list of projects

of a similar size and nature to that which NRC is seeking. The ability of the team leader to manage the project successfully should be demonstrated. The project team is expected to include a range of players in the housing industry, with their expertise and contributions to the success of the project clearly outlined. The proposal should include any plans of team member for promoting the Centre in their own marketing. A list of organizations that have indicated an interest in participating in the project or supplying products is included in Appendix 2.

5.17 **Construction Schedule:** A detailed construction schedule should be provided, including allowances for finalizing the designs, for installation of sensors and other monitoring equipment (up to **four** weeks at the pre-insulation stage), for sampling of materials for indoor air quality testing, and for documenting the construction process for promotional and educational purposes. Items that may be dependent on and require coordination with the site development and installation of services should be identified.

6. EVALUATION CRITERIA, GUIDELINES & REQUIREMENTS

6.1 **Guidelines and Requirements:** section 2 (SCOPE OF WORK) of this RFP describes the project and specifies some of the minimum requirements of the project. This section 6 of the RFP contains two types of additional information: general guidelines that are intended to communicate what building characteristics are desired, and mandatory requirements which are needed to adapt the 'typical' house into a research and demonstration facility. The **general guidelines** have been kept intentionally broad to allow proponents the opportunity to propose an R-2000 house design that is as close to their current construction practice as possible. The intention is in part to showcase this type of construction, to use the R-2000 house as a 'platform' for research and to minimize the cost of construction by avoiding customization as much as possible. The **mandatory requirements** specify to the proponent what additional features are required either to facilitate the research activities in the Research House or to demonstrate particular technologies or construction approaches that will be part of the Centre's research program.

6.2 **General Guidelines:** of the semi-detached Research House:

6.2.1 The appearance of the research house will be representative of the proponent's current houses in the marketplace -quality built and visually attractive.
6.2.2 The research houses will be between approximately 167-195 m^2 of livable area.
6.2.3 The number of rooms and bathrooms will be typical.
6.2.4 The design will take advantage of the open south exposure, as per the site plan.
6.2.5 Each house will feature and attached garage (special requirements for the garages are specified in 6.3 – mandatory requirements)
6.2.6 Barrier-free access to the main floor is desirable.
6.2.7 Interior finishes, flooring and carpets will be typical in most cases. (See 6.3 for exceptions and sampling requirements).
6.2.8 Cabinets will be typical (see 6.3 for sampling requirements)
6.2.9 No furniture will be required.
6.2.10 Plumbing will be typical
6.2.11 The main electrical wiring will be typical, and will be specified by the proponent. However, both Research Houses will also feature a separately metered electrical circuit to accommodate monitoring and occupancy simulation, as specified in subsection 6.3.
6.2.12 All light fixtures should be included and will be typical.

6.3 **Mandatory Requirements:** of the semi-detached Research House:

6.3.1 The Test unit and the Reference unit are to be an identical mirror image reflected through the planar surface of the partition wall, with the exception of characteristics to facilitate instrumentation, data acquisition, occupant simulation and home automation noted in 6.3.12 to 6.3.24. If material substitutions occur during construction, due to availability, these will be placed identically in both houses.

6.3.2 The Research Houses will be built to R-2000 and Healthy House requirements.
6.3.3 The Research House shall be built using typical wood frame construction techniques.
6.3.4 The Research House will be semi-detached.
6.3.5 Both semi-detached units will feature full basements.
6.3.6 They will meet the requirements of the 2010 National Building Code
6.3.7 The baseline mechanical equipment will be typical R-2000 best practice, and will include central air conditioning.
6.3.8 Provide appropriate electrical and gas connections to locations where all major appliances would be installed: stove, dishwasher, fridge, washer and dryer. The actual appliances will be purchased directly by NRC.
6.3.9 A sealed combustion gas fireplace shall be incorporated in the layout.
6.3.10 All natural gas lines termination points shall be installed with a quick-connect adapter to accommodate changing the combustion device for assessment of other models.
6.3.11 Demonstration of Complete Rain and Melt-water Management around the House and Lot. The proponent's usual specifications for eaves troughs and landscaping shall be modified (where different): to provide full eaves trough with downspout outlets that deposit water at least 2 meters from houses; to landscape with relatively steep slopes away from houses (10% grade), and to use a system of swales to deliver water to drainage ditches. Pathways are planned in such a way as to direct water away from the building. This surface water management system is to work effectively after normal settlement of landscaped areas.

<u>Characteristics to facilitate instrumentation, data acquisition, occupant simulation and home automation:</u>

6.3.12 Design in accordance with design brief to allow for Instrumentation of building envelope walls. For the Research House the proponent's usual drawings for the wall / floor and roof assemblies shall be modified: to include temperature and pressure sensors outboard of the concrete / wood sheathing, the interstitial stud cavities, and interior walls.
6.3.13 Design in accordance with design brief to allow for instrumentation of the building partition wall. For the Research House the proponent's usual drawings for the wall / floor and roof assemblies shall be modified: to include temperature and pressure sensors on the interior drywall, the interstitial stud cavities, and interior concrete walls.
6.3.14 Design in accordance with design brief to allow for instrumentation of the basement slab for Radon mitigation testing. Provisions for “Radon Ready” active sub-slab depressurization.
6.3.15 Baseboards are to double-up as instrumentation wiring chases in all finished rooms. Raceways can be used as well.
6.3.16 Drywall shall be fastened with screws to facilitate removal. However, except for the mechanical room, which will have no other finishing, typical taping and painting will be used in livable areas to conceal the drywall joints.
6.3.17 The garage for each house will have sufficient size to accommodate a 3.3 m x 3.3 m data acquisition enclosure (or equivalent area) for the monitoring and Home Automation equipment.

6.3.18 Design to allow for efficient removal and installation of furnace, water heater, and other mechanical plants for testing purposes.

6.3.19 Install a separate breaker panel for the monitoring and occupancy simulation circuits and the monitoring equipment in the monitoring enclosure in the garage (the main breaker panel for the regular house circuit can be in its normal location). Loop out wiring from each of the two breaker panels to facilitate later installation of meters for monitoring each circuit. Install wide breaker boxes to allow for brank line power monitoring with CT's. Both houses must have 200 amp services to accommodate electric resistance heating for testing purposes.

6.3.20 At least one closet on each floor is to be lined up vertically such that the closets on both floors can be interconnected and used as a vertical chase for additional future wiring, instrumentation or dueling that will be part of future experiments.

6.3.21 Access hatches to all concealed spaces shall be provided; e.g. attic.

6.3.22 Use of open-truss floor joists whereby the web spaces can be used to run conduits, ducting or wiring.

6.3.23 A separately metered electrical circuit will be required for monitoring and occupancy simulation. A minimum of one wall outlet per habitable room is required for the 'monitoring' circuit.

6.3.24 A pause of one half working day will be needed for NRC staff to install "sensors within the concrete forms, before the concrete is poured. A pause in construction of two weeks per unit will be required for instrumentation and Home Automation wiring before insulation is placed (Instrumentation and home automation wiring will be provided by NRC). Another day of pause will be required before interior finishes are placed, and before exterior finishes (and backfilling in the case of basements) to allow for the installation of appropriate sensors and wiring in various locations.

6.3.25 NRC materials sampling team will collect material samples, finishes and paint samples for the Indoor Air Quality Study. Coordination with installers of finishes will be required to allow NRC staff to obtain samples. Larger assemblies, such as kitchen and bathroom cabinets, will be tested in NRC's laboratory before installation in the research house.

6.4 Selection of the successful Proponent will be on the basis of responsiveness to the RFP, technical merit, innovative concepts, and best overall value, not on cost alone. Proposals rated lower than seventy (70) points will be considered non-responsive and will be eliminated from further consideration. A Cost per Point method will then be used in which the tendered price is divided by the number of points awarded to the proposal. The lowest valid Cost per Point submission will be successful. NRC reserves the right to negotiate with the successful Proponent.

6.5 The technical component of the proposals will be scored according to the following point allocation:

A.	Conceptual design for a two-unit semi-detached Research House	20
B.	Conceptual design of the power-pad	15
C.	Conceptual provisions for research infrastructure	20
D.	Proposed construction documentation process	10

E. Team		25
F. Construction Schedule	+	10
Total		100

6.6 The technical component of the proposals will be assessed using the following evaluation criteria table. Bidders should provide a detailed response to each criterion. NRC reserves the right to verify any and all information provided by the bidder in his/her proposal.

Criteria – Technical Scoring	**Max Points**	**Scored Points**
A. Conceptual design for a two-unit semi-detached Research House		
A.1 Does the proposal show an understanding of our objectives for the Research House (innovation, sustainability)?	8	
A.2 Is the house design representative and acceptable?	5	
A.3 Does it meet R-2000/Healthy House requirements? Is there a HOT2000 run?	5	
A.4 Have the insulation requirements been met?	2	
Total Points Allowed:	20	
B. Conceptual design of the Power-Pad		
B.1 Does the proposal show an understanding of our objectives for the Power-Pad (innovation, sustainability)?	3	
B.2 Are the space, electrical, mechanical, hydronic and gas provisions adequate?	3	
B.3 Does the layout provide the appropriate "plug and play" accessibility and distribution of energy features?	3	
B.4 Are there provisions for renewable energy generation systems (PV, Wind)?	3	
B.5 Are any additional innovative technologies / design features suggested, such as CHP & E-vehicle charging?	3	
Total Points Allowed:	15	
C. Conceptual provisions for research infrastructure		
C.1 Is the proposed method of upgrading the Research House energy performance to Net Zero+ acceptable?	5	
C.2 Are the proposed provisions and adaptation of the building to support features in the design brief plausible?	6	
C.3 Are the data acquisition room requirements for the garage incorporated?	5	
C.4 Is the proposed method to allow for easy changeover of mechanical room plants acceptable?	2	
C.5 Are any additional innovative technologies or design features suggested that have merit?	2	
Total Points Allowed:	20	
D. Proposed construction documentation process		
D.1 Will as-build construction drawings and broadcast-quality video be provided?	5	
D2. Will construction mock-ups be provided?	2	
D3. Is a construction waste management plan included?	2	
D4. Are any other forms of documentation to be provided?	1	
Total Points Allowed:	10	
E. Team (Refer to Appendix 7 - Builder Qualifications)		
Mandatory Requirements		
Refer to Qualification scoring sheet. Pass or Fail?	P or F	
Asset Qualifications		
Refer to Qualification scoring sheet. Total Mark: _____ % x 25 points =		
Total Points Allowed:	25	
F. Construction Schedule		
F.1: Is the schedule realistic and will our deadlines be met?	5	
F.2: Has time been allocated for NRC technicians to install sensors and monitoring equipment?	5	
Total Points Allowed:	10	

6.7 Selection of the successful bidder will be on the basis of technical merit and best overall value, not on cost alone. The compliant bidder with the lowest cost-per-point ratio will be considered the successful bidder (see section 9.2 for an example evaluation chart).

Proposals scoring less than 70 points of 100 points will be considered non-responsive and will be eliminated from further consideration. A proposal will be considered non-responsive if it does not meet the mandatory criteria or if it is not supported by proper and adequate detail, particularly where supporting evidence is required. Bidders must meet all RFP mandatory requirements indicated by imperative words such as, but not limited to, "must "shall", "will" and "essential" including compliance with the mandatory terms and conditions of the RFP. Furthermore, it is essential that the elements contained in proposals be stated in a clear, concise manner. Proposals should be in the same order and formatted using the same section and sub-section numbers as the RFP. Proposals will be evaluated solely on their content. Items not addressed will be given a score of zero.

7. COST PROPOSAL

7.1 The cost proposal must be a **fixed price quotation, FOB Destination, excluding GST/HST.** The fixed price must include all the materials and services required to fulfil all aspects of the Statement of Work. Bidders should identify the currency on which the cost proposal is based. The work will take place in the National Capital Region (NCR). The fixed price quotation must include all costs required to perform the work, including Travel and Living Costs incurred in performing the services.

7.2 GOODS AND SERVICES TAX (GST) and HARMONIZED SALES TAX (HST): The GST and HST, whichever is applicable, shall be considered an applicable tax for the purposes of this RFP and extra to the price herein. The amount of GST or HST shall be disclosed and shown as a separate item.

7.3 **Cost Proposal:** Provide itemized costs by completing the following chart:

Cost $C	**Phase of Work**
	Finalized R2000 designs and specifications approved
	Program A1 completed – Architectural & Structural
	Construction of the power-pad
Cost allowance*	Program B completed – **Special** Mechanical & Electrical
Cost allowance*	Program C completed – **Experimental**
	Program A2 completed – Finishing
	Landscaping
	As-built construction documents & final commissioning
	TOTAL

*Note: the cost allowance is not a cost to be carried by the proponent. Funds up to $25K will be made available to deal with specific issues relating to installation of special mechanical & electrical components, as well as experimental infrastructure, which may require support from general trades and specialized technicians.

8. LEVEL OF EFFORT

8.1 **Budget:** Cost estimates for the building range from $485K to $714K. The cost estimate for new services is $158K (including the *power-pad*).The funding available to support this work is limited to a maximum budget of $900,000 excluding the GST or HST, whichever is applicable. Proposals exceeding this cost will not be considered.

8.2 **Project Organization**: Within NRC, two principal organizations, the NRC-Construction (CONST), and the Administrative Services and Property Management Branch (ASPM), will be dealing with the successful Proponent. CONST is the end user of the proposed facility, and ASPM is an internal NRC service organization which is responsible for NRC physical asset management.

8.3 **Responsibility:** for the project rests with the General Manager of CONST. CONST and ASPM will be signing-off the project as progress is made and as a condition of further design and construction work, and to ensure NRC interests are addressed.

8.4 **A Project Manager:** has been identified by CONST to act as NRC's representative and point of contact between the successful Proponent and NRC with respect to all matters relating to the design of the proposed buildings. ASPM will supervise and coordinate the construction aspect of the project.

8.5 **Building Permit:** NRC will not insist that the successful Proponent obtain a building permit.

8.6 **NRC Project Definition:** NRC's project definition encompasses the Request for Proposal, with Appendices and the General Specifications and Guidelines. The Project includes a two-unit semi-detached research house and *power-pad* to demonstrate research housing technology in Canada. The scope of the project includes site service and road / pedestrian access with finished landscaping in keeping with the existing CCHT facility.

8.7 **Project Phases:** are envisioned, consisting of a design phase and a construction phase.

8.7.1 **Design:**
8.7.1.1 Briefing session with CONST team.
8.7.1.2 Program planning and schedule creation.
8.7.1.3 Review proposed designs.
8.7.1.4 Develop build programs.
8.7.1.5 Finalize designs with Technical Advisory Committee, design approved by NRC;
8.7.1.6 Issue R2000 program plans and elevation construction drawings.
8.7.2 **Construction:**
8.7.2.1 Excavation foundation and services.

8.7.2.2 Framing complete and closed in.
8.7.2.3 NRC installation of control and monitoring sensors and equipment.
8.7.2.4 R2000 pre-drywall inspections.
8.7.2.5 Construction complete; R2000 blower door tests.
8.7.2.6 Final commissioning.
8.7.2.7 Landscaping.

8.8 **Functional Requirements and NRC General Specifications Review:** The successful Proponent will be required to review the project scope within the context of NRC's Request for Proposals, and the NRC supplied General Specifications and Guidelines, and generally review NRC operations and areas of research as they relate to proposed design solutions. The successful Proponent will lead a design charrette to review the design options, architecture, finish treatments of the building as well as mechanical, electrical requirements and experimental provisions of the proposed design solutions. The successful Proponent will present the project plan to the project team to facilitate agreement on detailed design and construction requirements.

8.9 **Project Consultants, Contractors, Trades, Agencies and Management:** The successful Proponent will hire and pay for all required consultants and contractors to design, construct, coordinate and commission the facility as per NRC approved design and construction documents and agreements.

8.10 **Project Schedule:** The successful Proponent will advise NRC and maintain an ongoing project schedule providing bi-weekly updates to allow NRC to plan its installation of sensor, wiring, and instrumentation in coordination with the ongoing design and construction process, and to collect materials for indoor air sampling. A high level work plan will be created indicating what activities will be completed according to the project schedule.

8.11 **Project Reporting:** The successful Proponent will report monthly to NRC on the project's progress. Report formats and contents will be determined at the start of the design phase. Monthly reports should be accompanied by monthly schedule updates. Report and coordinate all project information to the designated NRC Project Manager.

8.12 **Drawings and Specifications:** Project drawings and any specifications shall be provided to NRC for its records and internal use. Provide these in electronic format. Drawings are to be created in AutoCAD, version 12, 13, or 14 in Metric, and according to NRC's layering conventions, which will be provided. Textual documents are to be in Microsoft Word.

8.13 **Design, Drawing and Specification Submissions and Sign Offs:** The Proponent and NRC will sign-off progress of the design and construction as a condition of any further work preceding at the following phases:

8.13.1 Finalized R2000 designs and specifications approved.
8.13.2 Program A1 completed – Architectural & Structural.
8.13.3 Construction of the power-pad.
8.13.4 Program B completed – Mechanical & Electrical.
8.13.5 Program C completed – Experimental.
8.13.6 R-2000 airtightness test PASS.

8.13.7 Program A2 completed – Finishing.
8.13.8 Landscaping
8.13.9 As-built construction documents & final commissioning.

In accordance with the cost proposal in section 7.5, and in accordance with **Appendix 13: Terms and Payment**, invoices may be submitted once each phase is signed off.

8.14 **Standards, Permits and Approvals:** Although a building permit is not required, the design and construction must meet all applicable codes and standards at the time of design; including, but not limited to the following:

- National Building Code latest edition
- National Fire Code latest edition
- Labour Canada
- Electrical Safety Authority
- Technical Standards and Safety Authority
- other applicable standards and codes as required

Arrange and pay for all required permits from all authorities having jurisdiction, including electricity and natural gas utilities and federal. Negotiate any problems arising with permit granting authorities to assure that permits can be obtained in a timely manner within the scope of the project schedule agreed to by NRC and the Proponent. Provide three copies of all permits and approvals to NRC for its records.

8.15 **Project Schedule and Coordination:** Provide complete schedule and coordination to provide a fully functioning, and equipped facility. The Proponent and its Consultants and Contractors will coordinate their work with the work of any NRC employees, contractors and / or consultants retained directly by NRC.

8.16 **Materials and Workmanship:** Install only new materials on this project unless specifically noted otherwise. Only first class workmanship will be accepted by NRC with regard to neatness of detail and performance. Use of materials with recycled components is encouraged.

8.17 **Alternates:** Proposed alternates whether materials, equipment, or techniques shall be reviewed with NRC prior to the Proponent approving or making any changes to documents that have already been signed-off by NRC.

8.18 **Work by NRC technicians:** During the course of construction, NRC technicians will be inspecting and documenting the project, collecting samples of materials being used, and installing measurement and data collection equipment.

8.19 **Commissioning Requirements and Schedule:** Provide all commissioning required to ensure that the whole facility and all its parts function properly. The direct overall charge of commissioning shall be the responsibility of one person, who is fully qualified through practical experience and comprehensive knowledge of the interactive nature of building systems and their controls.

8.20 **Commissioning Scope:** Ensure that appropriate NRC personnel are available and present during commissioning to review systems operation(s), function(s) and training. Organize, at a time convenient to NRC, a demonstration(s) of all equipment and systems for NRC users. The demonstration(s) shall only take place after commissioning has been successfully completed. Equipment. suppliers shall participate in the demonstration(s) as required.

8.21 **NRC Site Access:** NRC will have access to the site during construction for the purposes of reviewing and coordinating NRC requirements and activities.

8.22 **Discrepancies and Interferences:** The successful Proponent shall ensure that the complete facility design including coordination of the various trades meets the intended scope of work. Any defects, discrepancies, omissions or interferences noted should be brought to the attention of NRC.

8.23 **Safety and Security:** See **Appendix 20: Construction Specification Section 001545**

8.24 **Work Place Hazardous Materials Information System (WHMIS):** See **Appendix 20: Construction Specification Section 001000**

8.25 **Pollution Control:** Control all emissions (including noise) from equipment and plant to local authorities emission requirements. Prevent extraneous materials from contaminating the air beyond the immediate area of application by providing temporary enclosures. Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide appropriate containers as part of the required construction waste management plan.

8.26 **Documents Required on Site:** Maintain at least one (1) up-to-date copy of each of the following for NRC review on site,

8.26.1 Approved construction drawings, specifications, and addenda.
8.26.2 Change notices.
8.26.3 Any site instructions issued.
8.26.4 Approved schedules and updates
8.26.5 Manufacture's installation and application instructions
8.26.6 All permits
8.26.7 WHMIS Information

8.27 **Quality Control and Project Changes:** The Proponent will provide an appropriate professional level of construction site review and control of quality to ensure that construction conforms to prepared contract documents and design intent as signed-off by NRC. Any changes to the design during the construction process should be reviewed by the Proponent and the original designer and approved by NRC prior to proceeding with any such changes. All changes should be coordinated and documented by the Proponent.

8.28 **Testing, Certificates and Reports:** Provide NRC with three copies of all tests and reports related to the project including but not limited to R-2000 inspections.

8.29 **On-Site ASPM Contract Coordinator:** ASPM will assign an on-site coordinator during the course of the project to act as a liaison with respect to on site questions.

8.30 **Final Sign-Off:** As a condition of this project NRC will sign-off progress on the design and construction and at acceptance of the facility for occupancy.

8.31 **Base Building Equipment and Produce Warranties:** Provide three copies of all warranties.

8.32 **Base Building Maintenance and Operating Manuals:** Provide three copies of all maintenance, operating, service and parts manuals. These should be an organized compilation of all maintenance and operating data, technical information and operating instructions. Data should be organized into the same numerical order as the project specifications. Each section should be labeled with clearly visible dividing tabs. Drawings, diagrams and manufacturers information must be clearly legible. Manuals are to be vinyl, hard covered, 3" D type loose leaf ring binders suitable for *8 1/2"* x 11" size paper. Binders must be complete with clear spine pockets and identification. An index should be provided listing all products and systems covered.

9. CONDITIONS OF SUBMISSION

9.1 There shall be no payment by the National Research Council for costs incurred in the preparation and submission of proposals in response to this request. No payment shall be made for costs incurred for clarification(s) and/or demonstration(s) that may be required by NRC. The National Research Council reserves the right to reject any or all proposals submitted, or to accept any proposal in whole or in part without negotiation. A contract will not necessarily be issued as a result of this competition. NRC reserves the right to amend, cancel or reissue this requirement at any time.

9.2 Selection of the successful bidder will be on the basis of technical merit and best overall value, not on cost alone. A cost-per-point ratio will be calculated by dividing the total cost by the technical rating. The compliant bidder with the lowest cost-per-point ratio will be considered the successful bidder. NRC reserves the right to enter into negotiations with the successful bidder prior to contract award on any and all aspects of its offer. The following chart illustrates the relationship between point rating and bid price. The figures used are for illustration purposes only.

Proposal	Rating	Bid Price	Price/Point	Winner
A	72	$112,000	$ 1,555	
B	90	$ 120,000	$ 1,333	********
C	78	$ 105,000	$ 1,346	
D	85	$ 117,000	$ 1,376	

The method of selection will be highest combined Technical Rating (80%) and Price (20%)

9.3 Proposals submitted must be valid for not less than sixty (60) calendar days from the closing date of the RFP.

9.4 Your proposal should contain the following statement:

"We hereby certify that the price quote is not in excess of the lowest price charged anyone else, including our most favoured customer, for like services".

9.5 Any contract resulting from this invitation will be subject to the General Conditions – Services, attached as **Appendix 14: General Conditions** and any other special conditions that may apply.

10. OWNERSHIP OF INTELLECTUAL AND OTHER PROPERTY

10.1 All confidential information gathered or viewed or any product developed as a result of this RFP must be treated as confidential and as NRC property. Background information used and/or provided to the Awardee for the performance of the work and foreground information developed by NRC used and/or provided to the selected Proponent shall be owned by NRC. Under the Crown Procurement Contract, the Crown may own the foreground where the foreground consists of materials subject to copyright, with the exception of computer software and all documentation pertaining to that software. The proponent may wish to develop and share drawings with NRC via Non-Disclosure Agreements.

11. CONFIDENTIALITY

11.0 This document is UNCLASSIFIED, however; the contractor shall treat as confidential, during as well as after the services contracted for, any information of the affairs of NRC of a confidential nature to which its servants or agents become privy.

12. CRIMINAL CODE OF CANADA

12.1 Canada may reject an offer where the Bidder, or any employee or subcontractor included as part of the offer, has been convicted under section 121 (“Frauds on the government” & Contractor subscribing to election fund”), 124 (“Selling or purchasing office”), or 418 (“Selling defective stores to Her Majesty”) of the Criminal Code.

13. DEBRIEFINGS

13.1 After contract award, bidders may request a debriefing on the results of the bid solicitation. Bidders should make the request to the Contracting Authority within 15 working days of receipt of notification that their bid was unsuccessful. The debriefing may be provided in writing, by telephone or in person.

14. ATTACHMENTS

APPENDIX 1:	CCHT Fact Sheet
APPENDIX 2:	List of Proponents
APPENDIX 3:	Site Plan
APPENDIX 4:	Material Samples to be Collected
APPENDIX 5:	Design Brief
APPENDIX 6:	Sample Costing Analysis
APPENDIX 7:	Builder Qualifications
APPENDIX 8:	Construction Specification
APPENDIX 9:	Solar Ready Guidelines
APPENDIX 10:	Site Geotechnical Report

Canadian Centre for Housing Technology

Backgrounder

The Canadian Centre for Housing Technology (CCHT) is a partnership between the National Research Council of Canada (NRC), Natural Resources Canada (NRCan), and Canada Mortgage and Housing Corporation (CMHC). CCHT currently features a twin R-2000 house facility. The fully instrumented twin houses, with over 300 sensors, 23 meters and a simulated occupancy system, provide an ideal steppingstone between the laboratory and the marketplace. From helping to integrate products at the prototype stage, to assessing the energy performance of those that are already commercially available, CCHT researchers pursue a mandate of helping industry to accelerate the development of new technologies and their acceptance in the marketplace. A third building, the InfoCentre includes a display area and an office space. It also contains the FlexHouse – a townhouse designed as an evolving case study of how space can be adapted to an occupant's changing needs. Staying ahead of the industrial curve, CCHT has undergone continual additions to its facilities and modernizations since 1999, and this process continues today.

CCHT's twin research houses evaluate whole-house performance of new technologies in side-by-side assessment.

The success of CCHT can be attributed in part to strong working relationships with industry clients and partners and its partnership with world-class research laboratories and computer modelling specialists. Through 17 years of operation, CCHT has been host to a significant number of cutting-edge research and development projects in several crucial areas.

Alternative Energy

CCHT has demonstrated a number of renewable energy technologies. In the spring of 2005, a solid oxide fuel cell provided heat and power to the test house. Once running at steady state, the fuel cell emits only water and carbon dioxide, making it a clean alternative for generating heat and electricity.

The InfoCentre and FlexHouse have benefitted from solar energy in two ways: a number of different types of solar photovoltaic (PV) panels on the roof generate electricity during daylight hours, and a solar hot water system connected to a storage tank in the basement of the InfoCentre provides heat for water and space heating.

Research continued on the roof-integrated solar power system in 2011, when CCHT installed a roof-integrated PV system on the InfoCentre roof to monitor energy production, heat and moisture performance and other integration issues. Additionally, three deep-well ground source heat pump loops have been installed beside one of the CCHT twin houses to provide the cooling needs and part of the heating needs of the house. Alternative energy research continued on several projects, such as the Modulating Geo Heat Pump project, where one twin house was retrofit with a modern, variable capacity ground source heat pump.

Along with its university and industry partners, CCHT launched the SUNRISE (Semiconductors Using Nanostructures for Record Increases in Solar Cell Efficiency) project in 2010 to develop ultrahigh efficiency solar cells for photovoltaic concentrator systems.

A roof-integrated photovoltaic system was installed on the InfoCentre of the CCHT. The InfoCentre also includes the FlexHouse.

Combined Heat and Power Generation

Researchers at CCHT have examined a number of microCHP units including the very first residential fuel cell installation in Canada, two generations of a Stirling engine from New Zealand, and an internal combustion engine coupled to ground storage. All these technologies were powered by natural gas and generated between 1 and 6 kW of power. Through these experiments, researchers explored connectivity issues that arise between the microCHP technologies and the house.

In 2011, a longer-term research project began to explore the integration issues of energy power systems including power generation, storage, and management. The FlexHouse was equipped with a z-wave system capable of simulating a variety of realistic occupant-driven lighting loads, and began to automate the appliances. Plans are now in place to integrate next-generation advanced lithium batteries that were assessed at NRCan CANMET laboratories. The resulting energy management and storage system will be the focus of a further experimental program at the FlexHouse.

Energy Efficiency

A number of projects have examined energy-saving technologies and methods. For efficient products such as compact fluorescent lights and electronically commutated furnace motors, researchers measured not only the electrical savings, but also their impact on the space heating and cooling loads of the house, as well as indoor conditions.

An evaluation of several commercially available shower water heat recovery systems resulted in the creation of standards for assessing these products and a complementary online calculator to determine savings and payback periods.

As part of a project to reduce the peak electricity use in houses during periods of system-wide peak demand (notably hot summer afternoons), a variety of load-shifting strategies were demonstrated at the twin houses. Strategies included employing exterior shading, cycling the air conditioning system during periods of utility peak loads, opening windows on cool nights, and shifting appliance use to non-peak times.

Heating and Cooling Systems

The very first systems tested in the CCHT twin houses were gas-fired combined space and water heating systems. Hot water from these systems provided both the space heating and hot water needs of the house – allowing a hot water tank to perform the heating function of a furnace. Since then, CCHT has examined a variety of commercially available heating systems. In a novel heating project, a hydrogen electrolyzer produced hydrogen from water and electricity, which was then added to the natural gas stream of a high-efficiency condensing gas furnace. In partnership with the Gas Technology Institute, CCHT assessed the energy performance of a modulating propane -fired, direct-vent wall furnace system. The facility was also used to test the effect of gas fireplace operation in an open concept R-2000 home. The effects on energy consumption for heating and on surface temperatures in closed rooms were also studied.

A series of innovative heat pump projects included a two-stage air source heat pump; several air-source heat pump water heaters that heat water using energy taken from the air surrounding the equipment; mini-split heat pumps used in zoned-heating system; and a central air-source heat pump designed specifically for use in cold climate applications.

A packaged combination system consisting of a tankless water heater and matched two-zone integrated high-velocity air handler was installed to supply both water heating and space heating/cooling through a two-zone high-velocity ductwork. CCHT investigated the system's performance under winter and summer conditions. A similar approach was followed in 2014 using air dampers. An air balancing and zoning study has been initiated at CCHT, involving the assessment of air flow rates in each duct of CCHT's forced air distribution system in the twin houses. Zone dampers and airflow measuring stations were installed in the test house – one per branch. This work was in preparation for a larger project to investigate more effective zone distribution strategies for forced air systems, in both winter and summer conditions.

A number of heat recovery ventilators and energy recovery ventilators have been assess over the years. More recently, an innovative furnace fan generated (motorless) counter-flow air exchanger with heat recovery capabilities was installed at CCHT and was evaluated over the winter and summer periods.

As part of a multi-year project designed to develop technical documents for Health Canada on the performance of existing radon remediation strategies, a sub-slab depressurization fan was installed in the CCHT test house. Researchers examined its impact on home energy consumption for heating, and the risk of cross contamination between adjacent houses caused by radon discharge at ground level or at roof level.

Window and Shading Technology

The twin houses feature very efficient argon-filled high solar gain (HSG) windows. A project was carried out to compare the performance of these HSG windows to that of low solar gain (LSG) windows on a whole-house basis. Over 30 windows in one of the twin houses were replaced four times over the course of winter and summer experiments. Based on the experimental results, models were created for different locations across Canada and showed that the higher energy savings achieved with the HSG windows applied to all the cities considered. In the summer of 2010, the three CCHT partners undertook a project to examine the impact of awnings on cooling loads.

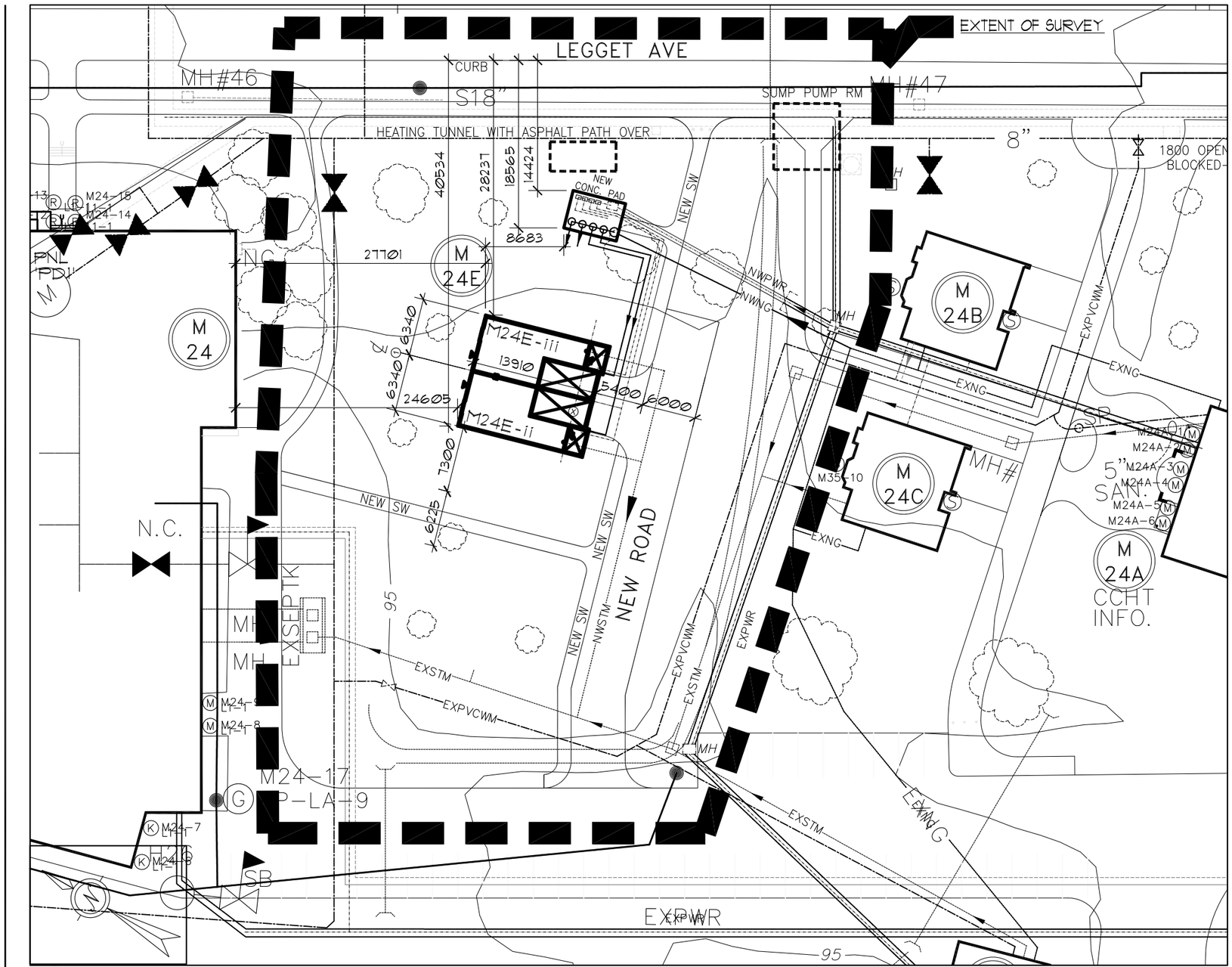
Mini-split heat pumps have the potential to produce home energy savings.

FlexHouse Renovation

Part of CCHT's InfoCentre, the townhouse featuring the CMHC's award winning FlexHouse design has been adapted and renovated over the years. In early 2013, renovations were made to improve some accessibility features of this demonstration house, and new themes and decor were incorporated to better highlight the rationale and function of modern FlexHousing™ design. In the process, spaces were customized for new energy-efficient appliances installed for the Smart Power System project. The updated FlexHousing™ facility has been featured in tours of the Centre since the renovation, and has also served as a demonstration site for a number of experiments on energy management for houses. These renovations were funded by CMHC.

Companies Endorsing the CCHT project / Compagnie approuvant le projet de CCTR

Company / Compagnie: CFocus Commissioning Services Ltd. **Name / Nom:** Claude Goulet **Title / Titre:** President	**Company / Compagnie:** Rheem Canada Ltd. **Name / Nom:** Mark Muzyka **Title / Titre:** Assistant National Sales Manager
Company / Compagnie: Solar Global Solutions **Name / Nom:** Sean Fleming **Title:** General Manager	**Company / Compagnie:** Environcentre **Name / Nom:** Michael Murr **Title:** Executive Director
Company / Compagnie: AddEnergie **Name / Nom:** Alexandre Louis **Title / Titre:** Sales Vice-President	**Company / Compagnie:** Eyedro Green Solutions Inc. **Name / Nom:** Trevor Orton **Title / Titre:** CEO / Co-Founder
Company / Compagnie: DigelAir HVAC Supply Inc. **Name / Nom:** Alexis Codina **Title:** P.Eng LEED AP Commercial Sales Engineer	**Company / Compagnie:** Owens Corning Canada **Name / Nom:** Salvatore Ciarlo **Title:** Technical Services Director
Company / Compagnie: Canadian Association of Home & Property Inspectors (CAHPI) **Name / Nom:** Sharry Featherston **Title / Titre:** Executive Director	**Company / Compagnie:** ecobee **Name / Nom:** Peter B. **Title / Titre:** Director Business Development
Company / Compagnie: Urbandale Construction **Name / Nom:** Peter Weiss **Title / Titre:** General Manager	**Company / Compagnie:** Quality Engineered Homes **Name / Nom:** Howard Sher **Title / Titre:** Executive Vice President
Company / Compagnie: Guildcrest Homes **Name / Nom:** George Tierney **Title / Titre:** Director, Marketing Services - Eastern Region	**Company / Compagnie:** Mitsubishi Electric Sales Canada **Name / Nom:** Clive Carr **Title / Titre:** Residential Sales Associate
Company / Compagnie: Opus One Solutions **Name / Nom:** Keyvan Cohanim **Title / Titre:** Chief Commercial Officer	**Company / Compagnie:** Crete – Ryan Construction **Name / Nom:** Randy Ryan **Title / Titre:** President
Company / Compagnie: Fenestration Canada **Name / Nom:** Jeff Baker **Title / Titre:** Fenestration Canada Technical Consultant	**Company / Compagnie:** JELD-WEN of Canada **Name / Nom:** Lisa Bergeron **Title / Titre:** Government Relations Manager
Company / Compagnie: Enbridge Gas Distribution **Name / Nom:** Shannon Bertuzzi **Title / Titre:** Manager, Residential Energy Solutions	**Company / Compagnie:** Continental Automated Buildings Association **Name / Nom:** Ron Zimmer **Title / Titre:** President & CEO
Company / Compagnie: Canadian Home Builders' Association **Name / Nom:** Sonja Winkelmann **Title / Titre:** Director, Net Zero Energy Housing	**Company / Compagnie:** Canadian Gas Association **Name / Nom:** Paul Cheliak **Title / Titre:** Director, Market Development
Company / Compagnie: Integral Group **Name / Nom:** Kevin Hydes **Title / Titre:** CEO & Founder	**Company / Compagnie:** Venmar Ventilation **Name / Nom:** Daniel Forest **Title / Titre:** VP Technology & Product Development
Company / Compagnie: ICYNENE **Name / Nom:** Andrew Deamone **Title / Titre:** Territory Manager, Eastern Canada	**Company / Compagnie:** Canadian Wood Council **Name / Nom:** Robert J. Jonkman **Title / Titre:** Director, Codes and Standards – Structural Eng.
Company: Independent Electricity System Operator **Name / Nom:** Tom Aagaard **Title / Titre:** Senior Specialist, Conservation Fund	**Company:** BC Hydro **Name / Nom:** Gary Hamer **Title / Titre:** Residential Specialist Eng, Advanced DSM.
Company / Compagnie: Canadian Manufactured Housing Institute **Name / Nom:** Adaire Chown **Title / Titre:** Senior Director, Technical Affairs	



1 / A01 OPTION A2 - TRADITIONAL TH's (EXECUTIVE MID) & 4 PLEX STACK TOWNS

SCALE = 1:500

ASPM 11x17

Material Samples to Be Collected During Construction of the Facility

In general, samples of materials that are used in significant amounts and have direct exposure to the indoor air should be collected. The following list outlines the general type of materials to be selected. Specific materials will be selected for collection after the contractor provides a detailed list of materials to be used for constructing the house.

1. **Individual materials /components**
    1) Interior panels (gypsum products, composite wood boards)
    2) Flooring (hardwood, cork, linoleum, rubber, vinyl, wood floor joists, subflooring)
    3) Carpeting (synthetic fiber, underpad)
    4) Wall covering (vinyl, paper)
    5) Ceiling (tiles, texturing compounds)
    6) Finishes (paints, stains, varnishes and sealers, solvents, thinners)
    7) Installation materials (caulking, adhesives, joint & patching compounds, grout)
    8) Insulation materials (fiber batts, cellulose fiber, fiberglass, wood fiberboard, polystyrene and polyurethane foams, cellular glass, foamed-in-place sealant / insulation)
    9) Cleaning 'materials
    10) Concrete

2. Systems
    1) Light fixtures
    2) Blinds, draperies, etc.
    3) Kitchen and bathroom cabinets, Wall units

IMC0166

CCHT Upgrade

M24E Design Brief

Daniel G. Booth

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Executive Summary

The Government of Canada (GOC), through the National Research Council Canada (NRC), is investing in the upgrade of the Canadian Centre for Housing Technology (CCHT) and as a result, is seeking industry partners to support this exciting project.

In response to changing industry needs, NRC will address leading-edge R&D by building a low-rise multi-unit residential building under part 9 of the National Building Code, as part of the CCHT facilities. The new building, to be located adjacent and to the North of the existing CCHT twin detached single-family test houses, will expand the scope of services offered to industry.

This new project will bring CCHT to the leading edge – for testing of heating, ventilating, and air conditioning (HVAC) equipment, envelope components, renewable energy and control systems. It will provide for the assessment and demonstration of intelligent building and smart grid integration technologies while addressing two market areas: detached and multi-unit homes and it will enable the assessment of how renewable energy sources, such as wind and solar, can be seamlessly integrated into the existing electrical grid using intelligent load management strategies. The new building will also allow for the expansion of existing services to better serve manufacturers of building envelope wall components and window technologies.

The timeline for the project is such that construction must be completed by March 2017. The build budget is $900K. The minimum scope of the project includes the construction of two unit semi-detached *smart-home* along with a *power-pad* to connect to external power sources and sinks.

This Design Brief provides an overview of the features of the new semi-detached *smart-home* and *power-pad* that will be supported by this project. The Design Brief will not provide technical detail. The technical detail will be determined during a design charrette process with the builder who is awarded the contract to build the new facility. This Design Brief will outline form and functional requirements for the new semi-detached *smart-home* and *power-pad* as well as a general project management structure.

This Design Brief will form part of a request for proposals from builders. Builders are invited to present their designs, plans and proposals for evaluation. Builders are expected to detail typical building plans and are not expected to detail experimental provisions that will be the responsibility of NRC and will be incorporated at the detailed design stage.

1. Introduction

Currently the Canadian Center for Housing Technology (CCHT) facility consists of twin experimental detached single-family houses, and a row-house comprising an InfoCentre to showcase innovative housing technologies, and a FlexHouse to showcase features enabling aging persons to remain at home. The CCHT was constructed in 1998 as a platform to accelerate the market acceptance of technologies that could be expanded in response to market demands. CCHT was developed and has operated as a partnership between Canada Mortgage and Housing Corporation (CMHC), Natural Resources Canada (NRCan), and the National Research Council of Canada (NRC). Constructed on NRC's Montreal Road Campus in Ottawa, NRC is the operating agent for CCHT. No major enhancements to the CCHT facilities have been undertaken since 1998; as such, the addition of the new *smart-home* multi-unit and *power-pad* will enable the CCHT to directly serve the specific strategic directions set by current and planned GoC R&D programs.

For almost a year, the GOC conducted internal and external stakeholder consultations to assess industry needs. Through these discussions it has been determined that product development for both detached and multi-unit residential buildings needs to be supported. Affordability, energy usage, land limitations and urban infrastructure costs are key issues driving increased development of multi-unit buildings. Conversely, early adopters of new technologies tend to be detached home owners with discretionary income and the autonomy to decide what technologies will be implemented in their homes. However, some technologies principally targeted toward detached home owners are applicable to multi-unit dwellings. Demonstration of these technologies in multi-units may help to open up new access to markets for manufacturers. With the addition of the new multi-unit *smart-home*, CCHT will be well positioned to address the needs of both detached and multi-unit markets.

The focus on reducing energy loads and greenhouse gas emissions, including the introduction of more stringent energy codes and carbon taxes, has caused manufacturers to react. Often complicating improved energy performance of new products are unintended consequences that adversely affect human comfort, health, and building performance. The new multi-unit *smart-home* and *power-pad* will extend the validation and proof of concept investigations currently supported by CCHT, but with an expanded scope. Industry has informed the GOC that the ability to modify the load side of the energy equation with flexible wall and window alterations is of value, and this capability is currently not readily available with the existing CCHT twin-homes. With this in mind, the new multi-unit *smart-home* should be built to accommodate improvements to building envelope exterior insulation and windows. How this is accomplished must be balanced with the over-riding objective that the new multi-unit be built according to existing building practice and not beyond the norm of what constitutes a typical high performance building built to current standards. A design charrette is envisaged to determine the details of design for this capability.

Though the existing twin-houses of the CCHT were built to R2000 standards and were the top energy efficient homes in 1998, new detached homes built today are now more efficient and are exceeding the base energy performance of the CCHT twin houses. At the same time, renovated older homes are catching up to the energy performance of CCHT twin-houses. In this context, the existing CCHT twin-houses are more representative of current building stock in Canada and thus are valuable to support the large $13B / year residential renovation market in Canada.

Continuing with the leading edge nature of the CCHT twin-home facility in its time, the new multi-unit *smart-home* will be built to the most recent R2000 standard to achieve a performance target of 50% better than code. This standard is considered to be the basis for net-zero-ready construction.

The goal of the project is to upgrade the Canadian Centre for Housing Technology (CCHT) to enable programs to meet the needs of their clients for performance assessment in real world conditions of new, heating, ventilation and air conditioning systems, with energy integration and management technologies that provide connectivity to the smart grid. The upgrade will also enable programs to offer CCHT services to better serve manufacturers of building envelope wall components and windows.

The new multi-unit *smart-home*, co-located with the existing CCHT buildings, will thus allow for the assessment of state-of-the-art building techniques, technologies, and processes that are applicable to both new build and retrofit markets. Energy management and provision for renewable energy, as well as energy storage will be features of the new build. This approach will allow for comparison of older home performance to new *smart-home* performance.

This Design Brief provides an overview of the features of the new multi-unit *smart-home* and *power-pad* that will be supported by this project. The Design Brief will not provide technical detail. The technical detail will be determined during a design charrette process with the builder who is awarded the contract to build the new facility. This Design Brief will outline form and functional requirements for the new multi-unit *smart-home* and *power-pad* as well as a general project management structure.

This Design Brief will form part of a request for proposals from builders. Builders are invited to present their designs, plans and proposals for evaluation. Builders are expected to detail typical building plans and are not expected to detail experimental provisions that will be the responsibility of NRC.

2. Scope of Work

In response to changing industry needs, NRC requires the construction of a leading-edge low-rise multi-unit residential building under part 9 of the National Building Code. The new build will be adjacent and to the North of the existing twin single-family test houses. The build will include a two-unit semi-detached *smart-home* with provisions for expansion.

The scope of the project includes all the design and construction, including site services, to develop and commission a test facility containing two finished dwelling units. It is important that new test facility be built according to current leading edge building standards and of a representative form and architecture, and finish conditions, so that building technologies are evaluated under realistic conditions. Note that no occupancy permit is required, and as an experimental resource, some deviations from standard building practice can be expected.

Site work includes the establishment of a “power pad” for connection to external power sources and sinks (PV tracker, emergency generator, district CHP, electric vehicle charger) to the new building. Site work includes grading, landscaping and a new access driveway and pedestrian foot-path. Some provisions in the new build will be necessary to allow for future expansion of the facility. Some existing mature trees will need to be removed and replaced at a 3:1 ratio. Finished landscaping of the site with replacement trees, sod / seeding is necessary.

The expansion of the CCHT platform requires the newly built home to be a *smart-home* to respond to client needs for R&D services and testing in the following areas: exterior insulation systems, window technologies, mechanical equipment, renewable energy & control systems, energy storage, and intelligent building and smart grid integration technologies.

NRC will lead the specification and installation of the experimental infrastructure in collaboration with the successful proponent. It is necessary to install experimental infrastructure for testing of exterior insulation systems, window technologies, mechanical equipment, renewable energy and control systems, energy storage and features for the assessment and demonstration of intelligent building and smart grid integration technologies. The new building allows for expansion of existing CCHT services to better serve manufacturers of building envelope wall components and windows, a known limitation of the existing buildings. Working with the successful proponent a design / build approach is envisioned whereby the design is to be completed by May 31 2016.

2.1. Design / Build Approach

It is important that CCHT be built according to current leading edge building standards, and must be representative of existing building architecture with a representative form. Note that no occupancy permit is required, and as an experimental resource, some deviations from standard building practice can be expected. It is expected that an experienced builder will inform the majority of the building design for the building envelope, and baseline mechanical and electrical systems. However, the builder will need to adapt the design to support certain research functionality requirements, as outlined in Section 2.2 below. A design / build approach to upgrading CCHT is detailed in this Design Brief. The interdependencies between all plans will be highlighted such that experimental provisions can be accommodated during the design and construction of the building. The design / build proposed has four separate build plans or phases: A1, B, C and A2.

1. Build Plan A1: Architectural & Structural – the building envelope / shell
2. Build Plan B: Mechanical & Electrical - Advanced Energy Systems
3. Build Plan C: Experimental – Measurement and Simulated Occupancy
4. Plan A2: Finishing

Experimental Building (Plan A1 & A2): Construct a single building containing two finished dwelling units (semi-detached). The building design is expected to be based on a proven existing design but with modifications as required to accommodate the functionalities described in Section 2.2. Plan A has two phases: A1 (Architectural & Structural) and A2 (Finishing). It is necessary to identify two phases because a pause is needed at the end of the rough framing stage (Plan A1) to install the Advanced Energy Systems (Plan B) and the Measurement and Simulated Occupancy Systems (Plan C) before interior finishes are installed (Plan A2) and the building is ready for commissioning and close-out.

Advanced Energy Systems (Plan B): Included are additional experimental energy systems used to monitor home energy and system performance as well as modifications to distribution systems to enable “plug and play” of mechanical and electrical systems within the homes. An external “power pad” will allow for swap-out / swap-in of building sub-systems and components to electrical, gas, and antifreeze systems that transfer energy from external energy sources / sinks to the semi-detached building. The majority of experimental systems and modifications to distribution systems will be specified by GoC staff.

Measurement and Simulated Occupancy Systems (Plan C): Experimental control systems, including occupant simulation systems, will be provided. The majority of experimental systems will be designed, specified, built, and installed by NRC staff due to their highly specialised nature.

2.2. Key features of the facility / functionalities to be considered

The new semi-detached home will include design modifications to allow for the accommodation of several functionalities that will be used for future R&D projects. The information provided in this document is for consideration only. Builders are not expected to account or incorporate features in response to this RFP beyond what would be provided in a typical build.

Architectural	
1	Envelope adjustable loads (variable infiltration and exfiltration)
2	Exterior insulated finish systems
3	Window options (different sizes, types, orientation)
4	Smart window technology
5	Adjustable overhangs (hard points)
6	Adjustable exterior window / wall shading (hard points)
7	Net Zero Energy Ready
Mechanical	
8	Provisions for plug & play forced air heating/cooling systems (furnaces, heat pumps, combination systems)
9	Right-sizing / compact systems (mechanical closet/basement mechanical room)
10	Flexible zoned ductwork/distribution system (bulk heads for supply trunk & branches, high wall & exterior wall outlet locations)
11	Provisions for return ducted and fully ducted HRV/ERV
12	Hydronic space heating/hydronic fan coil (slab, entry, kitchen, bathrooms)
13	Radiant heating/Electrical baseboard space heating
14	Combined heat & power
15	Space for large on-site storage/garage slab, foundation coil
16	Radon mitigation (ASD stacks, sub-slab tracer gas, foundation temp. & diff. pressure, membranes)
17	Connection to multiple external energy sources (piping and cable, solar pv, solar thermal, district energy, bore holes for geothermal)
18	Flexible gas line sizing and venting design (side walls or roof)
19	Hot water recirculation infrastructure
20	Space for fireplace (optional heat recovery)
Electrical	
21	House / electric vehicle charging infrastructure

22	Lighting (control and LED)
23	Plug load monitoring
24	Battery storage
25	Site energy management (micro-grid, export energy vs. on-site generation, linking with TOU, smart meters)
26	Home energy management (smart appliances, smart thermostats etc.)
27	Networked zone control (with occupancy sensors)
28	Fully wired house for DC circuitry (replicate AC circuit, power over Ethernet)
29	Wi-Fi
Experimental	
30	Occupant simulation: heat, appliances and DHW draw pattern
31	Occupant simulation: moisture generation (rh), CO2, movement, comfort
32	Structural change due to extreme weather
33	Ability to test stack effect impacts
34	Ability to monitor and measure acoustic impact
35	Remote data interface to display experimental results

Experimental provisions will need to be considered in the design and assembly of the building; however, the experimental systems will not be the responsibility of the builder to specify or acquire. Standard baseline systems typical of a standard build will be installed in both units for baseline comparison. The builder will be required to install the baseline systems.

2.3. Assumptions

No additional minor capital or major capital funding from NRC will contribute directly to the costs of the new building. However, outside in-kind contributions from partner organizations will be considered for increased functionality.

Some existing utility infrastructure may need minor upgrade in order to properly service the CCHT platform for both the new and existing infrastructure. Coordination with other NRC investment plans and operations that indirectly impact the CCHT new build will be necessary. The project manager will assess any and all new information to determine if any changes in plan are necessary.

An environmental assessment has been completed and a report issued. The risk to the environment is low and there are no obvious issues on site that would impede development. A geotechnical evaluation has been initiated. Based on past geotechnical evaluations for builds adjacent to the prosed build site, it is unlikely that a geotechnical evaluation will unearth any material or lead to new data that will inflate the cost of the build or cause great delay to the project.

2.4. Scope Change Management

The scope of the project is limited to the construction of two a two-unit semi-detached house with provisions for connection to external power sources and possible expansion. Any significant influence on the project will be evaluated to determine if the scope, costs or schedule are significantly impacted. If the scope, costs or schedule are determined to be impacted by any outside influence, actions detailed in the scope control section of the project management plan will be implemented.

2.5. Budget

The budget for the build is $900K and may be utilized from April 2015 to March 2017.

2.6. Preliminary Cost Estimates

Different aspects of the build have been investigated to support development of conceptual designs, and refining various aspects of the site and building.

Initial planning has been focused on the building form and related siting requirements and costs. The various preliminary aspects considered are:

- Sited for solar
- Back-fill requirements
- Access route options
- Electrical service options
- Gas service options
- Working sketch of the building on site
- Environmental

- Water supply options
- Sewer connection options
- Geotechnical

The cost for land is not a factor, however the cost for services is. Cost estimates for the building range from $485K to $714K. Cost estimates for new services are estimated to be $158K.

2.7. Procurement Strategy

The majority of the overall project funds are allocated for construction of the building. The awarding of the build contract will be through Public Works and Government Services Canada (PWGSC). The build documents will be posted on PWGSC Public Government Tendering Service (GETS) website: www.buyandsell.gc.ca.

There are four phases of the PWGSC process:

- Pre-contractual phase: Planning
- Contracting phase: Bidding and awarding of contract
- Contract management phase: After the contract is awarded
- Post-contract phase: Close out, warranty and audit

During the planning phase, a public notice will be posted using PWGSC GETS website. This Request for Information (RFI) notice will solicit feedback from interested parties that may wish to inform on the CCHT upgrade.

During the contracting phase, a public notice will be posted using PWGSC GETS website. This Request for Proposal (RFP) notice will solicit bids from proponents that are interested in building the new facility.

NRC reserves the right to negotiate the scope of work and price with the bid winner.

2.8. Contractor Conditions

No build permits, city inspectors, or occupancy certificates are necessary for construction and delivery of this experimental facility. NRC staff will inspect the build progress, identify any deficiencies and issue a certificate of substantial completion at the appropriate time.

2.9. Construction Standards

Construction will be to the 2012 R2000 standard. NRC will require some modifications to the 2012 standard in order to meet the Net Zero Ready (NZR) requirements of the build. Guidelines on developing solar ready buildings should be considered in the build.

Quality of materials and craftsmanship will be carried out to the applicable Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM), Canadian General Standards Board (CGSB), National Lumber Grades Authority (NLGA), National Hardwood

Lumber Association (NHLA), and Architectural Woodwork Manufacturers' Association of Canada (AWMAC).

Detailed design and construction standards are not described in this design brief. The building requirement document (to be developed with the builder) will detail the design and construction standards.

NRC reserves the right to approve the selection of all products, materials and systems used in the construction of this project. NRC reserves the right to undertake tests and evaluations to determine compliance with the performance specifications. Where specific products or suppliers are specified, these products or suppliers may only be changed with the express written agreement of NRC.

The conceptual designs presented here shall not take precedence over the requirements of any applicable federal, provincial or local codes, regulations or bylaws. Where conflicts are identified between the requirements presented in this document and any requirements of any authority having jurisdiction, it is the obligation of the design/build contractor to bring such conflicts to the attention of Project Manager and to resolve such conflicts to the satisfaction of Project Manager.

Where specific codes or standards are identified herein, they shall be adhered to as a minimum. In all cases, the more stringent of the requirements presented here and those required by code, regulation or by law shall take precedence.

The purpose of the experimental facility is to research and develop building technologies and build code development. Understandably, some deviation from existing codes and standards may be necessary for the facility to operate effectively in support of code and industry standard development. In pursuit of these goals, it is possible that some aspects of the building will not meet current building code or industry standards. Sound engineering practice, due diligence in design, and special inspections will ensure that the building is safe and secure.

3. Existing CCHT buildings

This short introduction to the existing CCHT twin-house facility is provided for background information purposes.

Built in 1998, the Canadian Centre for Housing Technology (CCHT) (www.ccht-cctr.gc.ca) is jointly operated by National Research Council (NRC), Natural Resources Canada (NRCan), and Canada Mortgage and Housing Corporation (CMHC). CCHT's mission is to accelerate the development of new technologies and their acceptance in the marketplace.

The Canadian Centre for Housing Technology features twin research houses to evaluate the whole-house performance of new technologies in side-by-side testing (see Figure 1, which shows the Control and the Experimental houses). These houses were designed and built by a local builder to the R-2000 standard. Table 1 provides an overview of the twin-house characteristics. The houses are a popular model currently on the market in the region, and were built with the same crews and techniques normally used by the builder.

Figure 1 - CCHT Twin-House Facility - Control and Experimental

No major enhancements to the CCHT facilities have been undertaken since 1998; as such, the addition of the new *smart-home* semi-detacheds and *power-pad* will enable the CCHT to directly serve the specific strategic directions set by current and planned GoC R&D programs.

Feature	Details
Construction Standard	R-2000
Liveable Area	210 m^2 (2260 ft^2), 2 storeys
Insulation	Attic: RSI 8.6, Walls: RSI 3.5, Rim joists: RSI 3.5
Basement	Poured concrete, full basement Floor: Concrete slab, no insulation Walls: RSI 3.5 in a framed wall. No vapour barrier.
Garage	Two-car, recessed into the floor plan; isolated control room in the garage
Exposed floor over the garage	RSI 4.4 with heated/cooled plenum air space between insulation and sub-floor.
Windows	Low-e coated, argon filled windows Area: 35.0 m^2 (377 ft^2) total, 16.2 m^2 (174 ft^2) South Facing
Air Barrier System	Exterior, taped fiberboard sheathing with laminated weather resistant barrier. Taped penetrations, including windows.
Airtightness	1.5 air changes per hour @ 50 Pa (1.0 lb/ft^2)
Furnishing	Unfurnished

Table 1 - Twin House Characteristics

4. New Build Description

The new build will be a two-unit semi-detached home, built with provisions for possible future expansion, as described in Section 7. The new build will be designated at building M24E.

4.1. Building Site Description

The build site will be to the North of the existing CCHT twin-houses. The green-field site is located at NRC's Montreal Road campus. The green-field and area of work is located at approximately 45.448956N, -75.621215W.

Electrical power, sewer, water and gas services are available at the site. A number of preliminary utility service options have been considered and cost estimates created. Space provisions to the North of the existing houses in 1998 created a greenspace for future expansion of CCHT. The new build will be constructed in this green space. Some mature trees will need to be removed and replaced at a 3:1 ratio. An internal NRC environmental evaluation has concluded that there are no species at risk and no special provisions are necessary to protect the environment other than standard environmental protection protocols typical for standard construction. Volley ball court posts will need to be removed. Road access will be from the West side of the site to avoid damage to the buried utilities to the East of the build site along Legget Road.

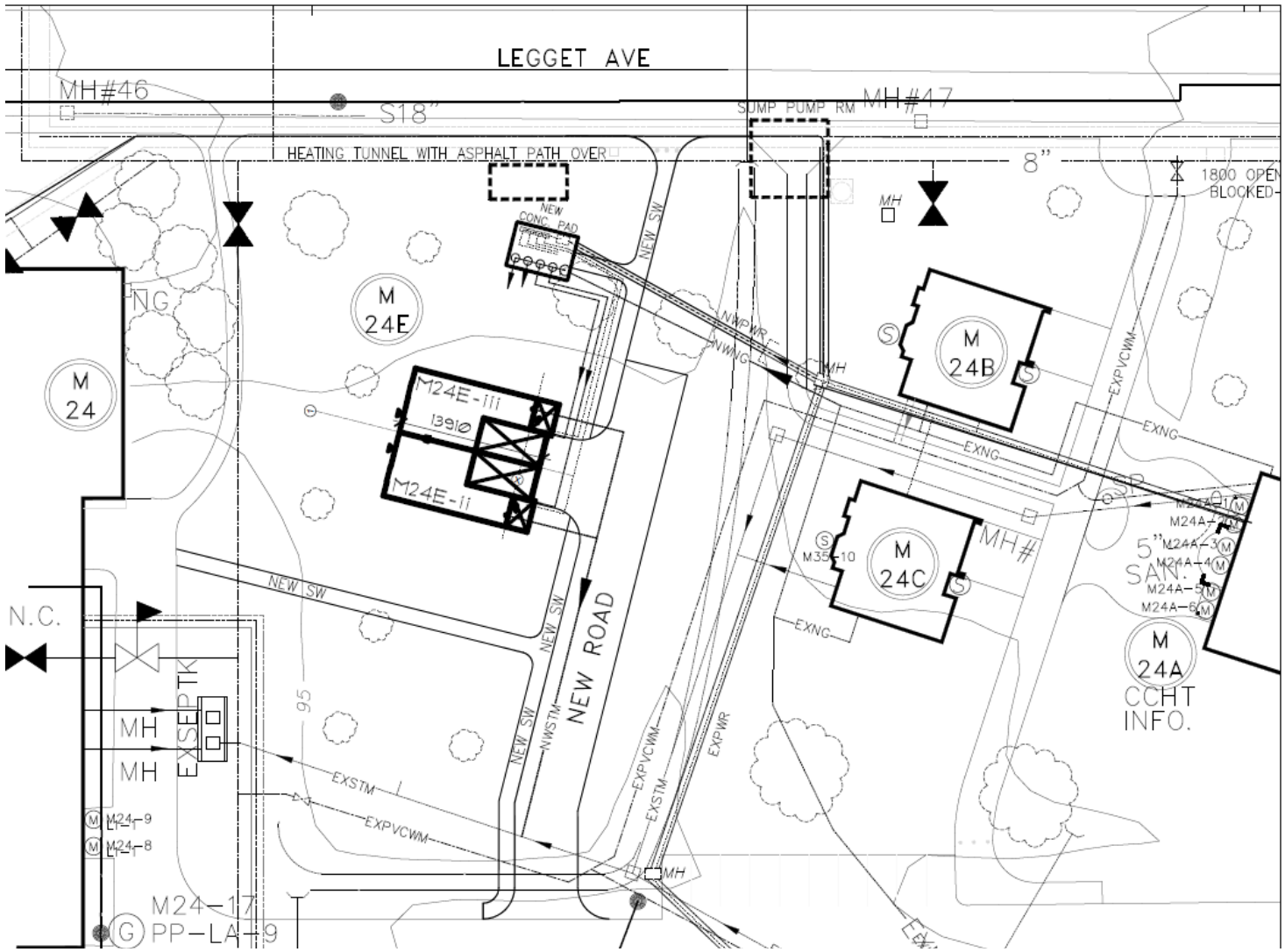

Figure 2 – Site service sketch

4.2. Building Form Description

The building form will be a two-unit semi-detached side-by-side home with provisions for expansion, as described in Section 7. The homes will consist of two stories with a full basement. The homes will include attached garages. The square-footage of each home will be between approximately 1800 to 2100 square feet (167 to 195 square meter) depending upon the successful design / build proposal. The construction method of the build will be wood frame.

The orientation of the building will be with either the front or back of the building facing True South. The roof of the building shall be designed to be able to support solar photo-voltaic panels. The East and West sides of the building will be designed to allow for a future party wall to allow for future expansion and/or the ability to modify the makeup of the exterior wall.

The building form will allow for easy removal of the exterior facia and siding allowing for testing of different Exterior Insulated Finished Systems (EIFS). The rough framing of the building will be large enough to accommodate different sizes of windows that are typical for the style of building. The building will incorporate attached garages.

Provisions will be made to allow for “plug and play” connection to external power sources as well as swap-out of internal HVAC equipment. In support of connection to external power sources such as a solar PV tracking system, a solar PV car port, an external battery storage / back-up generator or a gas fired combined heat and power system, a concrete “power pad” will be built to the East side of the building.

Figure 3 – Preliminary Semi-detached / Row house Concept

4.3. Building Interior Description

The interior of the building will be finished to “move-in” standard. All painting, flooring, cabinetry and fixtures will be installed and functional. No furniture will be installed. Smart appliances will be incorporated.

4.4. New Build Summary

Feature	Details
Construction Standard	R-2000, 2012, 50% higher energy performance than current building code
Liveable Area	1800 to 2100 ft^2, 2 storeys w finished basement.
Insulation	As defined by builder according to R2000, 2012 standard
Basement	As defined by builder according to R2000, 2012 standard
Garage	Recessed into the floor plan;
Exposed floor over the garage	As defined by builder according to R2000, 2012 standard
Windows	Low-e coated, argon filled windows Area: As defined by builder according to R2000, 2012 standard
Air Barrier System	As defined by builder according to R2000, 2012 standard
Airtightness	According to R2000, 2012 standard
Furnishing	Unfurnished

Table 2 – Two-unit Semi-detached Home Characteristics

4.5. Project Baseline Schedule

2015 (FY16)											
Q1			Q2			Q3			Q4		
April	May	June	July	August	September	October	November	December	January	February	March
Techno Ecconomic (TE)					Dev RFI	Post RFI			Design Power Pad		
Multi?		Form & Function			Dev RFP		Post RFP				
			Project Mgt Plan				Building Requirements			Design w builder	
							site prep		Award	Store Equip	
									Procure Experimental Equip		
2016 (FY17)											
Q1			Q2			Q3			Q4		
April	May	June	July	August	September	October	November	December	January	February	March
Design w builder								Inspections			
Prog A & B	Foundation	Framing		Controls	IT,V&D	Sealing	Finishing		Interior Finish		Close
	Prog C & D	shell up	Mech	Landscaping		Install / connect IT				Occupancy	Builder
		Install Sensors		Install DAQ & controls				Function Checks		Commission	

4.6. Design / Build Plan A1 – Architectural & Structural

Plan A requires a well-defined Building Requirements document that describes the functionality and processes which the building will support. Plan A requires careful consideration of:

- Flexible Envelope (no brick) to support exterior wall modifications and window replacement, and EIFS change-out enabling a Net Zero Energy READY structure,
- A roof structure oriented and structurally ready to support photo-voltaic panel "plug and play" installation,
- Attached garage, with provisions for charging of electric vehicles
- Structural hard points for the attachment of exterior shading devices, such as East and West solar blinds.
- Infrastructure to support experiments within the CCHT facility (plan B, C, and D).
- Interior stacks for Active Sub-slab Depressurization (ASD) for radon and soil gas mitigation.
- Minimal interior structural partitions to allow for flexible adjustment of interior partitions.
- Provisions for utility service distribution.
- Well sealed air-barrier.
- Some sensors will need to be installed during the construction process, such as instrumented walls, including sub-slab temperature measurement and underground temperature measurement.
- Some detailing of connection points for electrical and mechanical will need to be considered in Plan A although the majority of the electrical and mechanical will be detailed in Plan B.
- Routing of HVAC ducts, plumbing, electrical, metering panels, control caballing, control room and any core shared infrastructure between the units.
- Provisions for in-slab hydronic radiant heating, fireplace, duct chase access.
- Core building services: electrical, gas, water, sewer.

4.7. Design / Build Plan B – Mechanical, Plumbing & Electrical

Plan B will be informed by Plan A, base building loads, dimensions, and zoning will inform on the distribution and sizing of the electrical and mechanical systems as well as plumbing hardware and fixtures. With a weather tight exterior envelope (although not 100% finished) work can commence inside the building on the core infrastructure. In Plan B:

- Flexible mechanical ducting, dampers, boots, furnace, heat-pumps, ERVs / HRVs, baseboard / radiant heating, combined heat and power, venting, etc.

- Plumbing systems, stacks, drains, hot water recirculation, provisions for geothermal.
- Radon mitigation stacks.
- Fireplace, appliances and flexible gas line sizing.
- Housekeeping pads for mechanical equipment (not poured concrete).
- Electric vehicle charging infrastructure, battery storage.
- Provisions for electrical generating equipment (Photo Voltaic / Combined Heat and Power)
- Provisions for control electronics, plug load monitoring. Power monitoring systems (provisions for plan C)
- Electrical distribution boxes, electrical heaters, lighting, air conditioning, duplex power, etc.
- 24VDC power network: smart LED lighting, smart windows, receptacles.
- Lighting systems, Security systems, Home Energy Management Systems
- IT infrastructure, wifi, Ethernet, power-over-ethernet.
- Energy metering: meters and submitters for gas and electricity.
- Actuators / valves for plumbing fixtures, HVAC and non-smart appliances.
- Detailing of certain experimental measurement or control requirements will need to be considered in Plan B although the majority of the experimental infrastructure will be detailed in Plan C.

4.8. Design / Build Plan C – Experimental

Plan C will be informed by Plan A and B. Sensor locations, measurement devices and control devices will be installed by NRC technical staff. The remaining core data acquisition infrastructure will be installed and connected to the end-use devices. This will include:

- Sensors: Temperature, relative humidity, lighting, occupancy, loading / strain
- Flow meters: gas, water, airflow.
- Data acquisition and control systems
- Occupant simulation: heat, appliance control, DHW, DCW, moisture gen, CO2, motion.
- Other experimental equipment provisions.
- Air leakage, acoustics, ventilation and other investigations will be investigated using portable equipment without the necessitating development of core, purpose built, infrastructure.
- **Note**: During Plan C, technical staff from NRCan, CMHC and NRC will need access to the building. The CCHT experimentalist team will lead installation of experimental infrastructure. However, the expertise of the builder, sub-trades and construction workers may be required. A cost allowance will be provided to the builder to manage

aspects of the work best handled by the construction build manager, site-supervisor and trade workers / contractors.

4.9. Design / Build Plan A2 - Finishing

Plan A2 will be informed by the prior Plans and will involve the finishing of the building. Some provisions will be incorporated to allow for easy access to "behind the surface" experimental infrastructure and building systems. Accessibility features must not detract from typical home environments in order to have representative building performance.

- Kitchen counters, sinks, cupboards
- Bathroom counters, sinks, cupboards, toilets.
- Finished flooring and wall treatments.
- Smart Appliances
- Finished landscaping

5. Building Requirements Document for Building Plans

A building requirement document will be created for each of the building plans. The buildings requirement documents will reference the design brief, but will expand on the points listed in the brief in more detail. The building requirements document will be structured according to the building plans A1, B, C and A2 and may be issued in part as the building plans mature for each aspect of the design / build.

6. Preliminary Budgeting

The preliminary costing for the building of the facility has been estimated to be:

Facility Costing Element		**Budget**
	Design of Plans A1, B, C, A2	$25K
Plan A1	Site Services and Landscaping	$158K
Plan A1	Building – Architectural & Structural	$485K to $714
Plan A2	Finishing	
Plan B	Mechanical, Plumbing & Electrical	cost allowance for special mechanical, electrical and experimental requiring trade support. Baseline systems part of A1 and A2.
Plan C	Experimental	
	Total	$668K to $897K

Table 3 – Facility budget estimates

7. Special Considerations

This facility is intended to operate in the same manner as the existing twin detached test houses at CCHT. However, the scope of the project is that of one multi-unit building. An obvious criticism is that although A/B comparison between the semi-detached is possible, the fact is that the environmental exposures to wind, rain, and sun will not be identical as is the case for the twin homes.

To minimize these differences, the East and West walls of the building may be rough-framed for windows, but in the initial construction, the east and west walls will be party walls and should not have any fenestration. This will limit the impact of the different conditions for the morning and afternoon sun exposures on the East and West walls. Structural “hard-points” for “solar blinds” should be incorporated into the build.

7.1. Exterior Additions

The East and West walls of the semi-detached are to be constructed to allow for possible expansion of the facility. This will require special construction of the exterior wall as it may become a party wall in future. The exterior wall should be constructed in such a way that it can be deconstructed to accommodate the potential exterior addition. This may require a slightly wider foundation wall then would be typical for the load bearing of the one exterior wall. Some special detailing of this will be required.

Space provisions to the East and the West of the semi-detached should be made to allow for the possible future East and West townhome additions.

7.2. Interior Renovations

Like the existing CCHT flex-house, some thought has gone into how to design for longer term needs as our population ages. Some effort should be made to consider how best to provide a flexible interior partition system that allows for modification of the interior space. Although not a focus of the build, features in the final finishing and detailing of the interior that support assisted living at home for seniors should be considered.

7.3. Fire Safety, Security and Communications

Since the building will be part of the NRC Montreal Road campus, certain fire safety, security, and communication standards must be incorporated into the building. Information, system design details and coordination meetings will be required. The NRC project manager will meet with representatives from the various NRC authorities with jurisdiction in these areas and will communicate the requirements to the various stakeholders.

7.4. Site work

At the point in time of connection to the existing site services, a scheduled shutdown or isolation of the existing infrastructure will be required. Coordination of the shutdown will require advanced planning and communication with NRC's departmental representative.

Two large trees shown on the site plan between the proposed Power-Pad and M24B have been removed, but the stumps remain.

7.5. Advisors

An energy auditor will be contracted by NRC to advise the design team on matters relating to meeting the building energy performance criteria specified in the RFP.

A civil consultant will be contracted by NRC to advise the design team on matters relating to utilities, road access, and the power pad.

External stakeholders from industry may be invited to critique various plans to help inform on the design of the facility.

M-24E - NEW BUILD 2015 (Estimate)

17-Sep-2015

SITE WORK

Qty (SqM/M)	Qty (SqFt/Ft)	CSI Number	Description	Unit	Total Incl. O&P	Total	19-Sep-15
EXECUTIVE TOWNHOMES (1790 sqft) + (280 sqft Unfinished area Not Included)							Two Units
			ECONOMY 2 STOREY (EACH)				
	1790		SIDING ON WOOD FRAME CONSTRUCTION	95/S.F.	170,050.00		340,100
	2		FULL BATH	6300 EA.	12,600.00		25,200
	1		HALF BATH	3675 EA.	3,675.00		7,350
	1		ONE CAR GARAGE	13700 EA.	13,700.00		27,400
	1		GARAGE OPENER	565 EA.	565.00		1,130
	1790		A/C WITH HEATING DUCTS	2.62/S.F.	4,689.80		9,380
	1790		HEATING SYSTEM	3.39/S.F.	6,068.10		12,136
	1		GAS HOT WATER TANK (50 GAL)	1425 EA.	1,425.00		2,850
	1		ALARM/SECURITY SYSTEM	500 EA..	500.00		1,000
	5		SMOKE/CARBON DETECTOR	76 EA.	380.00		760
	1		FRONT DOOR	1250 EA.	1,250.00		2,500
	1		PATIO DOOR	2500 EA.	2,500.00		5,000
	1		WINDOW (Aprox. 3'6" x 4'0")	385 EA.	385.00		770
	2		WINDOW (Aprox. 4'0" x 6'0")	665 EA.	1,330.00		2,660
	2		WINDOW (Aprox. 5'0" x 6'0")	755 EA.	1,510.00		3,020
			Sub-Total		220,627.90		441,255.80
			General Contractor's Mark-up	10%	$22,062.79		$44,125.58
			GRAND TOTAL			**$242,690.69**	**$485,381.38**
			AVERAGE 2 STOREY (EACH)				
	1790		SIDING ON WOOD FRAME CONSTRUCTION	125/S.F.	223,750.00		447,500
	2		FULL BATH	6300 EA.	12,600.00		25,200
	1		HALF BATH	3675 EA.	3,675.00		7,350
	1		ONE CAR GARAGE	13700 EA.	13,700.00		27,400
	1		GARAGE OPENER	565 EA.	565.00		1,130
	1790		A/C WITH HEATING DUCTS	2.62/S.F.	4,689.80		9,380
	1790		HEATING SYSTEM	3.39/S.F.	6,068.10		12,136
	1		GAS HOT WATER TANK (50 GAL)	1425 EA.	1,425.00		2,850
	1		ALARM/SECURITY SYSTEM	500 EA..	500.00		1,000
	5		SMOKE/CARBON DETECTOR	76 EA.	380.00		760
	1		FRONT DOOR	1250 EA.	1,250.00		2,500
	1		PATIO DOOR	2500 EA.	2,500.00		5,000
	1		WINDOW (Aprox. 3'6" x 4'0")	385 EA.	385.00		770
	2		WINDOW (Aprox. 4'0" x 6'0")	665 EA.	1,330.00		2,660
	2		WINDOW (Aprox. 5'0" x 6'0")	755 EA.	1,510.00		3,020
			Sub-Total		274,327.90		548,655.80
			General Contractor's Mark-up	10%	$27,432.79		$54,865.58
			GRAND TOTAL			**$301,760.69**	**$603,521.38**
			CUSTOM 2 STOREY (EACH)				
	1790		SIDING ON WOOD FRAME CONSTRUCTION	153/S.F.	273,870.00		547,740
	2		FULL BATH	6300 EA.	12,600.00		25,200
	1		HALF BATH	3675 EA.	3,675.00		7,350
	1		ONE CAR GARAGE	13700 EA.	13,700.00		27,400
	1		GARAGE OPENER	565 EA.	565.00		1,130
	1790		A/C WITH HEATING DUCTS	2.62/S.F.	4,689.80		9,380
	1790		HEATING SYSTEM	3.39/S.F.	6,068.10		12,136
	1		GAS HOT WATER TANK (50 GAL)	1425 EA.	1,425.00		2,850
	1		ALARM/SECURITY SYSTEM	500 EA..	500.00		1,000
	5		SMOKE/CARBON DETECTOR	76 EA.	380.00		760
	1		FRONT DOOR	1250 EA.	1,250.00		2,500
	1		PATIO DOOR	2500 EA.	2,500.00		5,000
	1		WINDOW (Aprox. 3'6" x 4'0")	385 EA.	385.00		770
	2		WINDOW (Aprox. 4'0" x 6'0")	665 EA.	1,330.00		2,660
	2		WINDOW (Aprox. 5'0" x 6'0")	755 EA.	1,510.00		3,020
			Sub-Total		324,447.90		648,895.80
			General Contractor's Mark-up	10%	$32,444.79		$64,889.58
			GRAND TOTAL			**$356,892.69**	**$713,785.38**

CCHT Renewal

Builder Qualification Requirements

Daniel G. Booth & Jeremy Sager

3-February-2016

Executive Summary

Built in 1998, the Canadian Centre for Housing Technology (CCHT) (www.ccht-cctr.gc.ca) is jointly operated by National Research Council (NRC), Natural Resources Canada (NRCan), and Canada Mortgage and Housing Corporation (CMHC). CCHT's mission is to accelerate the development of new technologies and their acceptance in the marketplace.

The Canadian Centre for Housing Technology features twin research houses to evaluate the whole-house performance of new technologies in side-by-side testing. These houses were designed and built by a local builder to the R-2000 standard. The houses are a popular model currently on the market in the region, and were built with the same crews and techniques normally used by the builder.

No major enhancements to the CCHT facilities have been undertaken since 1998, as such, this capital investment project will enable upgrading CCHT to directly serve the specific strategic directions set by current R&D programs**.** In response to changing industry needs, the Government of Canada (GOC) will address *leading-edge R&D* by construction of a low-rise multi-unit residential building under part 9 of the National Building Code. The new building form will expand the scope of services offered to industry. The new build will be adjacent and to the North of the existing twin single-family test houses.

The purpose of this **builder qualification requirements** document is to inform on the qualification component of the request for proposal (RFP) that will be posted. The qualification should identify experienced tracked builders with in-house engineering and design capabilities that understand the current state of the art in high performance multi-unit residential building construction. The GOC would like to contract with companies that are innovative and see the need to advance R&D in areas relating to high performance buildings.

1. Introduction

The Proponent is requested to consult Section 1 of the Design Brief for a full Introduction to the project.

2. Scope of Work

The proponent is requested to consult Section 2 of the Design Brief for a full description of the Scope of the project.

Mandatory Requirements

3. Professional Qualification

The builder, representative to the Client and/or Design Team members (gathered from proponents staff of through sub-contract) will be required to meet the following professional qualification requirements:

- Architectural qualifications to perform the design of townhouses, detached, and semi-detached homes. Architect(s) and respective architectural firm(s) are to be licensed under the Ontario Association of Architects (OAA).
- Structural / Civil Engineering qualifications in order to be able to design a new townhouse / detached, semi-detached home.
- Mechanical, Electrical and Plumbing qualifications to design a new townhouse / detached, semi-detached home to include new HVAC, washrooms, lighting, mechanical and electrical hook-ups.
- All engineers and respective firm(s) are to be licensed under the Professional Engineers Ontario.
- Administrative, authorizations, and relationship with the Local Authorities qualifications such that all needed approvals will be obtained on time.
- The personnel requiring access to PROTECTED information, assets or sensitive work site(s) must have the ability to hold a valid RELIABILITY STATUS, granted or approved by NRC. Personnel are not required to hold this status as part of the submitted package (refer to the attached "Personnel Screening, Consent and Authorization Form" for details).

The organization of the Design Team required to reach the goals of the project within its constraints will be crucial. The Client is looking for a multidisciplinary Design Team with proven experience working with the lead architect on similar projects. The Design Team will demonstrate this experience by documenting previous work experiences in the areas of:

- Residential townhome / detached, semi-detached buildings and communities
- Advanced housing construction techniques
- Building renovations

The representative of the Design Team to the Client can be the Architect or a Project Manager / equivalent assigned by the Builder to the project. The representative will be responsible for the work of the entire Design Team and for maintaining communications of the Design Team's work with the Client. The representative will be expected to participate in frequent meetings and discussions with the Client

as needed during the design phase. Other members of the Design Team will have meetings with the Client as requested.

The description of the role of each member of the Design Team, the coordination of their contribution at every step of the project will be an important aspect for the Client to insure the capacity of the Design Team to answer to the objectives of the project. The submission by the proponent shall include a resume of each key Design Team member and will include:

- Full name
- Work title
- Professional credentials
- Education history
- Work experiences
- Security clearance

The builder must have training and past experience related to Natural Resources Canada's R2000 standard. The builder should support this requirement with proof of R2000 training and by citing at least one example of the construction of an R2000 home.

Asset Qualifications

4. Capabilities and Capacity to Perform

As the project takes a design / build approach, the builder, Representative of the Design Team and/or Design Team should demonstrate in-house design capability such that the Design Build Plans A1, B, C and A2 as outlined in Section 4.6, 4.7, 4.8 and 4.9 of the Design Brief as well as the Special Considerations outlined in Section 7 of the Design Brief can be adequately addressed.

5. Experience and Build Standards Used

The proponent is requested refer to Design Brief Section 4, New Build Description for a full description of the build standards to be used in the project. The proponent should demonstrate experience relevant to this project by citing examples of the following:

- Number of townhouses / detached, semi-detached homes built
- Types of townhouses / detached, semi-detached homes built
- Application of advanced housing standards such as Energy Star and R2000, Net Zero Homes , and/or Passive House
- Involvement in advanced housing build initiatives

6. Examples of High Performance Builds

The proponent will provide the Client, through a Non-Disclosure Agreement if necessary, advanced building plans and specifications that are similar or relevant to the New Build Description outlined in Section 4 of the Design Brief.

7. Fit for Project

In order to demonstrate a good fit for the project, the proponent should indicate their agreement to the following:

- Will develop building designs and specifications with the Client team
- Will share and modify designs according to experimental needs
- Will support design / build process
- Will provide site access to approved Client staff
- Will allow for Client technical staff to instrument the building at agreed to times
- Will respond to issues in an agreed to reasonable time frame
- Will support Client requirements to augment the building with Client supplied systems requiring specialty trades

8. References

The Proponent should provide references relevant to the project.

Other

9. Access to information

The Proponent will develop and share drawings with the Client, via Non-Disclosure Agreements.

10. Intellectual property

Background Information used and/or provided to the Awardee for the performance of the work and Foreground Information developed by the Crown used and/or provided to the selected Proponent shall be owned by the Crown.

Under the Crown Procurement Contract, the Crown may own the Foreground where the Foreground consists of material subject to copyright, with the exception of computer software and all documentation pertaining to that software.

11. Legal, financial and administrative information

The Proponent will need to show proof that he has the ability to obtain professional liability coverage with an insurance company licensed to do business in Ontario with limits of coverage no less than $2,000,000. There shall be no charge to the Client for such professional liability insurance coverage. If the Candidate is recommended for Award, the Candidate will provide proof of insurance using the attached document within seven (7) days of notification of Interest to Award. A copy of the policy must be submitted indicating that NRC has been added as an additional insurer.

12. Evaluation of qualification submissions

The evaluation of the RFQ submissions will be based on the Proponent's ability to complete the project on time, within budget, with a minimum of risk and to perform in accordance with the specifications. This will be based on the Proponent's submission which will be evaluated by the NRC using the information submitted by each Proponent.

The ranking will be carried out using the criteria listed below. Each item will be scored out of a total of 5 with the least positive score of 1 and best qualified score of 10. A score of 0 will be assigned if the criterion was not addressed in the submission. The total will be multiplied by a weighting factor as indicated and reflecting the relative importance of the criteria item in the RFP.

12.1. Mandatory Requirements

M.1	Project Representative and key identified Design Team members located within 60 minutes travel time of NRC campus	YES or NO
M.2	Statement that personnel anticipated to be onsite during the project able to obtain Reliability Status Security Clearance	YES or NO
M.3	Proponent, through cited example, has experience building townhomes, detached, semi-detached homes, and /or light commercial construction.	YES or NO
M.4	Proponent identified members of the Design Team including at least one licensed architect and one licensed engineer in each of the four trades: structural, civil, mechanical and electrical.	YES or NO

Specific mandatory information must be included with the submission and failure to include such information may, at the discretion of the NRC cause the RFQ submission to declared incomplete and so rejected.

12.2. Asset Qualifications

	Criteria	**Weighting**	**Score (0-10)**	**Weighted**
A.	***Quality of Submission***			
A.1	Clear concise response to the RFQ Submission	5%		
A.2	Professional package with value add for Client	5%		
B.	***Capabilities and Capacity to Perform Work***			
B.1	Professional skills of Representative of the Design Team	5%		
B.2	Professional skills of Lead Architect	5%		
B.3	Professional skills of Design team members – demonstrated experience	5%		
B.4	Overall Quality of Proponent Team & Resources	10%		
C.	***Experience and Build Standards Used***			
C.1	Number of residential builds	5%		
C.2	Types of residential builds	5%		

C.3	Application of advanced housing standards such as Energy Star and R2000, Net Zero Homes and/or Passive House. Experience related to net zero or net zero ready homes would be preferred.	10%		
C.4	Involvement in advanced housing build initiatives	5%		
D.	***Examples of High Performance Builds***			
D.1	Relevance to New Build Description	10%		
E.	***Fit for Project***			
E.1	Indication of agreement to the fit description	10%		
F.	***Performance***			
F.1	Ability to Meet Schedules and Deadlines	10%		
F.2	Quality of reference letter(s) from previous clients	10%		
	Weighted Total	**100%**		

A minimum of three (3) persons will review and evaluate all submissions independently and the average of the rankings will be used for the overall score. The following rating system will be used when determining how the Proponent's submission covered each of the criteria:

- Superior (score of 10): completely and comprehensively meets the criterion
- Good (score of 8): clearly meets the criterion
- Fair (score of 5): minimally meets the criterion
- Poor (score of 2): appears to meet the criterion but is implied
- Failed (score of 0): Clearly did not meet the criterion

13. Non-Exclusive

The NRC reserves the right to accept or reject any or all submissions.

The NRC has the right to change the dates, schedule, deadlines, process and requirements described in this qualification document; to change the limits and scope; to cancel or abandon this process for any reason, without incurring any liability for costs and damages incurred by any respondent.

14. Confidentiality of submissions

All information submitted to the NRC in the context of the present qualification document will be used for the sole purpose of internal evaluation by the NRC and will be treated as confidential and in compliance with any applicable laws.

15. Ethical Behaviour

Builders and associated staff shall:

- comply with applicable building codes of Canada as a minimum standard for construction and shall work toward its improvement in the interests of structural sufficiency, safety, and health.

- plan their sites and homes to conform to the principles of good community planning and support for the environment.
- deal justly with their employees, subcontractors, and suppliers of all goods and services.
- deal honestly and fairly with their customers and stand behind the quality of their work and service commitments.
- exchange information and experience, and encourage research on materials, technical advancements and building techniques in order to provide the best value for their customers.
- avoid all conduct or practice detrimental to the house building industry, to the good name or reputation of any of its members, or its customers.
- commit to continuing learning through human resource policies and practices, including employment practices which treat employees as assets.
- actively promote health and safety principles.
- treat their competitors, including their property and ideas, with respect.

NRC·CNRC Administrative Services and Property Management

SPECIFICATIONS

SOLICITATION #: RFP15-22186

BUILDING: M-24E
1200 Montreal Road Campus
Ottawa, Ontario

PROJECT: CCHT New Semi-Detached Home

PROJECT #: M24E-5034

Date: February 2016

National Research Council Canada | Conseil national de recherches Canada

Canada

SPECIFICATION

TABLE OF CONTENTS

NRC·CNRC

From **Discovery** to **Innovation...**

Directions to the Ottawa Research Facilities — Montreal Road

1200 Montréal Road
Ottawa, Ontario, Canada K1A 0R6

Tel: 613-993-9101

NRC Institutes/Branch/Program	Buildings
Information/Security	M-1
NRC Administrative Services and Property Management (NRC-ASPM)	M-5, M-6, M-15, M-16, M-18A, M-19, M-22, M-26, M-39, M-40A, M-53
NRC Canada Institute for Scientific and Technical Information (NRC-CISTI)	M-50, M-55
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NRC Institute For National Measurements Standards (NRC-INMS)	M-35, M-36, M-51
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NRC Strategy and Development Branch (NRC-SDB)	M-58

By Road, from the OTTAWA International Airport

1. From the airport take the AIRPORT PARKWAY to RIVERSIDE DR EAST
2. Follow RIVERSIDE DR EAST to HIGHWAY 417 EAST
3. Take HIGHWAY 417 EAST, past the ST-LAURENT BLVD exit, where HIGHWAY 417 splits, continue LEFT on HIGHWAY 174 (ROCKLAND)
4. Exit HIGHWAY 174 on BLAIR RD NORTH
5. Proceed on BLAIR RD NORTH, cross OGILVIE RD, and continue on to the traffic lights at the intersection of BLAIR and MONTREAL RD
6. Turn left onto MONTREAL RD and take the first immediate right onto the ramp leading down to the traffic circle. Stop at Building M-1 on the north side of the traffic circle. Ask the commissionaires in M-1 for directions to the NRC building, institute or staff member you seek.

By Road, from MONTRÉAL

1. Take MÉTROPOLITAIN 40 WEST and follow signs for OTTAWA and HIGHWAY 417 WEST
2. Follow 417 WEST to reach OTTAWA
3. Exit at HIGHWAY 174 EAST (ROCKLAND) when entering OTTAWA
4. Follow 174 EAST and exit at BLAIR RD NORTH (first exit after entering 174 EAST)
5. Follow BLAIR RD NORTH, cross OGILVIE RD, and continue on to the traffic lights at the intersection of BLAIR and MONTREAL RD
6. Turn left onto MONTREAL RD and take the first immediate right onto the ramp leading down to the traffic circle. Stop at Building M-1 on the north side of the traffic circle. Ask the commissionaires in M-1 for directions to the NRC building, institute or staff member you seek.


1 Sussex Facilities
2 Montreal Road Facilities
3 Uplands Facilities
4 NRC-CSTT
N
GATINEAU
OTTAWA
QUÉBEC
ONTARIO
Outaouais
Aylmer
Taché
Rockcliffe
Montréal
Vanier
Aviation
Blair
Sussex
Wellington
Bank
Bronson
Island Park
Ottawa River
Carling
Fisher
Prince of Wales
Walkley
Heron
Hawthorne
Hunt Club
Baseline
Riverside
Conroy
Airport
Uplands
Lester
Davidson
Albion
Hunt Club (W)
Merivale
Woodroffe
Greenbank
Fallowfield
Leitrim
50
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148
19
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174
417
38
73
31
416
0 1 2 km
NRC Institute
Trans Canada HWY
Major HWY
Secondary HWY
Airport
Train Station
Ferry
Bus Station
Metro


N
Howlett
Blair
Leggett
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Montréal
17B
Montréal
Mackenzie
Macallum
Lathe
Ballard
17B
Blair
Aviation
Bathgate
St. Laurent
Ogilvie
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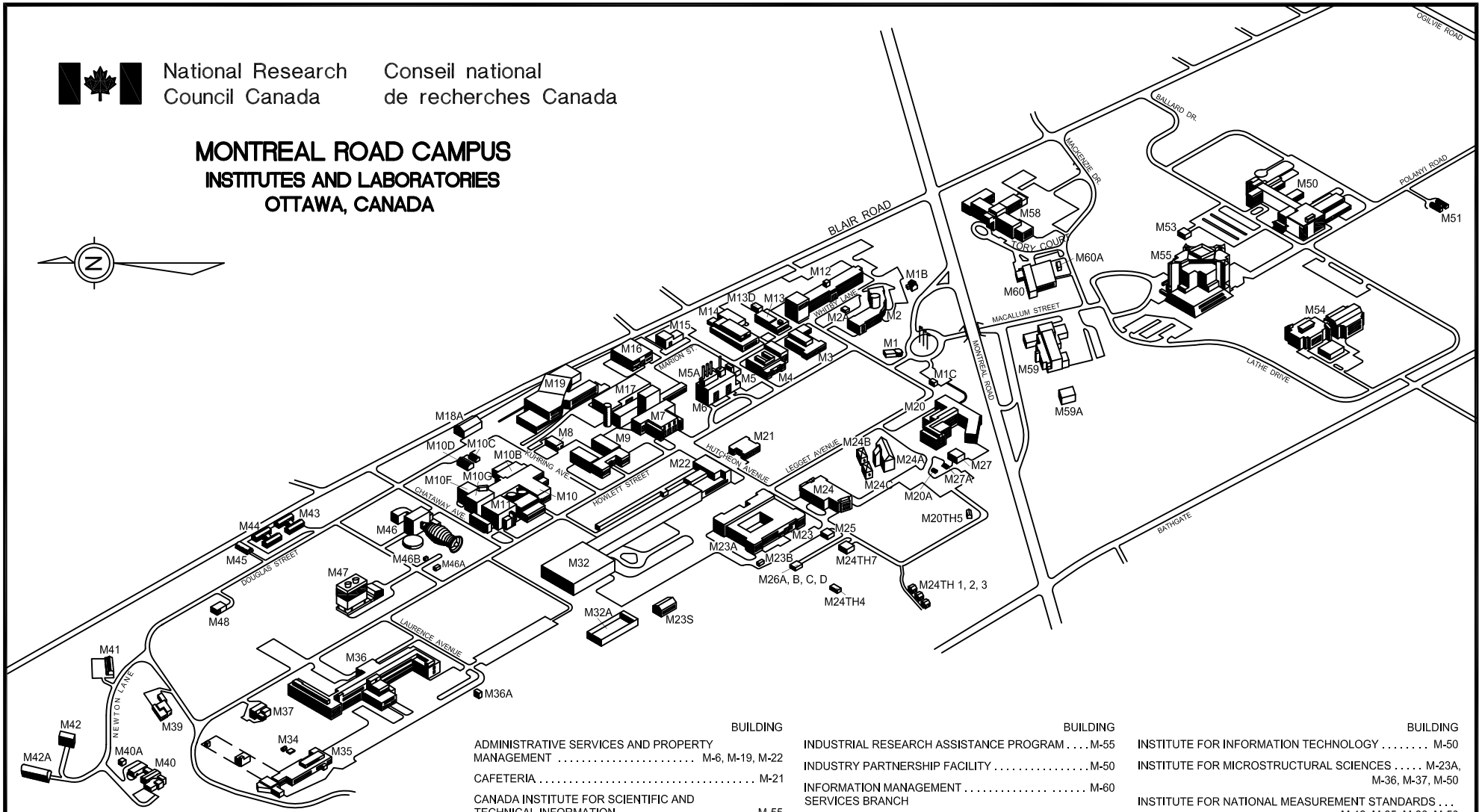
NRC Institute
Major HWY
Airport
Ferry
Metro
Trans Canada HWY
Secondary HWY
Train Station
Bus Station

National Research Council Canada | Conseil national de recherches Canada

MONTREAL ROAD CAMPUS
INSTITUTES AND LABORATORIES
OTTAWA, CANADA



BUILDING	
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INSTITUTE FOR NATIONAL MEASUREMENT STANDARDS	M-12, M-35, M-36, M-50
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RESEARCH PROGRAM SUPPORT OFFICE	M-4

Updated: July 2008

National Research Council Canada	Conseil national de recherches Canada
Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)

Construction Tender Form

Project Identification **M24E New Semi Detached Home**

Tender No.: **15-22186**

1.2 **Business Name and Address of Tenderer**

Name_____

Address_____

_____

Contact Person(Print Name)_____

Telephone (_____) _____ **Fax**: (_____) _____

1.3 Offer

I/We the Tenderer, hereby offer to Her Majesty the Queen in Right of Canada (hereinafter referred to as "Her Majesty") represented by the National Research Council Canada to perform and complete the work for the above named project in accordance with the Plans and Specifications and other Tender Documents, at the place and in the manner set out therein for the Total Tender Amount (to be expressed in numbers only) of**: $_____. _____ in lawful money of Canada (excluding GST/HST)**

The above amount is inclusive of all applicable (*) Federal, Provincial and Municipal taxes except that in the event of a change in any tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property, that occurs

.1 after the date this tender was mailed or delivered, or
.2 if this tender is revised, after the date of the last revision

the amount of this offer shall be decreased or decreased in the manner provided for in GC22 of the General Conditions of the Contract Documents.

1.3.1 Offer (continued)

(*) For the purpose of this tender, the Goods and Services Tax (GST) is not to be considered as an applicable tax.

In the province of Quebec, the Quebec Sales Tax is not to be included in the tender amount because the Federal Government is exempt from this tax. Tenderers shall make arrangements directly with the provincial Revenue Department to recover any tax they may pay on good and servives acquired in the performance of this contract. However, tenderers should include in their tender amount Quebec Sales Tax for which an Input Tax Refund is not available.

1.4 Acceptance and Entry into Contract

I/We undertake, within fourteen (14) days of notification of acceptance of my/our offer, to sign a contract for the performance of the work provided I/we are notified, by the Department, of the acceptance of my/our offer within 30 days of the tender closing date.

1.5 Construction Time

I/We Agree to complete the work within the time stipulated in the specification from the date of notification of acceptance of my/our offer.

1.6 Bid Security

I/We herewith enclose tender security in accordance with Article 5 of the General Instruction to Tenderers.

I/We understand that if a security deposit is furnished as tender security and if I/we refuse to enter into a contract when called upon to do so, my/our security deposit shall be forfeited but the Minister may, if it is in the public interest, waive the right of Her Majesty to forfeit the security deposit.

I/We understand that if the security furnished is not in the approved from as described in Article 5 of the General Instructions to Tenderers, my/our tender is subject to disqualification.

1.7 Contract Security

Within fourteen (14) days after receipt of written notification of the acceptance of my/our offer, I/we will furnish contract security in accordance with the Contract Conditions "F" of the Contract Documents.

I/We understand that the contract security referred to herein, if provided in the form of a bill of exchange, will be deposited into the Consolidated Revenue Fund of Canada.

1.8 Appendices

This Tender Form includes Appendix No. _____N/A_____.

1.9 Addenda

The Total Tender Amount provides for the Work described in the following Addenda:

NUMBER	DATE	NUMBER	DATE

(Tenderers shall enter numbers and dates of addenda)

1.10 Execution of Tender

The Tenderer shall refer to Article 2 of the General Instructions to Tenderers.

SIGNED, ATTESTED TO AND DELIVERED on the _____day of _____on behalf of

_____

(Type or print the business name of the Tenderer)

AUTHORIZED SIGNATORY (IES)

_____

(Signature of Signatory)

_____

(Print name & Title of Signatory)

_____

(Signature of Signatory)

_____

(Print name & Title of Signatory)

SEAL

BUY AND SELL NOTICE

M-24E CCHT New Semi-Detached Home

The National Research Council Canada, 1200 Montreal Road Campus, Ottawa, ON has a requirement for a project that includes:

EXECUTIVE SUMMARY

This is a design / build request for proposal (RFP). The following NRC requirements are to be read in conjunction with the RFP appendices. This RFP is for the design and construction of a new building as an upgrade to the Canadian Center for Housing Technology (CCHT).

Builders intending on submitting a proposal for this project are expected to submit existing or slightly modified plans for existing model homes. The experimental provisions and functionality necessary to complete this research facility are not expected to be detailed by the builder in response to this request for proposal. Experimental specifications and designs necessary to support research facility functionality will be developed during the design phase of this project.

However, evaluation of builder proposals will include an assessment of the ability to identify what aspects of the model home will require design / build modifications to accommodate the functionality necessary.

Please note that the conceptual plans presented in this RFP are for consideration only. Builders may suggest modifications to the conceptual plans so long as the intended functionality, costs, schedule and general scope of work (National Building Code of Canada, Part 9 Building) of the project is respected. If a builder feels that in order to meet the intended objectives of the project the proposal should be fundamentally different, such as building orientation, access routes, siting, and architectural design, then NRC will consider the merits of the proposal.

Builders may visit CCHT at a bidders conference at the date and time detailed in this RFP. **Multiple builders wishing to collaborate will be considered.**

MANDATORY REQUIREMENTS

M.1	Project Representative and key identified Design Team members located within 60 minutes travel time of NRC campus	YES or NO
M.2	Statement that personnel anticipated to be onsite during the project able to obtain Reliability Status Security Clearance	YES or NO
M.3	Proponent, through cited example, has experience building townhomes, detached, semi-detached homes, and /or light commercial construction.	YES or NO
M.4	Proponent identified members of the Design Team including at least one licensed architect and one licensed engineer in each of the four trades: structural, civil, mechanical and electrical.	YES or NO

1. GENERAL

Questions regarding any aspect of the project are to be addressed to and answered only by the Departmental Representative (or his designate) or the Contracting Authority.

Any information received other than from the Departmental Representative (or his designate) or the Contracting Authority will be disregarded when awarding the contract and during construction.

Firms intending to submit tenders on this project should obtain tender documents through the Buyandsell.gc.ca TMA services provider. Addenda, when issued, will be available from the Buyandsell.gc.ca TMA service provider. Firms that elect to base their bids on tender documents obtained from other sources do so at their own risk and will be solely responsible to inform the tender calling authority of their intention to bid. Tender packages are not available for distribution on the actual day of tender closing.

2. BIDDERS CONFERENCE / SITE VISIT

If you wish to visit the site on the dates they are scheduled, please contact Dan Booth 613 993-9696. daniel.booth@nrc-cnrc.gc.ca

The bidders conference / site visits will be held on March 3rd, 2016 at 9:30 and March 8th, 2016 at 15:00. Meet Daniel Booth at Building M-24, Main Entrance, 1200 Montreal Road Campus, Ottawa, ON. Bidders who, for any reason, cannot attend at the specified date and time will not be given an alternative appointment to view the site

3. TENDER CLOSING DATE

Tender closing date is March 23rd , 2016 at 14:00.

4. TENDER RESULTS

N/A

5. SECURITY REQUIREMENT FOR CANADIAN CONTRACTORS

5.1 MANDATORY SECURITY REQUIREMENT:

This procurement contains a mandatory security requirement as follows:

1 The Contractor must, at all times during the performance of the Contract, hold a valid Designated Organization Screening (DOS), issued by the Canadian Industrial Security Director (CISD), Public Works Government Services Canada.

2 The Contractor personnel requiring access to sensitive work site(s) must EACH hold a valid RELIABILITY STATUS, granted or approved by CISD/PWGSC.

3 The Contractor must comply with the provisions of the:

a. Security Requirements Checklist attached at Appendix “D”
b. Industrial Security Manual (Latest Edition) available at: http://ssi-iss.tpsgc-pwgsc.gc.ca/msi-ism/msi-ism-eng.html

5.2 VERIFICATION OF SECURITY CLEARANCE AT BID CLOSING

1 The Bidder must hold a valid Designated Organization Screening (DOS) issued by the Canadian Industrial Security Directorate (CISD), Public Works and Government Services Canada (PWGSC), TO BE INCLUDED WITH THEIR TENDER OR PROVIDED WITHIN 48 HOURS FROM THE DATE AND TIME OF TENDER CLOSING. Verifications will be made through CISD to confirm the security clearance status of the Bidder. Failure to comply with this requirement will render the bid non-compliant and no further consideration will be given to the bid.

2 Within 72 hours of tender closing, the General Contractor must name all of his sub-contractors, each of whom must hold a valid RELIABILITY STATUS, granted or approved by CISD/PWGSC, or any other Federal Department or Agency along with the names and birthdates or security clearance certificate numbers of all personnel who will be assigned to the project.

3 It is to be noted that any subcontractor required to perform any part of the work during the performance of the subsequent contract must also adhere to the mandatory security requirement of the contract. As well, no personnel without the required level of security will be allowed on site. It will be the responsibility of the successful bidder to ensure that the security requirement is met throughout the performance of the contract. The Crown will not be held liable or accountable for any delays or additional costs associated with the contractor's non-compliance to the mandatory security requirement. Failure to comply with the mandatory security requirement will be grounds for being declared in default of contract.

4 For any enquiries concerning the project security requirement during the bidding period, the Bidder/Tenderer must contact the Security Officer @ 613-993-8956.

6.0 WSIB (WORKPLACE SAFETY AND INSURANCE BOARD)

1 All Bidders must provide a valid WSIB certificate with their Tender or prior to contract award.

7.0 OFFICE OF THE PROCUREMENT OMBUDSMAN

1 Dispute Resolution Services
The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will, on request or consent of the parties to participate in an alternative dispute resolution process to resolve any dispute between the parties respecting the interpretation or application of a term and condition of this contract and their consent to bear the cost of such process, provide to the parties a proposal for an alternative dispute resolution process to resolve their dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.

2 Contract Administration
The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will review a complaint filed by [*the supplier or the contractor or the name of the entity awarded this contract*] respecting administration of this contract if the requirements of Subsection 22.2(1) of the *Department of Public Works and Government Services Act* and Sections 15 and 16 of the *Procurement*

Ombudsman Regulations have been met, and the interpretation and application of the terms and conditions and the scope of the work of this contract are not in dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.

3 The Office of the Procurement Ombudsman (OPO) was established by the Government of Canada to provide an independent avenue for suppliers to raise complaints regarding the award of contracts under $25,000 for goods and under $100,000 for services. You have the option of raising issues or concerns regarding the solicitation, or the award resulting from it, with the OPO by contacting them by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca. You can also obtain more information on the OPO services available to you at their website at www.opo-boa.gc.ca.

The Departmental Representative or his designate for this project is: **Daniel Booth**
Telephone: **613 993-9696**

Contracting Authority for this project is: **Marc Bédard marc.bedard@nrc-cnrc.gc.ca**
Telephone**: 613 993-2274**

INSTRUCTIONS TO BIDDERS

Article 1 – Receipt of Tender

1a) Tenders must be received not later than the specified tender closing time. Tenders received after this time are invalid and shall not be considered, regardless of any reason for their late arrival.

1b) A letter of printed telecommunication from a bidder quoting a price shall not be considered as a valid tender unless a formal tender has been received on the prescribed Tender Form.

1c) Bidders may amend their tenders by letter or printed telecommunication provided that such amendments are received not later than the specified tender closing time.

1d) Any amendments to the tender which are transmitted by telefax must be signed and must clearly identify the tenderer.

All such amendments are to be addressed to:
National Research Council of Canada
Marc Bedard, Senior Contracting Officer
Building M-22
Montreal Road, Ottawa, Ontario
K1A 0R6

Fax: (613) 991-3297

Article 2 – Tender Form & Qualifications

1) All tenders must be submitted on the Construction Tender Form and the tender must be signed in compliance with the following requirements:

a) Limited Company: The full names of the Company and the name(s) and status of the authorized signing officer(s) must be printed in the space provided for that purpose. The signature(s) of the authorized officer(s) and the corporate seal must be affixed.

b) Partnership: The firm name and the name(s) of the person(s) signing must be printed in the space provided. One or more of the partners must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.

c) Sole Proprietorship : The business name and the name of the sole proprietor must be printed in the space provided. The sole proprietor must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.

2) Any alterations in the printed part of the Construction Tender Form or failure to provide the information requested therein, may render the tender invalid.

3) All space in the Construction Tender Form must be completed and any handwritten or typewritten corrections to the parts so completed must be initialed immediately to the side of the corrections by the person or persons executing the tender on behalf of the the tenderer.

4) Tenders must be based on the plans, specifications and tender documents provided.

Article 3 - Contract

1) The Contractor will be required to sign a contract similar to the Standard Contract Form for Fixed Price Construction Contracts, a blank specimen of which is enclosed in the package for reference purposes.

Article 4 – Tender Destination

1a) Tenders are to be submitted in sealed envelopes to:
National Research Council Canada
Administrative Services and Property Management Branch
1200 Montreal Road
Building M-22
Ottawa, ON
K1A 0R6

Endorsed "Tender for (insert title of work as it appears in the drawings and specifications)" and must bear the name and address of the tenderer.

1b) Unless otherwise specified, the only documents required to be submitted with the tender are the Tender form and the Bid Security.

Article 5 - Security

1a) Bid Security is required and must be submitted in one of the following forms:

i) a certified cheque payable to the Receiver General for Canada and drawn on a member of the Canadian Payments Association or a local cooperative credit society that is a member of a central cooperative credit society having membership in the Canadian Payments Association; **OR**

ii) bonds of the Government of Canada, or bonds unconditionally guaranteed as to principal and interest by the Government of Canada; **OR**

iii) a bid bond.

1b) Regardless of the Bid Security submitted, it should never be more than $250,000 maximum, calculated at 10% of the first $250,000 of the tendered price, plus 5% of any amount in excess of $250,000.

2a) Bid Security shall accompany each tender or, if forwarded separately from the tender, shall be provided not later than the specified tender closing time. Bid Security must be in the ORIGINAL form. Fax or photocopies and NOT acceptable. FAILURE TO PROVIDE THE REQUIRED BID SECURITY SHALL INVALIDATE THE TENDER.

2b) If the tender is not accepted, the Bid Security submitted pursuant to Article 8 shall be returned to the tenderer.

3a) The successful tenderer is required to provide security within 14 days of receiving notice of tender acceptance. The tenderer must furnish EITHER:

i) a Security Deposit as described in 1(b) above together with a Labour and Material Payment Bond in the amount of at least 50% of the amout payable under the contract, OR

ii) a Performance Bond and a Labour and Material Payment Bond – each in the amount of 50% of the amount payable under the contract.

3b) Should it not be possible to obtain a Labour Material Payment Bond as required under 3(a) above, on making application thereof to at least two acceptable Bonding Companies, an additional Security Deposit of a straight 10% of the amount payable under the contract must be furnished.

3c) Where a tender has been accompanied by a Security Deposit, as described in 1(b) above, the amount of the Security Deposit required under 3(a) above may be reduced by the amount of the Security Deposit which accompanied the tender.

3d) Bonds must be in an approved form and from the companies whose

bonds are acceptable to the Government of Canada. Samples of the approved form of Bid Bond, Performance Bond and Labour and Material Payment Bond and a list of acceptable Bonding Companies may be obtained from the Contracting Officer, National Research Council, Building M-22, Montreal Road, Ottawa, Ontario, K1A 0R6.

Article 6 – Interest On Security Deposits

1) Tenderers are notified that they must make their own arrangements with their bankers as to the interest, if any, on the amount of the certified cheque accompanying their tender. The Council will not pay interest on said cheque pending the awarding of the contract nor be responsible for the payments of interest under any arrangement made by the tenderers.

Article 7 – Sales Tax

1) The amount of the tender shall include all taxes as levied under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act or the Customs Tariff, in force or applicable at the time.

2) In Quebec, the Provincial Sales Tax should not be included in the Tender Price as the Federal Government is exempt. Tenderers should contact the Provincial Revenue Minister to recover all taxes paid for goods and services rendered under this contract.

Tenderers must include in their Tender Price the amount of Provincial Sales Tax for which the exemption does not apply.

Article 8 – Examination of Site

1) All parties tendering shall examine the sites of the proposed work before sending in their tender and make themselves thoroughly acquainted with the same and obtain for themselves any and all information that may be necessary for the proper carrying out of the Contract. No after claim will be allowed or entertained for any work or material that may be requisite and necessary for the proper execution and completion of this Contract with the exception of that provided for under GC 35 in the General Conditions of the General Specification.

Article 9 – Discrepancies, Omissions, Etc.

1a) Bidders finding discrepancies in, or omissions from, drawings, specifications or other documents, or having any doubt as to the meaning or intent of any part thereof, should at once notify the Engineer who will send written instructions or explanation to all bidders.

1b) Neither the Engineer nor the Council will be responsible for oral instructions.

1c) Addenda or corrections issued during the time of the bidding shall be covered in the proposal. However, the contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the contract.

Article 10 – No additional Payments for Increased Costs

1) The only other adjustments in the contract price allowed are those specified in the General Conditions of the General Specification. The contract price will not be amended for change in freight rates, exchange rates, wage rates or cost of materials, plant or services.

Article 11 – Awards

1a) The Council reserves the power and right to reject tenders received from parties who cannot show a reasonable acquaintance with and preparation for the proper performance of the class of work herein specified and shown on plans. Evidence of such competence must be furnished by the tenderers if required to do so.

1b) A tenderer may be required to furnish to the Contracting Office, National Research Council of Canada, Building M-22, 1200 Montreal Road, Ottawa, Ontario, K1A 0R6, Canada, unsigned copies of the insurance requirements as covered by the Insurance Conditions of the General Specification.

1c) The Council does not bind itself to accept the lowest or any tender.

Article 12 – Harmonized Sales Tax

1) The Harmonized Sales Tax (HST) which in now in effect shall be considered an applicable tax for the purpose of this tender. However, the bidder shall NOT include any amount in the bid price for said HST. The successful contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract in addition to the amount certified for payment under the Contract and will therefore not affect the Contract Price. The Contractor agrees to remit any HST collected or due to Revenue Canada.

Non-resident contractors

RST guide 804
Published August 2006
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Publication Archived

Notice to the reader: For Retail Sales Tax (RST) – On July 1, 2010 the 13 per cent Harmonized Sales Tax (HST) took effect in Ontario replacing the existing provincial Retail Sales Tax (RST) and combining it with the federal Goods and Services Tax (GST). As a result, RST provisions described on this page and in other publications ended on June 30, 2010.

Effective July 1, 2010 this publication was archived for RST purposes **only**. Use caution when you refer to it, since it reflects the law in force for RST at the time it was released and may no longer apply.

- The information in this Guide explains the Retail Sales Tax (RST) responsibilities of a non-resident contractor who is awarded a construction contract to perform work in Ontario and their Ontario customers. Please note that this Guide replaces the previous version dated March 2001.

Non-Resident Contractor Defined

A non-resident contractor is a contractor located outside Ontario who has been awarded a construction contract to perform work in Ontario, and who has not maintained a permanent place of business in Ontario continuously for twelve months immediately prior to signing the contract, or which is not a company incorporated under the laws of Ontario. A construction contract is a contract for the erection, remodelling or repair of a building or other structure on land.
A contractor is a person who is in the business of constructing, altering, repairing or improving real property and includes, but is not limited to,

1. a general contractor and subcontractor,
2. a carpenter, bricklayer, stonemason, electrician, plasterer, plumber, painter, decorator, paver, and bridge builder,
3. a sheet metal, tile and terrazzo, heating, air conditioning, insulation, ventilating, papering, road, roofing and cement contractor, who installs or incorporates items into real property. (See RST Guide 206 - Real Property and Fixtures).

Registration and Guarantee Deposit

Non-resident contractors who are awarded a construction contract in Ontario are required to register with the Ministry of Finance (ministry), Centralized Programs Unit and post a guarantee equal to 4 per cent of the total of each Ontario contract. The guarantee can be paid in cash, by certified cheque (payable to the Minister of Finance), letter of credit or by a guarantee bond.

To register with the ministry and to obtain further information on posting a guarantee, contractors should contact the ministry's Centralized Programs Unit, 33 King Street West, PO Box 623, Oshawa, Ontario, L1H 8H7, toll-free 1 866 ONT-TAXS (1 866 668-8297) or fax to 905 435-3617.

Non-resident contractors who sell taxable goods on a supply only basis to Ontario customers, or provide taxable services in Ontario, may obtain a regular Vendor Permit to collect and remit RST on their sales. Non-resident contractors who have been issued a regular Vendor Permit must still register separately with the ministry and post a guarantee if they are awarded a construction contract in Ontario.

Letter of Compliance

After receiving the guarantee, the ministry mails out two copies of a "letter of compliance" to the contractor certifying the Retail Sales Tax (RST) requirements have been met. Contractors must give a copy of the letter to their customers.

If a copy of the compliance letter is not provided, the customer must withhold 4 per cent of all amounts payable to the non resident contractor and pay the withheld amounts to the Minister of Finance (minister). Details relating to the contract should be sent along with the payments to the Centralized Programs Unit. Customers may give the minister a guarantee bond equal to 4 per cent of the total contract price instead of making the 4 per cent payments.

Note: Customers who do not follow these requirements may be held liable for 4 per cent of all amounts payable to the non resident contractor or any other amount that the Ministry deems to be the RST payable resulting from the performance of the contract.

Calculation of RST

Fair Value

RST is payable on the "fair value" of materials, purchased or brought into Ontario, to be used for work performed in Ontario. "Fair value" includes:

- the purchase price in Canadian funds;
- all charges by the supplier for handling and delivery, and
- any federal customs duties and excise taxes paid (but not the federal Goods and Services Tax (GST)).

Contractors are also required to pay RST to Ontario suppliers on the purchase, rental or lease of taxable services, materials, machinery, or equipment.

Machinery and Equipment - Leased

If machinery or equipment is leased from a supplier outside Ontario and brought into the province, RST is payable on the lease payments for the period the machinery or equipment is in Ontario.

Machinery and Equipment - Owned by Contractor

If machinery or equipment is owned by the contractor, RST may be calculated in one of the following ways:

a. If a contractor brings machinery and equipment into Ontario for less than 12 months' use, RST is to be calculated using the following formula:

   1/36 × net book value at date of import × number of months in Ontario × tax rate

   For the purpose of this formula, RST is payable for each month or part of a month that the goods are in Ontario. A month is considered 31 consecutive days and a part month is considered more than 12 days. The RST payable is based on the number of days the machinery and equipment are located in Ontario and not the number of days the items are actually used.

Example: Equipment is brought into Ontario on March 28 and taken out on May 8. The items were in the province for 41 days. RST is payable on the first 31 days' temporary stay in Ontario vs. use of the equipment. Since the remainder (10 days) is not considered part of a month, no RST is payable on this portion.

b. If, at the time the goods are brought into Ontario, it is expected that the machinery or equipment will be in Ontario for more than twelve months, contractors must pay Retail Sales Tax (RST) on the following basis:

   net book value at date of import × tax rate

   If, at the time of import, the length of time is not known, vendors may use the formula under (a). If they later find it necessary to keep the machinery and equipment in Ontario for more than 12 months, the RST paid under (a) may be deducted from the RST payable under (b).

Using formula (a) or (b) above, contractors will calculate and remit the RST payable on the return that is filed when the contract is finished.

(See Completion of Contract section)

Manufacturing for Own Use

Contractors may need to manufacture items, such as doors and windows, for their construction contracts. Manufacturing is work done in a factory away from a construction site, or in a mobile unit or workshop that is on or near the construction site. Manufacturing occurs when raw materials are changed into manufactured goods for use in real property contracts.

Contractors are considered to be manufacturing contractors if they produce goods:
1. for their own use in real property contracts, and
2. the manufactured cost of the goods is more than $50,000 a year.

(See RST Guide 401 - Manufacturing Contractors)

Contracts with the Federal Government

Where a non-resident contractor enters into a construction contract with the federal government, for the construction of a building and/or the installation of equipment, the nature of the equipment will determine whether the contract should be let on a tax-included or tax excluded basis.

Contracts for the construction of a building and the installation of equipment that directly services that building (i.e., elevators, escalators, light fixtures, central heating and air conditioning, etc.) should be tendered on a tax -included basis. Contractors are the consumers of the materials used in fulfilling these contracts and must pay or account for RST on the materials used to complete the contracts. There is NO exemption just because the contract is with the federal government.

Contracts for the installation of equipment that becomes a fixture and does not directly service a building (i.e., material handling equipment, production machinery, communication equipment, training equipment) may be tendered on a tax-excluded basis. Contractors engaged in contracts of this nature are permitted to make tax exempt purchases of such equipment by issuing a valid Purchase Exemption Certificate (PEC) to their supplier. Only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC.

Exemptions

Contractors may supply and install equipment or materials for certain customers that may be entitled to an exemption from RST (e.g., manufacturers, Indian band councils, farmers and diplomatic organizations). The equipment or materials, when installed, becomes real property if it is permanently attached to land, or a fixture if it is permanently attached to a building or real property structure. Since

contractors are liable for RST, they should contact the ministry to find out if the customer qualifies for exemption before tendering the contract on a tax-excluded basis.

Status Indians, Indian Bands and Band Councils

Non-resident contractors may purchase building materials exempt from Retail Sales Tax (RST) for certain buildings and structures situated on reserves. The cost of such projects must be paid by the band council, and the buildings must provide a community service for the reserve. Contracts for the construction of an exempt community building project should be made on an RST-excluded basis. Non-resident contractors may purchase the materials exempt from RST by providing suppliers with a valid Purchase Exemption Certificate (PEC). As noted previously, only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC. (See RST Guide 204 - Purchase Exemption Certificates).

Non-resident contractors must pay RST on items purchased for incorporation into a building or structure built for individual status Indians on a reserve. (See RST Guide 808 - Status Indians, Indian Bands and Band Councils).

Completion of Contract

When a contract is completed, non-resident contractors who were required to post a guarantee must complete a Non-Resident Contractor Retail Sales Tax Return [PDF - 92 KB] that is provided by the ministry.

If a contractor's guarantee was given in cash or by certified cheque, the amount of the deposit can be deducted from the RST liability owed by the contractor. If the liability is greater than the deposit, the amount remaining must be paid by the contractor. If the deposit is more than the liability, the contractor will receive a refund.

If a guarantee bond was posted instead of cash, the bond will be discharged once the RST liability is paid in full.

All returns are subject to audit.

Legislative References

- Retail Sales Tax Act, Subsections 19(2) and 39(3)(4) and (5)
- Regulation 1012 under the Act, Subsections 15.3(1)(2)(5)(6) and (7)
- Regulation 1013 under the Act, Sections 1 and 3

For More Information

The information contained in this publication is only a guideline. For more information, please contact the Ontario Ministry of Finance at 1 866 ONT-TAXS (1 866 668-8297) or visit our website at ontario.ca/finance.

Acceptable Bonding Companies

Published September 2010

The following is a list of insurance companies whose bonds may be accepted as security by the government.

1. Canadian Companies

- ACE INA Insurance
- Allstate Insurance Company of Canada
- Ascentus Insurance Ltd. (Surety only)
- Aviva Insurance Company of Canada
- AXA Insurance (Canada)
- AXA Pacific Insurance Company
- Canadian Northern Shield Insurance Company
- Certas Direct Insurance Company (Surety only)
- Chartis Insurance Company of Canada (formerly AIG Commercial Insurance Company of Canada)
- Chubb Insurance Company of Canada
- Commonwealth Insurance Company
- Co-operators General Insurance Company
- CUMIS General Insurance Company
- The Dominion of Canada General Insurance Company
- Echelon General Insurance Company (Surety only)
- Economical Mutual Insurance Company
- Elite Insurance Company
- Everest Insurance Company of Canada
- Federated Insurance Company of Canada
- Federation Insurance Company of Canada
- Gore Mutual Insurance Company
- Grain Insurance and Guarantee Company
- The Guarantee Company of North America
- Industrial Alliance Pacific General Insurance Corporation
- Intact Insurance Company
- Jevco Insurance Company (Surety only)
- Lombard General Insurance Company of Canada
- Lombard Insurance Company
- Markel Insurance Company of Canada
- The Missisquoi Insurance Company
- The Nordic Insurance Company of Canada
- The North Waterloo Farmers Mutual Insurance Company (Fidelity only)
- Novex Insurance Company (Fidelity only)
- The Personal Insurance Company
- Pilot Insurance Company
- Quebec Assurance Company
- Royal & Sun Alliance Insurance Company of Canada
- Saskatchewan Mutual Insurance Company
- Scottish & York Insurance Co. Limited
- The Sovereign General Insurance Company
- TD General Insurance Company
- Temple Insurance Company
- Traders General Insurance Company

- Travelers Guarantee Company of Canada
- Trisura Guarantee Insurance Company
- The Wawanesa Mutual Insurance Company
- Waterloo Insurance Company
- Western Assurance Company
- Western Surety Company

2. Provincial Companies

Surety bonds issued by the following companies may be accepted provided that the contract of suretyship was executed in a province in which the company is licensed to do business as indicated in brackets.

- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- ALPHA, Compagnie d'Assurances Inc. (Que.)
- Canada West Insurance Company (Ont., Man., Sask, Alta., B.C., N.W.T.) (Surety only)
- The Canadian Union Assurance Company (Que.)
- La Capitale General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., Que.(Surety only), Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Coachman Insurance Company (Ont.)
- Continental Casualty Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- GCAN Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- The Insurance Company of Prince Edward Island (N.S., P.E.I., N.B.)
- Kingsway General Insurance Company (N.S., N.B., Que., Ont., Man., Sask., Alta., and B.C.)
- Liberty Mutual Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Manitoba Public Insurance Corporation (Man.)
- Norgroupe Assurance Générales Inc.
- Orleans General Insurance Company (N.B., Que., Ont.)
- Saskatchewan Government Insurance Office (Sask.)
- SGI CANADA Insurance Services Ltd. (Ont., Man., Sask., Alta.)
- L'Unique General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., N.B., Que.(Surety only), Ont.(Surety only), Man., Sask., Alta., B.C.(Surety only), Nun., N.W.T., Yuk.)

3. Foreign Companies

- Aspen Insurance UK Limited
- Compagnie Française d'Assurance pour le Commerce Extérieur (Fidelity only)
- Eagle Star Insurance Company Limited
- Ecclesiastical Insurance Office Public Limited Company (Fidelity only)
- Lloyd's Underwriters
- Mitsui Sumitomo Insurance Company, Limited
- NIPPONKOA Insurance Company, Limited
- Sompo Japan Insurance Inc.
- Tokio Marine & Nichido Fire Insurance Co., Ltd.
- XL Insurance Company Limited (Surety only)
- Zurich Insurance Company Ltd

Standard Construction Contract – Articles of Agreement
(23/01/2002)

A1 Contract Documents

A2 Date of Completion of Work and Description of Work

A3 Contract Amount

A4 Contractor's Address

A5 Unit Price Table

Articles of Agreement

These Articles of Agreement made in duplicate this day of .

Between

Her Majesty the Queen, in right of Canada (referred to in the contract documents as " Her Majesty") represented by the National Research Council Canada (referred to in the contract documents as the "Council")

and

(referred to in the contract documents as the "Contractor")

Witness that in consideration for the mutual promises and obligations contained in the contract, Her Majesty and the Contractor covenant and agree as follows:

A1 Contract Documents

(23/01/2002)

1.1 Subject to A1.4 and A1.5, the documents forming the contract between Her Majesty and the Contractor, referred to herein as the contract documents, are

1.1.1 these Articles of Agreement,

1.1.2 the document attached hereto, marked "A" and entitled "Plans and Specifications", referred to herein as the Plans and Specifications,

1.1.3 the document attached hereto, marked "B" and entitled "Terms of Payment", referred to herein as the Terms of Payment,

1.1.4 the document attached hereto, marked "C" and entitled "General Conditions", referred to herein as the General Conditions,

1.1.5 the document attached hereto, marked "D" and entitled "Labour Conditions", referred to herein as the Labour Conditions,

1.1.6 the document attached hereto, marked "E" and entitled "Insurance Conditions", referred to herein as the Insurance Conditions,

1.1.7 the document attached hereto, marked "F" and entitled "Contract Security Conditions", referred to herein as the Contract Security Conditions, and

1.1.8 any amendment or variation of the contract documents that is made in accordance with the General Conditions.

1.1.9 the document entitled Fair Wage Schedules for Federal Construction Contracts referred to herein as Fair Wage Schedules

1.1.10

The Council hereby designates of of the Government of Canada as the Engineer for the purposes of the contract, and for all purposes of or incidental to the contract, the Engineer's address shall be deemed to be:

1.2 **In the contract**

1.3.1 " Fixed Price Arrangement" means that part of the contract that prescribes a lump sum as payment for performance of the work to which it relates; and

1.3.2 " Unit Price Arrangement" means that part of the contract that prescribes the product of a price multiplied by a number of units of measurement of a class as payment for performance of the work to which it relates.

1.3 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Unit Price Arrangement are not applicable to any part of the work to which a Fixed Price Arrangement is applicable.

1.4 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Fixed Price Arrangement are not applicable to any part of the work to which a Unit Price Arrangement is applicable.

A2 Date of Completion of Work and Description of Work

(23/01/2002)

2.1 The contractor shall, between the date of these Articles of Agreement and the , in the careful and workmanlike manner, diligently perform and complete the following work:

which work is more particularly described in the Plans and Specifications.

A3 Contract Amount

(23/01/2002)

3.1 Subject to any increase, decrease, deduction, reduction or set-off that may be made under the Contract, Her Majesty shall pay the Contractor at the times and in the manner that is set out or referred to in the Terms of Payment

3.1.1 the sum of (GST/HST extra), in consideration for the performance of the work or the part thereof that is subject to Fixed Price Arrangement, and

3.1.2 a sum that is equal to the aggregate of the products of the number of units of Measurement of each class of labour, plant and material that is set out in a Final Certificate of Measurement referred to in GC44.8 multiplied in each case by the appropriate unit price that is set out in the Unit Price Table in consideration for the performance of the work or the part thereof that is subject to a Unit Price Arrangement.

3.2 For the information and guidance of the Contractor and the persons administering the contract on behalf of Her Majesty, but not so as to constitute a warranty , representation or undertaking of any nature by either party, it is estimated that the total amount payable by Her Majesty to the Contractor for the part of the work to which a Unit Price Arrangement is applicable will be approximately $N/A

3.3 A3.1.1 is applicable only to a Fixed Price Arrangement.

3.4 A3.1.2 and A3.2 applicable only to a Unit Price Arrangement.

A4 Contractor's Address

(23/01/2002)

4.1 For all purposes of or incidental to the contract, the Contractor's address shall be deemed to be:

A5 Unit Price Table

(23/01/2002)

5.1 Her Majesty and the Contractor agree that the following table is the Unit Price Table for the purposes of the contract.

Column 1 Item	**Column 2** Class of Labour Plant Or Material	**Column 3** Unit of Measurement	**Column 4** Estimated Total Quantity	**Column 5** Price per Unit	**Column 6** Estimated Total Price
		N/A			

5.2 The Unit Price Table that is set out in A5.1 designates the part of the work to which a Unit Price Arrangement is applicable.

5.3 The part of the work that is not designated in the Unit Price Table referred to in A5.2 is the part of the work to which a Fixed Price Arrangement is applicable.

Articles of Agreement

Signed on behalf of Her Majesty by

_____

as Senior Contracting Officer

and_____

as_____

of the **National Research Council Canada**

on the_____

day of _____

Signed, sealed and delivered by

_____

as_____and
Position

by_____

as_____
Position

Seal

of

on the_____

day of_____

SPECIFICATIONS

1. SCOPE OF WORK

.1 Work under this contract covers the design and construction of a semi-detached research house in the Montreal Road Campus of the National Research Council.

2. DRAWINGS

.1 The following drawings illustrate the work and form part of the contract documents:

3. COMPLETION

.1 Complete all work within 60 week(s) after receipt of notification of acceptance of tender.

4. GENERAL

.1 The word "provide" in this Specification means to supply and install.

.2 Provide items mentioned in either the drawings or the specification.

5. SPECIFIED ACCEPTABLE & ALTERNATIVE EQUIPMENT & MATERIALS

.1 Materials and equipment scheduled and/or specified on the drawings or in the specifications have been selected to establish a performance and quality standard. In most cases, acceptable manufacturers are stated for any material or equipment specified by manufacturer's name and model number. Contractors may base their tender price on materials and equipment supplied by any of the manufacturers' names as acceptable for the particular material or equipment.

.2 In addition to the manufacturers specified or named as acceptable, you may propose alternative manufacturers of materials or equipment to the Departmental Representative for acceptance. For a product to be considered as an alternative product substitute, make a written application to the Departmental Representative during the tender period, not later than ten (10) working days before tender closing.

.3 Certify in writing that the alternative meets all requirements of the specified material or equipment. In addition, it shall be understood that all costs required by or as a result of acceptance or proposed alternatives, will be borne by the contractor.

.4 Approval of alternatives will be signified by issue of an Addendum to the Tender Documents.

.5 Any alternative manufacturers or materials submitted which are incomplete and cannot be evaluated, or are later than ten (10) working days before tender closing date or after the tender period, will not be considered.

6. MINIMUM STANDARDS

.1 Conform to or exceed minimum acceptable standards of the various applicable federal, provincial and municipal codes such as The National Building Code, The National Fire

Code, Canadian Plumbing Code, Canadian Electrical Code, Canadian Code for Construction Safety and the Provincial Construction Safety Act.

.2 Work to conform to referenced standards and codes as reaffirmed or revised to date of specification.

7. WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS)

.1 The general contractor shall comply with Federal and Provincial legislation regarding the WHMIS. The contractor's responsibilities include, but are not limited to the following:

.1 To ensure that any controlled product brought on site by the contractor or sub-contractor is labeled;

.2 To make available to the workers and the Departmental Representative, Material Safety Data Sheets (MSDS) for these controlled products;

.3 To train own workers about WHMIS, and about the controlled products that they use on site;

.4 To inform other contractors, sub-contractors, the Departmental Representative, authorized visitors and outside inspection agency personnel about the presence and use of such products on the site.

.5 The site foreman or superintendent must be able to demonstrate, to the satisfaction of the Departmental Representative, that he/she has had WHMIS training and is knowledgeable in its requirements. The Departmental Representative can require replacement of this person if this condition or implementation of WHMIS is not satisfactory.

8. REQUIREMENTS OF BILL 208, SECTION 18(a)

Under the requirements of Bill 208 of the Ontario Ministry of Labour Occupational Health & Safety Act, the following designated substances may be encountered while performing the work described in these contract documents:

.1 Not applicable to this project.

9. COST BREAKDOWN

.1 Submit, for approval by the Departmental Representative, a cost breakdown of tender 72 hours after the contract is awarded.

.2 Use the approved cost breakdown as the basis for submitting all claims.

.3 Request Departmental Representative's verbal approval to amount of claim prior to preparing and submitting the claim in its final form.

10. SUB-TRADES

.1 Submit no later than 72 hours after tender closing, a complete list of sub trades for the Departmental Representative's review.

11. PERSONNEL SECURITY AND IDENTIFICATION

.1 All persons employed by the contractor, or by any subcontractor and present on the site must be security cleared in accordance with the requirements of the Section entitled Special Instructions to Tenderers.

.2 All such persons must wear and keep visible identification badges as issued by the Security Office of NRC.

12. WORKING HOURS AND SECURITY

.1 Normal working hours on the NRC property are from 8:00 a.m. until 4:30 p.m., Monday to Friday inclusive, except statutory holidays.

.2 At all other times, special written passes are required for access to the building site.

~~.3~~ Before scheduling any work outside normal working hours, obtain permission from the Departmental Representative to perform the specific tasks.

.4 An escort may be required whenever working outside normal hours. Contractor to bear the associated costs.

13. SCHEDULE

.1 The contractor shall prepare a detailed schedule, fixing the date for commencement and completion of the various parts of the work and update the said schedule. Such schedule shall be made available to the Departmental Representative not later than two weeks after the award of the contract and prior to commencement of any work on site.

.2 Notify Departmental Representative in writing of any changes in the schedule.

.3 30 day(s) before the scheduled completion date, arrange to do an interim inspection with the Departmental Representative.

14. PROJECT MEETINGS

.1 Hold regular project meetings at times and locations approved by the Departmental Representative.

.2 Notify all parties concerned of meetings to ensure proper coordination of work.

.3 Departmental Representative will set times for project meetings and assume responsibility for recording and distributing minutes.

15. SHOP DRAWINGS

.1 Review shop drawings, data sheets and samples prior to submission.

.2 Submit electronic copy of all shop drawings and product data and sample~~s~~ for review, unless otherwise specified.

.3 Review of shop drawings and product data by the Departmental Representative does not relieve the contractor of the responsibility for errors and omissions and for the conformity with contract documents.

16. SAMPLES AND MOCK-UPS

.1 Submit samples in sizes and quantities as specified.

.2 Where colour, pattern or texture is criterion, submit full range of samples.

.3 Construct field samples and mock-ups at locations acceptable to Departmental Representative.

.4 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work will be checked on the project.

17. MATERIALS AND WORKMANSHIP

.1 Install only new materials on this project unless specifically noted otherwise.

.2 Only first class workmanship will be accepted, not only with regard to safety, efficiency, durability, but also with regard to neatness of detail and performance.

18. WORK & MATERIALS SUPPLIED BY OWNER

.1 Work and materials not included in this contract are described on drawings and in this specification.

.2 Deliver to a storage place, as directed by the Departmental Representative, all materials returned to the Owner.

.3 Unless otherwise specified, accept owner-supplied materials at their storage location and provide all transportation as required.

.4 General Contractor's duties:

.1 Unload at site.

.2 Promptly inspect products and report damaged or defective items.

.3 Give written notification to the Departmental Representative for items accepted in good order.

.4 Handle at site, including uncrating and storage.

.5 Repair or replace items damaged on site.

.6 Install, connect finished products as specified.

19. SITE ACCESS

.1 Make prior arrangements with the Departmental Representative before starting work or moving materials and equipment on site.

.2 Obtain approval of Departmental Representative for regular means of access during the construction period.

.3 Obtain approval of Departmental Representative before temporarily suspending operations on site; before returning to the site and before leaving the site at the end of the job.

.4 Provide and maintain access to site.

.5 Build and maintain temporary roads and provide snow removal during period of work.

.6 Make good any damage and clean up dirt, debris, etc., resulting from contractor's use of existing roads.

20. USE OF SITE

.1 Restrict operations on the site to the areas approved by the Departmental Representative

.2 Locate all temporary structures, equipment, storage, etc., to the designated areas.

.3 Restrict parking to the designated areas.

21. ACCEPTANCE OF SITE

.1 Inspect the site before commencing work, review any unexpected conditions with the Departmental Representative.

.2 Commencement of work will imply acceptance of existing conditions.

22. SITE OFFICE & TELEPHONE

.1 Contractor to erect a temporary site office at his own expense.

.2 Install and maintain a telephone, if necessary.

.3 Use of NRC phones is not permitted unless in the case of an emergency.

23. SANITARY FACILITIES

.1 Provide sanitary facilities, and bear all associated costs.

24. TEMPORARY SERVICES

.1 A source of temporary power will be made available in the area. Bear all costs to make connections to the power source and perform distribution on site.

.2 Provide all load centres, breakers, conduit, wiring, disconnects, extension cords, transformers, as required from the source of power.

.3 Power is to be used only for power tools, lighting, controls, motors, and not for space heating.

.4 A source of temporary water will be made available if required.

.5 Bear all costs associated with distributing the water to the required locations.

.6 Comply with NRC requirements when connecting to existing systems in accordance with the articles entitled "Co-operation" and "Service Interruptions" of this section.

25. DOCUMENTS REQUIRED AT WORK SITE

.1 The contractor shall keep on the site, one (1) up-to-date copy of all contract documents, including specifications, drawings, addenda, shop drawings, change notices, schedule and any reports or bulletins pertaining to the work, in good order, available to the Departmental Representative and to his / her representatives at all times.

.2 At least one (1) copy of specifications and drawings shall be marked by the contractor to show all work "As Built" and shall be provided to the Departmental Representative with the Application for Payment and for the Final Certificate of Completion.

26. CO-OPERATION

.1 Co-operate with NRC staff in order to keep disruption of normal research work to an absolute minimum.

.2 Work out in advance, a schedule for all work which might disrupt normal work in the building.

.3 Have schedule approved by the Departmental Representative.

.4 Notify the Departmental Representative in writing, 72 hours prior to any intended interruption of facilities, areas, corridors, mechanical or electrical services and obtain requisite permission.

27. PROTECTION AND WARNING NOTICES

.1 Provide all materials required to protect existing equipment.

.2 Erect dust barriers to prevent dust and debris from spreading through the building.

.3 Place dust protection in the form of cover sheets over equipment and furniture and tape these sheets to floors, to ensure no dust infiltration.

.4 Repair or replace any and all damage to Owner's property caused during construction, at no cost to the Owner and to the satisfaction of the Departmental Representative.

.5 Protect the buildings, roads, lawns, services, etc. from damage which might occur as a result of this work.

.6 Plan and co-ordinate the work to protect the buildings from the leakage of water, dust, etc.

.7 Ensure that all doors, windows, etc., that could allow transfer of dust, noise, fumes, etc., to other areas of the building are kept closed.

.8 Be responsible for security of all areas affected by the work under the Contract until acceptance by NRC. Take all necessary precautions to prevent entry to the work area by unauthorized persons and guard against theft, fire and damage by any cause. Secure working area at the end of each day's work and be responsible for same.

.9 Provide and maintain adequate safety barricades around the work sites to protect NRC personnel and the public from injury during the construction.

.10 Post warnings, in all instances where possible injury could occur such as Work Overhead, Hard Hat Areas, etc. or as required by the Departmental Representative.

.11 Provide temporary protective enclosures over building entrances and exits to protect pedestrians. All enclosures to be structurally sound against weather and falling debris.

28. BILINGUALISM

.1 Ensure that all signs, notices, etc. are posted in both official languages.

.2 Ensure that all identification of services called for by under this contract are bilingual.

29. LAYOUT OF WORK

.1 Location of equipment, fixtures, outlets and openings indicated on drawings or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with the manufacturer's recommendations for safety, access and maintenance.

.3 Employ competent person to lay out work in accordance with the contract documents.

30. DISCREPANCIES & INTERFERENCES

.1 Prior to the start of the work, examine drawings and specifications. Report at once to the Departmental Representative, any defects, discrepancies, omissions or interferences affecting the work.

.2 Contractor to immediately inform the Departmental Representative in writing, of any discrepancies between the plans and the physical conditions so the Departmental Representative may promptly verify same.

.3 Any work done after such a discovery, until authorized, is at the contractor's risk.

.4 Where minor interferences as determined by the Departmental Representative are encountered on the job and they have not been pointed out on the original tender or on the plans and specifications, provide offsets, bends or reroute the services to suit job conditions at no extra cost.

.5 Arrange all work so as not to interfere in any way with other work being carried out.

31. MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.2 Notify the Departmental Representative in writing of any conflict between these specifications and manufacturer's instruction. Departmental Representative will designate which document is to be followed.

32. TEMPORARY HEATING AND VENTILATING

.1 Bear the costs of temporary heat and ventilation during construction including costs of installation, fuel, operation, maintenance, and removal of equipment.

.2 Use of direct-fired heaters discharging waste products into the work areas will not be permitted unless prior approval is given by the Departmental Representative.

.3 Furnish and install temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of work.

.2 Protect work and products against dampness and cold.

.3 Reduce moisture condensation on surfaces to an acceptable level.

.4 Provide ambient temperature and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for a safe working environment.

.4 Maintain minimum temperature of 10 ^{o}C (50 ^{o}F) or higher where specified as soon as finishing work is commenced and maintain until acceptance by the Departmental Representative. Maintain ambient temperature and humidity levels as required for comfort of NRC personnel.

.5 Prevent hazardous or unhealthy accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction including also, storage areas and sanitary facilities.

.1 Dispose of exhaust materials in a manner that will not result in a harmful or unhealthy exposure to persons.

.6 Maintain strict supervision of operation of temporary heating and ventilating equipment.

.1 Enforce conformance with applicable codes and standards.

.2 Comply with instructions of the Departmental Representative including provision of full-time watchman services when directed.

.3 Enforce safe practices.

.4 Vent direct-fired combustion units to outside.

.7 Submit tenders assuming existing or new equipment and systems will not be used for temporary heating and ventilating.

.8 After award of contract, Departmental Representative may permit use of the permanent system providing agreement can be reached on:

.1 Conditions of use, special equipment, protection, maintenance, and replacement of filters.

.2 Methods of ensuring that heating medium will not be wasted and in the case of steam, agreement on what is to be done with the condensate.

.3 Saving on contract price.

.4 Provisions relating to guarantees on equipment.

33. CONNECTIONS TO AND INTERRUPTIONS TO EXISTING SERVICES

.1 Where work involves breaking into or connecting to existing services, carry out work at times and in the manner agreed to by the Departmental Representative and by authorities having jurisdiction, with minimum disruption to NRC Personnel and vehicular traffic and minimum service interruption. Do not operate any NRC equipment or plant.

.2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.

.3 Submit a schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility; allow minimum 72 hours notice. Adhere to approved schedule and provide notice to the Departmental Representative.

.4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.5 Provide detours, bridges, alternate feeds, etc., as required to minimize disruptions.

.6 Protect existing services as required and immediately make repairs if damage occurs.

.7 Remove any abandoned service lines as indicated on the contract documents and as approved by the Departmental Representative; cap or otherwise seal lines at cut-off points. Record and provide a copy to the Departmental Representative of locations of maintained, re-routed and abandoned service lines.

34. CUTTING AND PATCHING

.1 Cut existing surfaces as required to accommodate new work.

.2 Remove all items as shown or specified.

.3 Patch and make good with identical materials, the surfaces that have been disturbed, cut or damaged, to the satisfaction of the Departmental Representative.

.4 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 12mm (1/2") clearance around the pipes or pipe insulation. Do not drill or cut any surface without the approval of the Departmental Representative.

.5 Obtain written approval of the Departmental Representative before cutting openings through existing or new structural members.

.6 Seal all openings where cables, conduits or pipes pass through walls with an acoustic sealant conforming to CAN/CGSB-19.21-M87.

.7 Where cables, conduits and pipes pass through fire rated walls and floors, pack space between with compressed glass fibres and seal with fire stop caulking in accordance with CAN/CGSB-19.13-M87 AND NBC 3.1.7.

35. FASTENING DEVICES

.1 Do not use explosive actuated tools, without first obtaining permission from the Departmental Representative.

.2 Comply with the requirements of CSA A-166 (Safety Code for Explosive Actuated Tools).

.3 Do not use any kind of impact or percussion tool without first obtaining permission from the Departmental Representative.

36. OVERLOADING

.1 Ensure that no part of the building or work is subjected to a load which will endanger safety or cause permanent deformation or structural damage.

37. DRAINAGE

.1 Provide temporary drainage and pumping as required to keep excavations and site free of water.

38. ENCLOSURE OF STRUCTURES

.1 Construct and maintain all temporary enclosures as required to protect foundations, sub-soil, concrete, masonry, etc., from frost penetration or damage.

.2 Maintain in place until all chances of damage are over and proper curing has taken place.

.3 Provide temporary weather tight enclosures for exterior openings until permanent sash and glazing and exterior doors are installed.

.4 Provide lockable enclosures as required to maintain the security of NRC facilities and be responsible for the same.

.5 Provide keys to NRC security personnel when required.

.6 Lay out the work carefully and accurately and verify all dimensions and be responsible for them. Locate and preserve general reference points.

.7 Throughout the course of construction, keep continuously acquainted with field conditions, and the work being developed by all trades involved in the project. Maintain an awareness of responsibility to avoid space conflict with other trades.

.8 Conceal all services, piping, wiring, ductwork, etc., in floors, walls or ceilings except where indicated otherwise.

39. STORAGE

.1 Provide storage as required to protect all tools, materials, etc., from damage or theft and be responsible for the same.

.2 Do not store flammable or explosive materials on site without the authorization of the Departmental Representative.

40. GENERAL REVIEW

.1 Periodic review of the contractor's work by the Departmental Representative does not relieve the contractor of the responsibility of making the work in accordance with contract documents. Contractor shall carry out his own quality control to ensure that the construction work is in accordance with contract documents.

.2 Inform the Departmental Representative of any impediments to the installation and obtain his / her approval for actual location.

41. INSPECTION OF BURIED OR CONCEALED SERVICES

.1 Prior to concealing any services that are installed, ensure that all inspection bodies concerned, including NRC, have inspected the work and have witnessed all tests. Failure to do so may result in exposing the services again at the contractor's expense.

42. TESTING

.1 On completion, or as required by local authority inspectors and/or Departmental Representative during progress of work and before any services are covered up and flushing is complete, test all installations in the presence of the Departmental Representative.

.2 Obtain and hand to the Departmental Representative all acceptance certificates or test reports from authority having jurisdiction. The project will be considered incomplete without the same.

43. PARTIAL OCCUPANCY

.1 NRC may request partial occupancy of the facility if the contract extends beyond the expected completion date.

.2 Do not restrict access to the building, routes, and services.

.3 Do not encumber the site with materials or equipment.

44. DISPOSAL OF WASTES

.1 Dispose of waste materials including volatiles, safely off NRC property. Refer to the section entitled "General and Fire Safety Requirements” included as part of this specification.

45. CLEAN-UP DURING CONSTRUCTION

.1 On a daily basis, maintain project site and adjacent area of campus including roofs, free from debris and waste materials.

.2 Provide on-site dump containers for collection of waste materials and rubbish.

46. FINAL CLEAN-UP

.1 Upon completion do a final clean-up to the satisfaction of the Departmental Representative.

.2 Clean all new surfaces, lights, existing surfaces affected by this work, replace filters, etc.

.3 Clean all resilient flooring and prepare to receive protective finish. Protective finish applied by NRC

47. WARRANTY AND RECTIFICATION OF DEFECTS IN WORK

.1 Refer to General Conditions "C", section GC32.

.2 Ensure that all manufacturers' guarantees and warranties are issued in the name of the **General** Contractor and the National Research Council.

48. MAINTENANCE MANUALS

.1 Provide three (3) bilingual copies of maintenance manuals or two English and two French maintenance manuals immediately upon completion of the work and prior to release of holdbacks.

.2 Manuals to be neatly bound in hard cover loose leaf binders.

.3 Manuals to include operating and maintenance instructions, all guarantees and warranties, shop drawings, technical data, etc., for the material and apparatus supplied under this contract.

END OF SECTION

1. GENERAL CONSTRUCTION SAFETY REQUIREMENTS

.1 The Contractor shall take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.

.2 The Contractor shall be solely responsible for the construction safety of both its employees and those of its sub-contractors at the work site, and for initiating, maintaining and supervising safety precautions, programs and procedures in connection with the performance of the work.

.3 The Contractor shall comply with all Federal, Provincial and Municipal safety codes and regulations and the Occupational Health and Safety Act and the Workplace Safety and Insurance Board. In the event of any conflict between any provisions in legislation or codes, the most stringent provisions shall apply.

.4 Periodic review of the contractor's work by the Departmental Representative, using the criteria of the contract documents, does not relieve the contractor of his safety responsibilities in carrying out the work in accordance with the contract documents. The contractor shall consult with the Departmental Representative to ensure that this responsibility is carried out.

.5 The Contractor shall ensure that only competent personnel are permitted to work on site. Throughout the term of the contract, any person will be removed from the site who is not observing or complying with the safety requirements.

.6 All equipment shall be in safe operating condition and appropriate to the task.

.7 Following a project and site hazard assessment, the Contractor shall develop a Site Specific Safety Plan based on the following minimum requirements:

- .1 Provide a safety board mounted in a visible location on the project site, with the following information included thereon:
  - .1 Notice of Project
  - .2 Site specific Safety Policy
  - .3 Copy of Ontario Health and Safety Act
  - .4 Building Schematic showing emergency exits
  - .5 Building emergency procedures
  - .6 Contact list for NRC, Contractor and all involved sub-contractors
  - .7 Any related MSDS sheets
  - .8 NRC Emergency phone number

.8 The Contractor shall provide competent personnel to implement its safety program and those of any Health and Safety Act legislation applicable at this project location, and to ensure they are being complied with.

.9 The Contractor shall provide safety orientation to all its employees as well as those of any subcontractors under its jurisdiction.

.10 The Departmental Representative will monitor to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Contractor or sub-contractors removed from the site.

.11 The Contractor will report to the Departmental Representative and jurisdictional authorities, any accident or incident involving Contractor or NRC personnel or the public and/or property arising from the Contractor's execution of the work.

.12 If entry to a laboratory is required as part of the work of the Contractor, a safety orientation shall be provided to all his employees as well as those of any subcontractors regarding lab safety requirements and procedures, as provided by the Researcher or the Departmental Representative.

2. FIRE SAFETY REQUIREMENTS

.1 Authorities

1. The Fire Commissioner of Canada (FC) is the authority for fire safety at NRC.
2. For the purpose of this document, "Departmental Representative" will be deemed as the NRC person in charge of the project and who will enforce these Fire Safety Requirements.
3. Comply with the following standards as published by the Office of the Fire Commissioner of Canada:
    a. Standard No. 301 - June 1982 "Standard for Construction Operations";
    b. Standard No. 302 - June 1982 "Standard for Welding and Cutting".

.2 Smoking

.1 Smoking is prohibited inside all NRC buildings, as well as roof areas.

.2 Obey all "NO SMOKING" signs on NRC premises.

.3 Hot Work

.1 Prior to commencement of any "Hot Work" involving welding, soldering, burning, heating, use of torches or salamanders or any open flame, obtain a Hot Work Permit from the Departmental Representative.

.2 Prior to commencement of "Hot Work", review the area of hot work with the Departmental Representative to determine the level of fire safety precautions to be taken.

.4 Reporting Fires

.1 Know the exact location of the nearest Fire Alarm Pull Station and telephone, including the emergency phone number.

.2 REPORT immediately, all fire incidents as follows:

.1 Activate nearest fire alarm pull station and;

.2 Telephone the following emergency phone number as appropriate:

FROM AN NRC PHONE	**333**
FROM ANY OTHER PHONE	**(613) 993-2411**

4. When reporting a fire by phone, give the location of fire, building number and be prepared to verify location.
5. The person activating fire alarm pull station must remain at a safe distance from the scene of the fire but readily available to provide information and direction to the Fire Department personnel.

.5 Interior and Exterior Fire protection & Alarm Systems

.1 DO NOT OBSTRUCT OR SHUT OFF FIRE PROTECTION EQUIPMENT OR SYSTEMS, INCLUDING BUT NOT LIMITED TO FIRE ALARM SYSTEMS, SMOKE/HEAT DETECTORS, SPRINKLER SYSTEM, PULL STATIONS, EMERGENCY CALL BUTTONS AND PA SYSTEMS, WITHOUT AUTHORIZATION FROM THE DEPARTMENTAL REPRESENTATIVE.

.2 WHEN ANY FIRE PROTECTION EQUIPMENT IS TEMPORARILY SHUT DOWN, ALTERNATIVE MEASURES AS PRESCRIBED BY THE DEPARTMENTAL REPRESENTATIVE SHALL BE TAKEN TO ENSURE THAT FIRE PROTECTION IS MAINTAINED.

.3 DO NOT LEAVE FIRE PROTECTION OR ALARM SYSTEMS INACTIVE AT THE END OF A WORKING DAY WITHOUT NOTIFICATION AND AUTHORISATION FROM THE DEPARTMENTAL REPRESENTATIVE. THE DEPARTMENTAL REPRESENTATIVE WILL ADVISE THE (FPO) OF THE DETAILS OF ANY SUCH EVENT.

.4 DO NOT USE FIRE HYDRANTS, STANDPIPES AND HOSE SYSTEMS FOR OTHER THAN FIRE FIGHTING PURPOSES UNLESS AUTHORISED BY DEPARTMENTAL REPRESENTATIVE.

.6 Fire Extinguishers

.1 Provide a minimum of 1-20 lb. ABC Dry Chemical Fire Extinguisher at each hot work or open flame location.

.2 Provide fire extinguishers for hot asphalt and roofing operations as follows:

a. Kettle area - 1-20 lb. ABC Dry Chemical;
b. Roof - 1-20 lb. ABC Dry Chemical at each open flame location.

.3 Provide fire extinguishers equipped as below:

c. Pinned and sealed;
d. With a pressure gauge;
e. With an extinguisher tag signed by a fire extinguisher servicing company.

.4 Carbon Dioxide (C02) extinguishers will not be considered as substitutes for the above.

.7 Roofing Operations

.1 Kettles:

.1 Arrange for the location of asphalt kettles and material storage with the Departmental Representative before moving on site. Do not locate kettles on any roof or structure and keep them at least 10m (30 feet) away from a building.

.2 Equip kettles with 2 thermometers or gauges in good working order; a hand held and a kettle-mounted model.

.3 Do not operate kettles at temperatures in excess of 232°C (450 °F).

.4 Maintain continuous supervision while kettles are in operation and provide metal covers for the kettles to smother any flames in case of fire. Provide fire extinguishers as required in article 2.6.

.5 Demonstrate container capacities to Departmental Representative prior to start of work.

.6 Store materials a minimum of 6m (20 feet) from the kettle.

.2 Mops:

.1 Use only glass fibre roofing mops.

.2 Remove used mops from the roof site at the end of each working day.

.3 Torch Applied Systems:

.1 DO NOT USE TORCHES NEXT TO WALLS.

.2 DO NOT TORCH MEMBRANES TO EXPOSED WOOD OR CAVITY

.3 Provide a Fire Watch as required by article 2.9 of this section.

.4 Store all combustible roofing materials at least 3m (10 feet) away from any structure.

.5 Keep compressed gas cylinders a minimum of 6m (20 feet) away from the kettle, protected from mechanical damage and secured in an upright position.

.8 Welding / Grinding Operations

.1 Contractor to provide fire blankets, portable fume extraction devices, screens or similar equipment to prevent exposure to welding flash, or sparks from grinding.

.9 **Fire Watch**

.1 Provide a fire watch for a minimum of one hour after the termination of any hot work operation.

.2 For temporary heating, refer to General Instructions Section 00 010 00.

.3 Equip fire watch personnel with fire extinguishers as required by article 2.6.

.10 Obstruction of access/egress routes-roadways, halls, doors, or elevators

.1 Advise the Departmental Representative in advance of any work that would impede the response of Fire Department personnel and their apparatus. This includes violation of minimum overhead clearance, erection of barricades and the digging of trenches.

.2 Building exit routes must not be obstructed in any way without special permission from the Departmental Representative, who will ensure that adequate alternative routes are maintained.

.3 The Departmental Representative will advise the FPO of any obstruction that may warrant advanced planning and communication to ensure the safety of building occupants and the effectiveness of the Fire Department.

.11 Rubbish and Waste Materials

.1 Keep rubbish and waste materials to a minimum and a minimum distance of 6m (20 feet) from any kettle or torches.

.2 Do not burn rubbish on site.

.3 Rubbish Containers

.1 Consult with the Departmental Representative to determine an acceptable safe location for any containers and the arrangement of chutes etc. prior to bringing the containers on site.

.2 Do not overfill the containers and keep area around the perimeter free and clear of any debris.

.4 Storage

.1 Exercise extreme care when storing combustible waste materials in work areas. Ensure maximum possible cleanliness, ventilation and that all safety standards are adhered to when storing any combustible materials.

.2 Deposit greasy or oily rags or materials subject to spontaneous combustion in CSA or ULC approved receptacles and remove at the end of the work day or shift, or as directed.

.12 Flammable Liquids

.1 The handling, storage and use of flammable liquids is governed by the current National Fire Code of Canada.

.2 Flammable Liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 45 litres (10 imp gal), provided they are stored in approved safety cans bearing the ULC seal of approval and kept away from buildings, stockpiled combustible materials etc. Storage of quantities of flammable liquids exceeding 45 litres (10 imp gal) for work purposes, require the permission of the Departmental Representative.

.3 Flammable liquids are not to be left on any roof areas after normal working hours.

.4 Transfer of flammable liquids is prohibited within buildings.

.5 Do not transfer flammable liquids in the vicinity of open flames or any type of heat producing device.

.6 Do not use flammable liquids having a flash point below 38 ^{o}C (100 ^{o}F) such as naphtha or gasoline as solvents or cleaning agents.

.7 Store flammable waste liquids for disposal in approved container located in a safe, ventilated area. Waste flammable liquids are to be removed from the site on a regular basis.

.8 Where flammable liquids, such as lacquers or urethane are used, ensure proper ventilation and eliminate all sources of ignition. Inform the Departmental Representative prior to, and at the cessation of such work.

3. Questions and/or clarifications

.1 Direct any questions or clarification on Fire or General Safety, in addition to the above requirements, to the Departmental Representative.

END OF SECTION

TP1 Amount Payable – General

1.1 Subject to any other provisions of the contract, Her Majesty shall pay the Contractor, at the times and in the manner hereinafter set out, the amount by which

1.1.1 the aggregate of the amounts described in TP2 exceeds

1.1.2 the aggregate of the amounts described in TP3

and the Contractor shall accept that amount as payment in full satisfaction for everything furnished and done by him in respect of the work to which the payment relates.

TP2 Amounts Payable to the Contractor

2.1 The amounts referred to in TP1.1.1 are the aggregate of

2.1.1 the amounts referred to in the Articles of Agreement, and

2.1.2 the amounts, if any, that are payable to the Contractor pursuant to the General Conditions.

TP3 Amounts Payable to Her Majesty

3.1 The amounts referred to in TP1.1.2 are the aggregate of the amounts, in any, that the Contractor is liable to pay Her Majesty pursuant to the contract.

3.2 When making any payments to the Contractor, the failure of Her Majesty to deduct an amount referred to in TP3.1 from an amount referred to in TP2 shall not be constitute a waiver of the right to do so, or an admission of lack of entitlement to do so in any subsequent payment to the Contractor.

TP4 Time of Payment

4.1 In these Terms of Payment

4.1.1 The "payment period" means a period of 30 consecutive days or such other longer period as is agreed between the Contractor and the Departmental Representative.

4.1.2 An amount is "due and payable" when it is due and payable by Her Majesty to the Contractor according to TP4.4, TP4.7 or TP4.10.

4.1.3 An amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

4.1.4 The "date of payment" means the date of the negotiable instrument of an amount due and payable by the Receiver General for Canada and given for payment.

4.1.5 The "Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the opening of business on the date of payment.

4.2 The Contractor shall, on the expiration of a payment period, deliver to the Departmental Representative in respect of that payment period a written progress claim that fully describes any part of the work that has been completed, and any material that was delivered to the work site but not incorporated into the work during that payment period.

4.3 The Departmental Representative shall, not later than ten days after receipt by him of a progress claim referred to in TP4.2,

4.3.1 inspect the part of the work and the material described in the progress claim; and

4.3.2 issue a progress report, a copy of which the Departmental Representative will give to the Contractor, that indicates the value of the part of the work and the material described in the progress claim that, in the opinion of the Departmental Representative,

4.3.2.1 is in accordance with the contract, and

4.3.2.2 was not included in any other progress report relating to the contract.

4.4 Subject to TP1 and TP4.5 Her Majesty shall, not later than 30 days after receipt by the Departmental Representative of a progress claim referred to in TP4.2, pay the Contractor

4.4.1 an amount that is equal to 95% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has been furnished by the Contractor, or

4.4.2 an amount that is equal to 90% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has not been furnished by the Contractor.

4.5 It is a condition precedent to Her Majesty's obligation under TP4.4 that the Contractor has made and delivered to the Departmental Representative,

4.5.1 a statutory declaration described in TP4.6 in respect of a progress claim referred to in TP4.2,

4.5.2 in the case of the Contractor's first progress claim, a construction schedule in accordance with the relevant sections of the Specifications, and

4.5.3 if the requirement for a schedule is specified, an update of the said schedule at the times identified in the relevant sections of the Specifications.

4.6 A statutory declaration referred to in TP4.5 shall contain a deposition by the Contractor that

4.6.1 up to the date of the Contractor's progress claim, the Contractor has complied with all his lawful obligations with respect to the Labour Conditions; and

4.6.2 up to the date of the Contractor's immediately preceding progress claim, all lawful obligations of the Contractor to subcontractors and suppliers of material in respect of the

work under the contract have been fully discharged.

4.7 Subject to TP1 and TP4.8, Her Majesty shall, not later than 30 days after the date of issue of an Interim Certificate of Completion referred to in GC44.2, pay the Contractor the amount referred to in TP1 less the aggregate of

4.7.1 the sum of all payments that were made pursuant to TP4.4;

4.7.2 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty or rectifying defects described in the Interim Certificate of Completion; and

4.7.3 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty of completing the parts of the work described in the Interim Certificate of Completion other than the defects referred to in TP4.7.2.

4.8 It is a condition precedent to Her Majesty's obligation under TP4.7 that the Contractor has made and delivered to the Departmental Representative,

4.8.1 a statutory declaration described in TP4.9 in respect of an Interim Certificate of Completion referred to in GC44.2, and

4.8.2 if so specified in the relevant sections of the Specifications, and update of the construction schedule referred to in TP4.5.2 and the updated schedule shall, in addition to the specified requirements, clearly show a detailed timetable that is acceptable to the Departmental Representative for the completion of any unfinished work and the correction of all defects.

4.9 A statutory declaration referred to in TP4.8 shall contain a deposition by the contractor that up to the date of the Interim Certificate of Completion the Contractor has

4.9.1 complied with all of the Contractor's lawful obligations with respect to the Labour Conditions;

4.9.2 discharged all of the Contractor's lawful obligations to the subcontractors and suppliers of material in respect of the work under the contract; and

4.9.3 discharged the Contractor's lawful obligations referred to in GC14.6.

4.10 Subject to TP1 and TP4.11, Her Majesty shall, not later than 60 days after the date of issue of a Final Certificate of Completion referred to in GC44.1, pay the Contractor the amount referred to in TP1 less the aggregate of

4.10.1 the sum of all payments that were made pursuant to TP4.4; and

4.10.2 the sum of all payments that were made pursuant to TP4.7.

4.11 It is a condition precedent to Her Majesty's obligation under TP4.10 that the Contractor has made and delivered a statutory declaration described in TP4.12 to the Departmental Representative.

4.12 A statutory declaration referred to in TP4.11 shall, in addition to the depositions described in TP4.9, contain a deposition by the Contractor that all of the Contractor's lawful obligations and any lawful claims against the Contractor that arose out of the performance of the contract have been discharged and satisfied.

TP5 Progress Report and Payment Thereunder Not Binding on Her Majesty

5.1 Neither a progress report referred to in TP4.3 nor any payment made by Her Majesty pursuant to these Terms of Payment shall be construed as an admission by Her Majesty that the work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

TP6 Delay in Making Payment

6.1 Nothwithstanding GC7 any delay by Her Majesty in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by Her Majesty.

6.2 Her Majesty shall pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 -1/4 per centum on any amount which is overdue pursuant to TP4.1.3, and the interest shall apply from and include the day such amount became overdue until the day prior to the date of payment except that

6.2.1 interest shall not be payable or paid unless the amount referred to in TP6.2 has been overdue for more that 15 days following

6.2.1.1 the date the said amount became due and payable, or

6.2.1.2 the receipt by the Departmental Representative of the Statutory Declaration referred to in TP4.5, TP4.8 or TP4.11,

whichever is the later, and

6.6.2 interest shall not be payable or paid on overdue advance payments if any.

TP7 Right of Set-off

7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, Her Majesty may set off any amount payable to Her Majesty by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract.

7.2 For the purposes of TP7.1, "current contract" means a contract between Her Majesty and the Contractor

7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or

7.2.2 in respect of which Her Majesty has, since the date of which the Articles of Agreement were made, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.

TP8 Payment in Event of Termination

8.1 If the contract is terminated pursuant to GC41, Her Majesty shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

TP9 Interest on Settled Claims

9.1 Her Majesty shall pay to the Contractor simple interest on the amount of a settled claim at an average Bank Rate plus 1 ¼ per centum from the date the settled claim was outstanding until the day prior to the date of payment.

9.2 For the purposes of TP9.1,

9.2.1 a claim is deemed to have been settled when an agreement in writing is signed by the Departmental Representative and the Contractor setting out the amount of the claim to be paid by Her Majesty and the items or work for which the said amount is to be paid.

9.2.2 an "average Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the end of each calendar month averaged over the period the settled claim was outstanding.

9.2.3 a settled claim is deemed to be outstanding from the day immediately following the date the said claim would have been due and payable under the contract had it not been disputed.

9.3 For the purposes of TP9 a claim means a disputed amount subject to negotiation between Her Majesty and the Contractor under the contract.

GC1 Interpretation

1.1 In the contract

1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein;

1.1.2 "contract" means the contract document referred to in the Articles of Agreement;

1.1.3 "contract security" means any security given by the Contractor to Her Majesty in accordance with the contract;

1.1.4 "Departmental Representative" means the officer or employee or Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;

1.1.5 "material" includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;

1.1.6 "Minister" includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;

1.1.7 "person" includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;

1.1.8 "plant" includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;

1.1.9 "subcontractor' means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;

1.1.10 "superintendant" means the employee of the Contractor who is designated by the Contractor to act pursuant to GC19;

1.1.11 "work includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.

1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between

1.4.1 the Plans and Specifications, the Specifications govern;

1.4.2 the Plans, the Plans drawn with the largest scale govern; and

1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

GC2 Successors and Assigns

2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

GC3 Assignment of Contract

3.1 The contract may not be assigned by the Contractor, either in whole or in part, without the written consent of the Minister.

GC4 Subcontracting by Contractor

4.1 Subject to this General Condition, the Contractor may subcontract any part of the work.

4.2 The Contractor shall notify the Departmental Representative in writing of his intention to subcontract.

4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.

4.4 The Departmental Representative may object to the intended subcontracting by notifying the Contractor in writing within six days of receipt by the Departmental Representative of a notification referred to in GC4.2.

4.5 If the Departmental Representative objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.

4.6 The contractor shall not, without the written consent of the Departmental Representative, change a subcontractor who has been engaged by him in accordance with this General Condition.

4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of ths contract that are of general application.

4.8 Neither a subcontracting nor the Departmental Representative's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon Her Majesty.

GC5 Amendments

5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

GC6 No Implied Obligations

6.1 No implied terms or obligations of any kind by or on behalf of Her Majesty shall arise from anything in the contract and the express covenants and agreements therein contained and made by Her Majesty are the only covenants and agreements upon which any rights against Her Majesty are to be founded.

6.2 The contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work that were made prior to the date of the contract.

GC7 Time of Essence

7.1 Time is of the essence of the contract.

GC8 Indemnification by Contractor

8.1 The Contractor shall indemnify and save Her Majesty harmless from and against all claims, demand, losses, costs, damages, actions, suits, or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, subcontractors and sub-subcontractors in performing the work including an infringement or an alleged infringement of a patent of invention or any other kind of intellectual property.

8.2 For the purpose of GC8.1, "activities" includes any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

GC9 Indemnification by Her Majesty

9.1 Her Majesty shall, subject to the Crown Liability Act, the Patent Act, and any other law that affects Her Majesty's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to

9.1.1 lack of or a defect in Her Majesty's title to the work site whether real or alleged; or

9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by Her Majesty to the Contractor.

GC10 Members of House of Commons Not to Benefit

10.1 As required by the Parliament of Canada Act, it is an express condition of the contract that no member of the House of Commons shall be admitted to any share of part of the contract or to any benefit arising therefrom.

GC11 Notices

11.1 Any notice, consent, order, decision, direction or other communication, other than a notice referred to in GC11.4, that may be given to the Contractor pursuant to the contract may be given in any manner.

11.2 Any notice, consent, order, decision, direction or other communication required to be given in writing, to any party pursuant to the contract shall, subject to GC11.4, be deemed to have been effectively given

11.2.1 to the Contractor, if delivered personally to the Contractor or the Contractor's superintendent, or forwarded by mail, telex or facsimile to the Contractor at the address set out in A4.1, or

11.2.2 to Her Majesty, if delivered personally to the Departmental Representative, or forwarded by mail, telex or facsimile to the Departmental Representative at the address set out in A1.2.1.

11.3 Any such notice, consent, order, decision, direction or other communication given in accordance with GC11.2 shall be deemed to have been received by either party

11.3.1 if delivered personally, on the day that it was delivered,

11.3.2 if forwarded by mail, on the earlier of the day it was received and the sixth day after it was mailed, and

11.3.3 if forwarded by telex or facsimile, 24 hours after it was transmitted.

11.4 A notice given under GC38.1.1, GC40 and GC41, if delivered personally, shall be delivered to the Contractor if the Contractor is doing business as sole proprietor or, if the Contractor is a partnership or corporation, to an officer thereof.

GC12 Material, Plant and Real Property Supplied by Her Majesty

12.1 Subject to GC12.2, the Contractor is liable to Her Majesty for any loss of or damage to material, plant or real property that is supplied or placed in the care, custody and control of the Contractor by Her Majesty for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.

12.2 The Contractor is not liable to Her Majesty for any loss or damage to material, plant or real property referred to in GC12.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.

12.3 The Contractor shall not use any material, plant or real property referred to in GC12.1 except for

the purpose of performing this contract.

12.4 When the Contractor fails to make good any loss or damage for which he is liable under GC12.1 within a reasonable time after being required to do so by the Departmental Representative, the Departmental Representative may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to Her Majesty for the cost thereof and shall, on demand, pay to Her Majesty an amount equal to that cost.

12.5 The Contractor shall keep such records of all material, plant and real property referred to in GC12.1 as the Departmental Representative from time to time requires and shall satisfy the Departmental Representative, when requested, that such material, plant and real property are at the place and in the condition which they ought to be.

GC13 Material, Plant and Real Property Become Property of Her Majesty

13.1 Subject to GC14.7 all material and plant and the interest of the Contractor in all real property, licenses, powers and privileges purchased, used or consumed by the Contractor for the contract shall, after the time of their purchase, use or consumption be the property of Her Majesty for the purposes of the work and they shall continue to be the property of Her Majesty.

13.1.1 in the case of material, until the Departmental Representative indicates that he is satisfied that it will not be required for the work, and

13.1.2 in the case of plant, real property, licenses, powers and privileges, until the Departmental Representative indicates that he is satisfied that the interest vested in Her Majesty therein is no longer required for the purposes of the work.

13.2 Material or plant that is the property of Her Majesty by virtue of GC13.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Departmental Representative.

13.3 Her Majesty is not liable for loss of or damage from any cause to the material or plant referred to in GC13.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of Her Majesty.

GC14 Permits and Taxes Payable

14.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than Her Majesty.

14.2 Within 10 days of making a tender pursuant to GC14.1, the Contractor shall notify the Departmental Representative of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.

14.3 If the municipal authority does not accept the amount tendered pursuant to GC14.1 the Contractor shall pay that amount to Her Majesty within 6 days after the time stipulated in GC14.2.

14.4 For the purposes of GC14.1 to GC14.3 "municipal authority" means any authority that would have jurisdiction respecting permission to perform the work if the owner were not Her Majesty.

14.5 Notwithstanding the residency of the Contractor, the Contractor shall pay any applicable tax arising from or related to the performance of the work under the contract.

14.6 In accordance with the Statutory Declaration referred to in TP4.9, a Contractor who has neither residence nor place of business in the province in which work under the contract is being performed shall provide Her Majesty with proof of registration with the provincial sales tax authorities in the said province.

14.7 For the purpose of the payment of any applicable tax or the furnishing of security for the payment of any applicable tax arising from or related to the performance of the work under the contract, the Contractor shall, notwithstanding the fact that all material, plant and interest of the Contractor in all real property, licenses, powers and privileges, have become the property of Her Majesty after the time of purchase, be liable, as a user or consumer, for the payment or for the furnishing of security for the payment of any applicable tax payable, at the time of the use or consumption of that material, plant or interest of the Contractor in accordance with the relevant legislation.

GC15 Performance of Work under Direction of Departmental Representative

15.1 The Contractor shall

15.1.1 permit the Departmental Representative to have access to the work and its site at all times during the performance of the contract;

15.1.2 furnish the Departmental Representative with such information respecting the performance of the contract as he may require; and

15.1.3 give the Departmental Representative every possible assistance to enable the Departmental Representative to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Departmental Representative under the contract.

CG16 Cooperation with Other Contractors

16.1 Where, in the opinion of the Departmental Representative, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Departmental Representative, allow them access and cooperate with them in the carrying out of their duties and obligation.

16.2 If

16.2.1 the sending onto the work or its site of other contractors or workers pursuant to GC16.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract, and

16.2.2 the Contractor incurs, in the opinion of the Departmental Representative, extra expense in complying with GC16.1, and

16.2.3 The Contractor has given the Departmental Representative written notice of his claim for the extra expense referred to in GC16.2.2 within 30 days of the date that the other contractors or workers were sent onto the work or its site,

Her Majesty shall pay the Contractor the cost, calculated in accordance with GC48 to GC50, of the extra labour, plant and material that was necessarily incurred.

GC17 Examination of Work

17.1 If, at any time after the commencement of the work but prior to the expiry of the warranty or guarantee period, the Departmental Representative has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Departmental Representative may have that work examined by an expert of his choice.

17.2 If, as a result of an examination of the work referred to in GC17.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of Her Majesty's rights and remedies under the contract either at law or in equity, the Contractor shall pay Her Majesty, on demand, all reasonable costs and expenses that were incurred by Her Majesty in having that examination performed.

GC18 Clearing of Site

18.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Departmental Representative.

18.2 Before the issue of an interim certificate referred to in GC44.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy by Her Majesty's servants, unless otherwise stipulated in the contract.

18.3 Before the issue of a final certificate referred to in GC44.1, the Contractor, shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

18.4 The Contractor's obligations described in GC18.1 to GC18.3 do not extend to waste material and other debris caused by Her Majesty's servants or contractors and workers referred to in GC16.1.

GC19 Contractor's Superintendent

19.1 The Contractor shall, forthwith upon the award of the contract, designate a superintendent.

19.2 The Contractor shall forthwith notify the Departmental Representative of the name, address and telephone number of a superintendent designate pursuant to GC19.1.

19.3 A superintendent designated pursuant to GC19.1 shall be in full charge of the operations of the Contractor in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.

19.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.

19.5 The Contractor shall, upon the request of the Departmental Representative, remove any superintendent who, in the opinion of the Departmental Representative, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Departmental Representative.

19.6 Subject to GC19.5, the Contractor shall not substitute a superintendent without the written consent of the Departmental Representative.

19.7 A breach by the Contractor of GC19.6 entitles the Departmental Representative to refuse to issue any certificate referred to in GC44 until the superintendent has returned to the work site or another superintendent who is acceptable to the Departmental Representative has been substituted.

GC20 National Security

20.1 If the Minister is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor

20.1.1 to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and

20.1.2 to remove any person from the work and its site if, in the opinion of the Minister, that person may be a risk to the national security.

20.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC19 to GC21.

20.3 The Contractor shall comply with an order of the Minister under GC20.1

GC21 Unsuitable Workers

21.1 The Contractor shall, upon the request of the Departmental Representative, remove any person employed by him for purposes of the contract who, in the opinion of the Departmental Representative, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

GC22 Increased or Decreased Costs

22.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or any wage adjustment arising pursuant to the Labour Conditions.

22.2 Notwithstanding GC22.1 and GC35, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC22.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property

22.2.1 occurs after the date of the submission by the Contractor of his tender for the contract,

22.2.2 applies to material, and

22.2.3 affects the cost to the Contractor of that material.

22.3 If a change referred to in GC22.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC51 to be the increase or decrease in the cost incurred that is directly attributable to that change.

22.4 For the purpose of GC22.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Minister of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

GC23 Canadian Labour and Material

23.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and expeditious carrying out of the work.

23.2 Subject to GC23.1, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available, and shall use the offices of the Canada Employment Centres for the recruitment of workers wherever practicable.

23.3 Subject to GC23.1 and GC23.2, the Contractor shall, in the performance of the work, employ a reasonable proportion of persons who have been on active service with the armed forces of Canada and have been honourably discharged therefrom.

GC24 Protection of Work and Documents

24.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, drawings, information, material, plant and real property, whether or not they are supplied by Her Majesty to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Minister, except as may be essential for the performance of the work.

24.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Departmental Representative to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.

24.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Minister to inspect or to take security measures in respect of the work and its site.

24.4 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure compliance with or to remedy a breach of GC24.1 to GC24.3.

GC25 Public Ceremonies and Signs

25.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Minister.

25.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Departmental Representative.

GC26 Precautions against Damage, Infringement of Rights, Fire, and Other Hazards

26.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that

26.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reasons of the Contractor's activities in performing the contract;

26.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;

26.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Departmental Representative, any fire is promptly extinguished;

26.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;

26.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;

26.1.6 adequate sanitation measures are taken in respect of the work and its site; and

26.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Departmental Representative are protected and are not removed, defaced, altered or destroyed.

26.2 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure

compliance with or to remedy a breach of GC26.1.

26.3 The Contractor shall, at his own expense, comply with a direction of the Departmental Representative made under GC26.2.

GC27 Insurance

27.1 The Contractor shall, at his own expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to the Departmental Representative in accordance with the requirements of the Insurance Conditions "E".

27.2 The insurance contracts referred to in GC27.1 shall

27.2.1 be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in Insurance Conditions "E", and

27.2.2 provide for the payment of claims under such insurance contracts in accordance with GC28.

GC28 Insurance Proceeds

28.1 In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid directly to Her Majesty, and

28.1.1 the monies so paid shall be held by Her Majesty for the purposes of the contract, or

28.1.2 if Her Majesty elects, shall be retained by Her Majesty, in which event they vest in Her Majesty absolutely.

28.2 In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid by the insurer directly to the claimant.

28.3 If an election is made pursuant to GC28.1, the Minister may cause an audit to be made of the accounts of the Contractor and of Her Majesty in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

28.3.1 the aggregate of the amount of the loss or damage suffered or sustained by Her Majesty, including any cost incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to Her Majesty under the contract, minus any monies retained pursuant to GC28.12, and

28.3.2 the aggregate of the amounts payable by Her Majesty to the Contractor pursuant to the contract up to the date of the loss or damage.

28.4 A difference that is established pursuant to GC28.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the

creditor.

28.5 When payment of a deficiency has been made pursuant to GC28.4, all rights and obligations of Her Majesty and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC28.3, be deemed to have been expended and discharged.

28.6 If an election is not made pursuant to GC28.1.2 the Contractor shall, subject to GC28.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.

28.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC 28.6, Her Majesty shall pay him out of the monies referred to in GC28.1 so far as they will thereunto extend.

28.8 Subject to GC28.7, payment by Her Majesty pursuant to GC28.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

GC29 Contract Security

29.1 The Contractor shall obtain and deliver contract security to the Departmental Representative in accordance with the provisions of the Contract Security Conditions.

29.2 If the whole or a part of the contract security referred to in GC29.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC43 and GC45.

29.3 If a part of the contract security referred to in GC29.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

GC30 Changes in the Work

30.1 Subject o GC5, the Departmental Representative may, at any time before he issues his Final Certificate of Completion,

30.1.1 order work or material in addition to that provided for in the Plans and Specifications; and

30.1.2 delete or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material proved for in the Plans and Specifications or in any order made pursuant to GC30.1.1,

if that additional work or material, deletion, or change is, in his opinion, consistent with the general intent of the original contract.

30.2 The Contractor shall perform the work in accordance with such orders, deletions and changes that are made by the Departmental Representative pursuant to GC30.1 from time to time as if they had appeared in and been part of the Plans and Specifications.

30.3 The Departmental Representative shall determine whether or not anything done or omitted by the Contractor pursuant to an order, deletion or change referred to in GC30.1 increased or decreased the cost of the work to the Contractor.

30.4 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been increased, Her Majesty shall pay the Contractor the increased cost that the Contractor necessarily incurred for the additional work calculated in accordance with GC49 or GC50.

30.5 If the Departmental Representative determines pursuant to GC303.3 that the cost of the work to the Contractor has been decreased, Her Majesty shall reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost caused by the deletion or change referred to in GC30.1.2 and calculated in accordance with GC49.

30.6 GC30.3 to GC30.5 are applicable only to a contract or a portion of a contract for which a Fixed Price Arrangement is stipulated in the contract.

30.7 An order, deletion or change referred to in GC30.1 shall be in writing, signed by the Departmental Representative and given to the Contractor in accordance with GC11.

GC31 Interpretation of Contract by Departmental Representative

31.1 If, ar any time before the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about

31.1.1 the meaning of anything in the Plans and Specification,

31.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their working or intention,

31.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,

31.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,

31.1.5 what quantity of any kind of work has been completed by the Contractor, or

31.1.6 the timing and scheduling of the various phases of the performance of the work,

the question shall be decided by the Departmental Representative whose decision shall be final and conclusive in respect of the work.

31.2 The Contractor shall perform the work in accordance with any decisions of the Departmental

Representative that are made under GC31.1 and in accordance with any consequential directions given by the Departmental Representative.

GC32 Warranty and Rectification of Defects in Work

32.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense,

32.1.1 rectify and make good any defect or fault that appears in the work or comes to the attention of the Minister with respect to those parts of the work accepted in connection with the Interim Certificate of Completion referred to GC44.2 within 12 months from the date of the Interim Certificate of Completion;

32.1.2 rectify and make good any defect or fault that appears in or comes to the attention of the Minister in connection with those parts of the work described in the Interim Certificate of Completion referred to in GC44.2 within 12 months from the date of the Final Certificate of Completion referred to in GC44.1.

32.2 The Departmental Representative may direct the Contractor to rectify and make good any defect or fault referred to in GC32.1 or covered by any other expressed or implied warranty or guarantee.

32.3 A direction referred to in GC32.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC11.

32.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC32.2 within the time stipulated therein.

GC33 Non-Compliance by Contractor

33.1 If the Contractor fails to comply with any decision or direction given by the Departmental Representative pursuant to GC18, GC24, GC26, GC31 or GC32, the Departmental Representative may employ such methods as he deems advisable to do that which the Contractor failed to do.

33.2 The Contractor shall, on demand, pay Her Majesty an amount that is equal to the aggregate of all cost, expenses and damage incurred or sustained by Her Majesty by reason of the Contractor's failure to comply with any decision or direction referred to in GC33.1, including the cost of any methods employed by the Departmental Representative pursuant to GC33.1.

GC34 Protesting Departmental Representative's Decisions

34.1 The Contractor may, within ten days after the communication to him of any decision or direction referred to in GC30.3 or GC33.1, protest that decision or direction.

34.2 A protest referred to in GC34.1 shall be in writing, contain full reasons for the protest, be signed

by the Contractor and be given to Her Majesty by delivery to the Departmental Representative.

34.3 If the Contractor gives a protest pursuant to GC34.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action he considers appropriate in the circumstances.

34.4 The giving of a protest by the Contractor pursuant to GC34.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.

34.5 Subject to GC34.6, the Contractor shall take any action referred to in GC34.3 within three months after the date that a Final Certificate of Completion is issued under GC44.1 and not afterwards.

34.6 The Contractor shall take any action referred to in GC34.3 resulting from a direction under GC32 within three months after the expiry of a warranty or guarantee period and not afterwards.

34.7 Subject to GC34.8, if Her Majesty determines that the Contractor's protest is justified, Her Majesty shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.

34.8 Costs referred to in GC34.7 shall be calculated in accordance with GC48 to GC50.

GC35 Changes in Soil Conditions and Neglect or Delay by Her Majesty

35.1 Subject to GC35.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by Her Majesty to the Contractor for any extra expense or any loss or damage incurred or sustained by the Contractor.

35.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to

35.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or

35.2.2 any neglect or delay that occurs after the date of the contract on the part of Her Majesty in providing any information or in doing any act that the contract either expressly requires Her Majesty to do or that would ordinarily be done by an owner in accordance with the usage of the trade,

he shall, within ten days of the date the actual soil conditions described in GC35.2.1 were encountered or the neglect or delay described in GC35.2.2 occurred, give the Departmental Representative written notice of his intention to claim for that extra expense or that loss or damage.

35.3 When the Contractor has given a notice referred to in GC35.2, he shall give the Departmental Representative a written claim for extra expense or loss or damage within 30 days of the date that

a Final Certificate of Completion referred to in GC44.1 is issued and not afterwards.

35.4 A written claim referred to in GC35.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Departmental Representative to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Departmental Representative requires from time to time.

35.5 If the Departmental Representative determines that a claim referred to in GC35.3 is justified, Her Majesty shall make an extra payment to the Contractor in an amount that is calculated in accordance with GC47 to GC50.

35.6 If, in the opinion of the Departmental Representative, an occurrence described in GC35.2.1 results in a savings of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to GC35.7, be reduced by an amount that is equal to the saving.

35.7 The amount of the saving referred to in GC35.6 shall be determined in accordance with GC47 to GC49.

35.8 If the Contractor fails to give a notice referred to in GC35.2 and a claim referred to in GC35.3 within the times stipulated, an extra payment shall not be made to him in respect of the occurrence.

GC36 Extension of Time

36.1 Subject to GC36.2, the Departmental Representative may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date if, in the opinion of the Departmental Representative, causes beyond the control of the Contractor have delayed its completion.

36.2 An application referred to in GC36.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

GC37 Assessments and Damages for Late Completion

37.1 For the purposes of this General Condition

37.1.1 the work shall be deemed to be completed on the date that an Interim Certificate of Completion referred to in GC44.2 is issued, and

37.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC36.1, and any other day on which, in the opinion of the Departmental Representative, completion of the work was delayed for reasons beyond the control of the Contractor.

37.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay Her Majesty an amount equal to the aggregate of

37.2.1 all salaries, wages and travelling expenses incurred by Her Majesty in respect of persons overseeing the performance of the work during the period of delay;

37.2.2 the cost incurred by Her Majesty as a result of the inability to use the completed work for the period of delay; and

37.2.3 all other expenses and damages incurred or sustained by Her Majesty during the period of delay as a result of the work not being completed by the day fixed for its completion.

37.3 The Minister may waive the right of Her Majesty to the whole or any part of the amount payable by the Contractor pursuant to GC37.2 I , in the opinion of the Minister, it is in the public interest to do so.

GC38 Taking the Work Out of the Contractor's Hands

38.1 The Minister may, at his sole discretion, by giving a notice in writing to the Contractor in accordance with GC11, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor

38.1.1 Has not, within six days of the Minister or the Departmental Representative giving notice to the Contractor in writing in accordance with GC11, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Departmental Representative;

38.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;

38.1.3 has become insolvent;

38.1.4 has committed an act of bankruptcy;

38.1.5 has abandoned the work;

38.1.6 has made an assignment of the contract without the consent required by GC3.1; or

38.1.7 has otherwise failed to observe or perform any of the provisions of the contract.

38.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC38.1,

38.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC38.4, extinguished, and

38.2.2 the Contractor is liable to pay Her Majesty, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by Her Majesty in respect of the

Contractor's failure to complete the work.

38.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC38.1 is completed by Her Majesty, the Departmental Representative shall determine the amount, if any, of the holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating Her Majesty for any other loss or damage incurred or sustained by reason of the Contractor's default.

38.4 Her Majesty may pay the Contractor the amount determined not to be required pursuant to GC38.3.

GC39 Effect of Taking the Work Out of the Contractor's Hands

39.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC38 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.

39.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC38, all plant and material and the interest of the Contractor is all real property, licenses, powers and privileges acquired, used or provided by the Contractor under the contract shall continue to be the property of Her Majesty without compensation to the Contractor.

39.3 When the Departmental Representative certifies that any plant, material, or any interest of the Contractor referred to in GC39.2 is no longer required for the purposes of the work, or that it is not in the interest of Her Majesty to retain that plant, material or interest, it shall revert to the Contractor.

G40 Suspension of Work by Minister

40.1 The Minister may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension in wiring to the Contractor in accordance with GC11.

40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC11, he shall suspend all operations in respect of the work except those that, in the opinion of the Departmental Representative, are necessary for the care and preservation of the work, plant and material.

40.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Departmental Representative.

40.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period, resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC48 to GC50, of any labour, plant and material necessarily incurred by him as a result of the suspension.

40.5 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Minister and the Contractor.

40.6 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC41.

GC41 Termination of Contract

41.1 The Minister may terminate the contract at any time by giving a notice of termination in writing to the Contractor in accordance with GC11.

41.2 When a notice referred to in GC41.1 is received by the Contractor in accordance with GC11, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.

41.3 If the contract is terminated pursuant to GC41.1, Her Majesty shall pay the Contractor, subject to GC41.4, an amount equal to

41.3.1 the cost to the contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated in the contract, or

41.3.2 the lesser of

41.3.2.1 an amount, calculated in accordance with the Terms and Payment, that would have been payable to the Contractor had he completed the work, and

41.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC49 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract

less the aggregate of all amounts that were paid to the Contractor by Her Majesty and all amounts that are due to Her Majesty from the Contractor pursuant to the contract.

41.4 If Her Majesty and the Contractor are unable to agree about an amount referred to in GC41.3 that amount shall be determined by the method referred to in GC50.

GC42 Claims Against and Obligations of the Contractor or Subcontractor

42.1 Her Majesty may, in order to discharge lawful obligations of and satisfy claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or the subcontractor but such amount if any, as is paid by Her Majesty, shall not exceed that amount which the Contractor would have been obliged to pay to

such claimant had the provisions of the Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, been applicable to the work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration or otherwise as might have been necessary to preserve or perfect any claim for lien or privilege which claimant might have had;

42.2 Her Majesty will not make any payment as described in GC42.1 unless and until that claimant shall have delivered to Her Majesty:

42.2.1 a binding and enforceable Judgment or Order of a court of competent jurisdiction setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or

42.2.2 a final and enforceable award of an arbitrator setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or

42.2.3 the consent of the Contractor authorizing a payment.

For the purposes of determining the entitlement of a claimant pursuant to GC42.2.1 and GC42.2.2, the notice required by GC42.8 shall be deemed to replace the registration or provision of notice after the performance of work as required by any applicable legislation and no claim shall be deemed to have expired, become void or unenforceable by reason of the claimant not commencing any action within the time prescribed by any applicable legislation.

42.3 The Contractor shall, by the execution of his contract, be deemed to have consented to submit to binding arbitration at the request of any claimant those questions that need be answered to establish the entitlement of the claimant to payment pursuant to the provisions of GC42.1 and such arbitration shall have as parties to it any subcontractor to whom the claimant supplied material, performed work or rented equipment should such subcontractor wish to be adjoined and the Crown shall not be a party to such arbitration and, subject to any agreement between the Contractor and the claimant to the contrary, the arbitration shall be conducted in accordance with the Provincial or Territorial legislation governing arbitration applicable in the Province or Territory in which the work is located.

42.4 A payment made pursuant to GC42.1 is, to the extent of the payment, a discharge of Her Majesty's liability to the Contractor under the contract and may be deducted from any amount payable to the Contractor under the contract.

42.5 To the extent that the circumstances of the work being performed for Her Majesty permit, the Contractor shall comply with all laws in force in the Province or Territory where the work is being performed relating to payment period, mandatory holdbacks, and creation and enforcement of mechanics' liens, builders' liens or similar legislation or in the Province of Quebec, the law relating to privileges.

42.6 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires Her

Majesty to pay the Contractor.

42.7 The Contractor shall, whenever requested to do so by the Departmental Representative, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC42.6.

42.8 GC42.1 shall only apply to claims and obligations

42.8.1 the notification of which has been received by the Departmental Representative in writing before payment is made to the Contractor pursuant to TP4.10 and within 120 days of the date on which the claimant

42.8.1.1 should have been paid in full under the claimant's contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or

42.8.1.2 performed the last of the services, work or labour, or furnished the last of the material pursuant to the claimant's contract with the Contractor or subcontractor where the claim is not for money referred to in GC42.8.1.1, and

42.8.2 the proceedings to determine the right to payment of which, pursuant to GC42.2. shall have commenced within one year from the date that the notice referred to in GC42.8.1 was received by the Departmental Representative, and

the notification required by GC42.8.1 shall set forth the amount claimed to be owing and the person who by contract is primarily liable.

42.9 Her Majesty may, upon receipt of a notice of claim under GC42.8.1, withhold from any amount that is due and payable to the Contractor pursuant to the contract the full amount of the claim or any portion thereof.

42.10 The Departmental Representative shall notify the Contractor in writing of receipt of any claim referred to in GC42.8.1 and of the intention of Her Majesty to withhold funds pursuant to GC42.9 and the Contractor may, at any time thereafter and until payment is made to the claimant, be entitled to post, with Her Majesty, security in a form acceptable to Her Majesty in an amount equal to the value of the claim, the notice of which is received by the Departmental Representative and upon receipt of such security Her Majesty shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the provisions of GC42.9 in respect of the claim of any claimant for whom the security stands.

GC43 Security Deposit – Forfeiture or Return

43.1 If

43.1.1 the work is taken out of the Contractor's hands pursuant to GC38,

43.1.2 the contract is terminated pursuant to GC41, or

43.1.3 the Contractor is in breach of or in default under the contract,

Her Majesty may convert the security deposit, if any, to Her own use.

43.2 If Her Majesty converts the contract security pursuant to GC43.1, the amount realized shall be deemed to be an amount due from Her Majesty to the Contractor under the contract.

43.3 Any balance of an amount referred to in GC43.2 that remains after payment of all losses, damage and claims of Her Majesty and others shall be paid by Her Majesty to the Contractor if, in the opinion of the Departmental Representative, it is not required for the purposes of the contract.

GC44 Departmental Representative's Certificates

44.1 On the date that

44.1.1 the work has been completed, and

44.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Departmental Representative, the Departmental Representative shall issue a Final Certificate of Completion to the Contractor.

44.2 If the Departmental Representative is satisfied that the work is substantially complete he shall, at any time before he issues a certificate referred to in GC44.1, issue an Interim Certificate of Completion to the Contractor, and

44.2.1 for the purposes of GC44.2 the work will be considered to be substantially complete,

44.2.1.1 when the work under the contract or a substantial part thereof is, in the opinion of the Departmental Representative, ready for use by Her Majesty or is being used for the purpose intended; and

44.2.1.2 when the work remaining to be done under the contract is, in the opinion of the Departmental Representative, capable of completion or correction at accost of not more that

44.2.1.2.1 -3% of the first $500,000, and

44.2.1.2.2 -2% of the next $500,000, and

44.2.1.2.3 -1% of the balance

of the value of the contract at the time this cost is calculated.

44.3 For the sole purpose of GC44.2.1.2, where the work or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the work or a part thereof cannot be completed by the time specified in A2.1, or as amended pursuant to GC36, for reasons beyond the control of the Contractor or where the Departmental Representative and the Contractor agree not to complete a part of the work within the specified time, the cost of that part of the work

which was either beyond the control of the Contractor to complete or the Departmental Representative and the Contractor have agreed not to complete by the time specified shall be deducted from the value of the contract referred to GC44.2.1.2 and the said cost shall not form part of the cost of the work remaining to be done in determining substantial completion.

44.4 An Interim Certificate of Completion referred to in GC44.2 shall describe the parts of the work not completed to the satisfaction of the Departmental Representative and all things that must be done by the Contractor

44.4.1 before a Final Certificate of Completion referred to in GC44.1 will be issued, and

44.4.2 before the 12-month period referred to in GC32.1.2 shall commence for the said parts and all the said things.

44.5 The Departmental Representative may, in addition to the parts of the work described in an Interim Certificate of Completion referred to in GC44.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the satisfactory completion of the work.

44.6 If the contract or a part thereof is subject to a Unit Price Arrangement, the Departmental Representative shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

44.7 The Contractor shall assist and co-operate with the Departmental Representative in the performance of his duties referred to in GC44.6 and shall be entitled to inspect any record made by the Departmental Representative pursuant to GC44.6.

44.8 After the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, he shall, if GC44.6 applies, issue a Final Certificate of Measurement.

44.9 A Final Certificate of Measurement referred to in GC44.8 shall

44.9.1 contain the aggregate of all measurements of quantities referred to in GC44.6, and

44.9.2 be binding upon and conclusive between Her Majesty and the Contractor as to the quantities referred to therein.

GC45 Return of Security Deposit

45.1 After an Interim Certificate of Completion referred to in GC44.2 has been issued, Her Majesty shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Departmental Representative, is not required for the purposes of the contract.

45.2 After a Final Certificate of Completion referred to in GC44.1 has been issued, Her Majesty shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.

45.3 If the security deposit was paid into the Consolidated Revenue Fund of Canada, Her Majesty shall pay interest thereon to the Contractor at a rate established from time to time pursuant to section 21(2) of the Financial Administration Act.

GC46 Clarification of Terms in GC47 to GC50

46.1 For the purposes of GC47 to GC50,

46.1.1 "Unit Price Table" means the table set out in the Articles of Agreement, and

46.1.2 "plant" does not include tools customarily provided by a tradesman in practicing his trade.

GC47 Additions or Amendments to Unit Price Table

47.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Departmental Representative and the Contractor may, by an agreement in writing,

47.1.1 add classes of labour or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in the Final Certificate of Measurement referred to in GC44.8 is not included in any class of labour, plant or material set out in the Unit Price Table; or

47.1.2 subject to GC47.2 and GC47.3, amend a price set out in the Unit Price Table for any class of labour, plant or material included therein if the Final Certificate of Measurement referred to in GC44.8 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is

47.1.2.1 less than 85% of that estimated total quantity, or

47.1.2.2 in excess of 115% of that estimated total quantity.

47.2 In no event shall the total cost of an item set out in the Unit Price Table that has been amended pursuant to GC47.1.2.1 exceed the amount that would have been payable to the Contractor had the estimated total quantity actually been performed, used or supplied.

47.3 An amendment that is made necessary by GC47.1.2.2 shall apply only to the quantities that are in excess of 115%.

47.4 If the Departmental Representative and the Contractor do not agree as contemplated in GC47.1, the Departmental Representative shall determine the class and the unit of measurement of the labour, plant or material and, subject to GC47.2 and GC47.3, the price per unit therefore shall be determined in accordance with GC50.

GC48 Determination of Cost – Unit Price Table

48.1 Whenever, for the purposes of the contract, it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table.

GC49 Determination of Cost – Negotiation

49.1 If the method described in GC48 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of that labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Departmental Representative.

49.2 For the purposes of GC49.1, the Contractor shall submit to the Departmental Representative any necessary cost information requested by the Departmental Representative in respect of the labour, plant and material referred to in GC49.1

GC50 Determination of Cost – Failing Negotiation

50.1 If the methods described in GC47, GC48 or GC49 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of

50.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant and material that falls within one of the classes of expenditure described in GC50.2 that are directly attributable to the performance of the contract,

50.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration cost, financing and interest charges, and every other cost, charge and expenses, but not including those referred to in GC50.1.1 or GC50.1.3 or a class referred to in GC50.2, in an amount that is equal to 10% of the sum of the expenses referred to in GC50.1.1, and

50.1.3 interest on the cost determined under GC50.1.1 and GC50.1.2, which interest shall be calculated in accordance with TP9,

provide that the total cost of an item set out n the Unit Price Table that is subject to the provisions of GC47.1.2.1 does not exceed the amount that would have been payable to the Contractor had the estimated total quantity of the said item actually be performed, used or supplied.

50.2 For purposes of GC50.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,

50.2.1 payments to subcontractors;

50.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living

and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Departmental Representative,

50.2.3 assessments payable under any statutory authority relating to workmen's compensation, unemployment insurance, pension plan or holidays with pay;

50.2.4 rent that is paid for plant or an amount equivalent of the said rent if the plant is owned by the Contractor that is necessary for and used in the performance of the work, if the rent of the equivalent amount is reasonable and use of that plant has been approved by the Departmental Representative;

50.2.5 payments for maintaining and operating plant necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Departmental Representative, are necessary to the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;

50.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;

50.2.7 payments for preparation, delivery, handling, erection, installation, inspection protection and removal of the plant and material necessary for and used in the performance of the contract; and

50.2.8 any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the contract.

GC51 Records to be kept by Contractor

51.1 The Contractor shall

51.1.1 maintain full records of his estimated and actual cost of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto.

51.1.2 make all records and material referred to in GC5.1.1 available to audit and inspection by the Minister and the Deputy Receiver General for Canada or by persons acting on behalf of either of both of them, when requested;

51.1.3 allow any of the person referred to in GC51.1.2 to make copies of and to take extracts from any of the records and material referred to in GC51.1.1; and

51.1.4 furnish any person referred to in GC51.1.2 with any information he may require from time to time in connection with such records and material.

51.2 The records maintained by the Contractor pursuant to GC51.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC44.1 was issued or until the expiration of such other period of time as the

Minister may direct.

51.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly controlled by or affiliated with the Contractor and all persons directly or indirectly having control of the Contractor to comply with GC51.1 and GC51.2 as if they were the Contractor.

GC52 Conflict of Interest

52.1 It is a term of this contract that no former public office holder who is not in compliance with the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

GC53 Contractor Status

53.1 The Contractor shall be engaged under the contract as an independent contractor.

53.2 The Contractor and any employee of the said Contractor is not engaged by the contract as an employee, servant or agent of Her Majesty.

53.3 For the purposes of GC53.1 and GC53.2 the Contractor shall be solely responsible for any and all payments and deductions required to be made by law including those required for Canada or Quebec Pension Plans, Unemployment Insurance, Worker's Compensation or Income Tax.

GENERAL CONDITONS

IC 1 Proof of Insurance
IC 2 Risk Management
IC 3 Payment of Deductible
IC 4 Insurance Coverage

GENERAL INSUANCE COVERAGES

GCI 1 Insured
GIC 2 Period of Insurance
GIC 3 Proof of Insurance
GIC 4 Notification

COMMERCIAL GENERAL LIABILITY

CGL 1 Scope of Policy
CGL 2 Coverages/Provisions
CGL 3 Additional Exposures
CGL 4 Insurance Proceeds
CGL 5 Deductible

BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS

BR 1 Scope of Policy
BR 2 Property Insured
BR 3 Insurance Proceeds
BR 4 Amount of Insurance
BR 5 Deductible
BR 6 Subrogation
BR 7 Exclusion Qualifications

INSURER'S CERTIFICATE OF INSURANCE

General Conditions

IC 1 Proof of Insurance
(02/12/03)

Within thirty (30) days after acceptance of the Contractor's tender, the Contractor shall, unless otherwise directed in writing by the Contracting Officer, deposit with the Contracting Officer an Insurer's Certificate of Insurance in the form displayed in this document and, if requested by the Contracting Officer, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the Insurance Coverage Requirements shown hereunder.

IC 2 Risk Management
(01/10/94)

The provisions of the Insurance Coverage Requirements contained hereunder are not intended to cover all of the Contractor's obligations under GC8 of the General Conditions "C" of the contract. Any additional risk management measures or additional insurance coverages the Contractor may deem necessary to fulfill its obligations under GC8 shall be at its own discretion and expense.

IC 3 Payment of Deductible
(01/10/94)

The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contactor.

IC 4 Insurance Coverage
(02/12/03)

The Contractor has represented that it has in place and effect the appropriate and usual liability insurance coverage as required by these Insurance Conditions and the Contractor has warranted that it shall obtain, in a timely manner and prior to commencement of the Work, the appropriate and usual property insurance coverage as required by these Insurance Conditions and, further, that it shall maintain all required insurance policies in place and effect as required by these Insurance Conditions.

INSURANCE COVERAGE REQUIREMENTS

PART I
GENERAL INSUANCE COVERAGES (GIC)

GCI 1 Insured
(02/12/03)

Each insurance policy shall insure the Contractor, and shall include, as an Additional Named Insured, Her Majesty the Queen in right of Canada, represented by the National Research Council Canada.

GIC 2 Period of Insurance
(02/12/03)

Unless otherwise directed in writing by the Contracting Officer or otherwise stipulated elsewhere in these Insurance Conditions, the policies required hereunder shall be in force and be maintained from the date of the contract award until the day of issue of the Departmental Representative's Final Certificate of Completion.

GIC 3 Proof of Insurance
(01/10/94)

Within twenty five (25) days after acceptance of the Contractor's tender, the Insurer shall, unless otherwise directed by the Contractor, deposit with the Contractor an Insurer's Certificate of Insurance in the form displayed in the document and, if requested, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the requirements of these Insurance Coverages.

GIC 4 Notification
(01/10/94)

Each Insurance policy shall contain a provision that (30) days prior written notice shall be given by the Insurer to Her Majesty in the event of any material change in or cancellation of coverage. Any such notice received by the Contractor shall be transmitted forthwith to Her Majesty.

PART II
COMMERCIAL GENERAL LIABILITY

CGL 1 Scope of Policy
(01/10/94)

The policy shall be written on a form similar to that known and referred to in the insurance industry as IBC 2100 – Commercial General Liability policy (Occurrence form) and shall provide for limit of liability of not less than $2,000,000 inclusive for Bodily Injury and Property Damage for any one occurrence or series of occurrences arising out of one cause. Legal or defence cost incurred in respect of a claim or claims shall not operate to decrease the limit of liability.

CGL 2 Coverages/Provisions
(01/10/94)

The policy shall include but not necessarily be limited to the following coverages/provisions.

2.1 Liability arising out of or resulting from the ownership, existence, maintenance or use of premises by the Contractor and operations necessary or incidental to the performance of this contract.

2.2 "Broad Form" Property Damage including the loss of use of property.

2.3 Removal or weakening of support of any building or land whether such support be natural or otherwise.

2.4 Elevator liability (including escalators, hoists and similar devices).

2.5 Contractor's Protective Liability

2.6 Contractual and Assumed Liabilities un this contact.

2.7 Completed Operations Liability – The insurance, including all aspects of this Part II of these Insurance Conditions shall continue for a period of at least one (1) year beyond the date of the Departmental Representative's Final Certificate of Completion for the Completed Operations.

2.8 Cross Liability – The Clause shall be written as follows:

Cross Liability – The insurance as is afforded by this policy shall apply in respect to any claim or action brought against any one Insured by any other Insured. The coverage shall apply in the same manner and to the same extent as though a separate policy had been issued to each Insured. The inclusion herein of more than one Insured shall not increase the limit of the Insurer's liability.

2.9 Severability of Interests – The Clause shall be written as follows:

Severability of Interests – This policy, subject to the limits of liability stated herein, shall apply separately to each Insured in the same manner and to the same extent as if a separate policy had been issued to each. The inclusion herein of more than one insured shall not increase the limit of the Insurer's liability.

CGL 3 Additional Exposures
(02/12/03)

The policy shall either include or be endorsed to include the following exposures of hazards if the Work is subject thereto:

3.1 Blasting

3.2 Pile driving and calsson work

3.3 Underpinning

3.4 Risks associated with the activities of the Contractor on an active airport

3.5 Radioactive contamination resulting from the use of commercial isotopes

3.6 Damage to the portion of an existing building beyond that directly associated with an addition, renovation or installation contract.

3.7 Marine risks associated with the contraction of piers, wharves and docks.

CGL 4 Insurance Proceeds
(01/10/94)

Insurance Proceeds from this policy are usually payable directly to a Claimant/Third Party.

CGL 5 Deductible
(02/12/03)

This policy shall be issued with a deductible amount of not more than $10,000 per occurrence applying to Property Damage claims only.

PART III
BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS

BR 1 Scope of Policy
(01/10/94)

The policy shall be written on an "All Risks" basis granting coverages similar to those provided by the forms known and referred to in the insurance industry as "Builder's Risk Comprehensive Form" or "Installation Floater – All Risks".

BR 2 Property Insured
(01/10/94)

The property insured shall include:

2.1 The Work and all property, equipment and materials intended to become part of the finished Work at the site of the project while awaiting, during and after installation, erection or construction including testing.

2.2 Expenses incurred in the removal from the construction site of debris of the property insured, including demolition of damaged property, de-icing and dewatering, occasioned by loss, destruction or damage to such property and in respect of which insurance is provided by this policy.

BR 3 Insurance Proceeds
(01/10/94)

3.1 Insurance proceeds from this policy are payable in accordance with GC28 of the General Conditions "C" of the contract.

3.2 This policy shall provide that the proceeds thereof are payable to Her Majesty or as the Minister may direct.

3.3 The Contractor shall do such things and execute such documents as are necessary to effect payment of the proceeds.

BR 4 Amount of Insurance
(01/10/94)

The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Her Majesty at the site of the project to be incorporated into and form part of the finished Work.

BR 5 Deductible
(02/12/03)

The Policy shall be issued with a deductible amount of not more than $10,000.

BR 6 Subrogation
(01/10/94)

The following Clause shall be included in the policy:

"All rights of subrogation or transfer of rights are hereby waived against any corporation, firm, individual or other interest, with respect to which, insurance is provided by this policy".

BR 7 Exclusion Qualifications
(01/10/94)

The policy may be subject to the standard exclusions but the following qualifications shall apply:

7.1 Faulty materials, workmanship or design may be excluded only to the extent of the cost of making good thereof and shall not apply to loss or damage resulting therefrom.

7.2 Loss or damage caused by contamination by radioactive material may be excluded except for loss or damage resulting from commercial isotopes used for industrial measurements, inspection, quality control radiographic or photographic use.

7.3 Use and occupancy of the project or any part of section thereof shall be permitted where such use and occupancy is for the purpose for which the project is intended upon completion.

INSURER'S CERTIFICATE OF INSURANCE

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

CONTRACT

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

INSURER

NAME
ADDRESS

BROKER

NAME
ADDRESS

INSURED

NAME OF CONTRACTOR
ADDRESS

ADDITIONAL INSURED

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA

THIS DOCUENT CERTIFIES THAT THE FOLLOWING POLICES OF INSURANCE ARE AT PRESENT IN FORCE COVERING ALL OPERATIONS OF THE INSURE IN CONNECTION WITH THE CONTRACT MADE BETWEEN THE NAMED INSURED AND THE NATIONAL RESEARCH COUNCIL CANADA AND IN ACCORDANCE WITH THE INSURANCE CONDITIONS "E"

POLICY					
TYPE	NUMBER	INCEPTION DATE	EXPIRY DATE	LIMITS OF LIABILITY	DEDUCTIBLE
COMMERCIAL GENERAL LIABILITY					
BUILDERS RISK "AL RISKS"					
INSTALLATION FLOATER "ALL RISKS"					

THE INSURER AGREES TO NOTIFY THE NATIONAL RESEARCH COUNCIL CANADA IN WRITING 30 DAYS PRIOR TO ANY MATERIAL CHANGE IN OR CANCELLATION OF ANY POLICY OR COVERAGE SPECIFICALLY RELATED TO THE CONTRACT

NAME OF INSURER'S OFFICER OR AUTHORIZED EMPLOYEE	SIGNATURE	DATE:
		TELEPHONE NUMBER:

ISSUANCE OF THIS CERTIFIATE SHALL NOT LIMIT OR RESTRICT THE RIGHT OF THE NATIONAL RESEARCH COUNCIL CANADA TO REQUEST AT ANY TIME DUPLICATE COPIES OF SAID INSURANCE POLICIES

CS1 Obligation to provide Contract Security

1.1 The Contractor shall, at the Contractor's own expense, provide one or more of the forms of contract security prescribed in CS2.

1.2 The Contractor shall deliver to the Departmental Representative the contract security referred to in CS1.1 within 14 days after the date that the Contractor receives notice that the Contractor's tender or offer was accepted by Her Majesty.

CS2 Prescribed Types and Amounts of Contract Security

2.1 The Contractor shall deliver to the Departmental Representative pursuant to CS1

2.1.1 a performance bond and a labour and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or

2.1.2 a labour and material payment bond in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, and a security deposit in an amount that is equal to

2.1.2.1 not less than 10% of the contract amount referred to in the Articles of Agreement where that amount does not exceed $250,000, or

2.1.2.2 $25,000 plus 5% of the part of the contract amount referred to in the Articles of Agreement that exceeds $250,000, or

2.1.3 a security deposit in an amount prescribed by CS2.12 plus an additional amount that is equal to 10% of the contract amount referred to in the Articles of Agreement.

2.2 A performance bond and a labour and material payment bond referred to in CS2.1 shall be in a form and be issued by a bonding or surety company that is approved by Her Majesty.

2.3 The amount of a security deposit referred to in CS2.1.2 shall not exceed $250,000 regardless of the contract amount referred to in the Articles of Agreement.

2.4 A security deposit referred to in CS2.1.2 and CS2.1.3 shall be in the form of

2.4.1 a bill of exchange made payable to the Receiver General of Canada and certified by an approved financial institution or drawn by an approved financial institution on itself, or

2.4.2 bonds of or unconditionally guaranteed as to principal and interest by the Government of Canada.

2.5 For the purposes of CS2.4

2.5.1 a bill of exchange is an unconditional order in writing signed by the Contractor and addressed to an approved financial institution, requiring the said institution to pay, on demand, at a fixed or determinable future time a sum certain of money to, or to the order

of, the Receiver General for Canada, and

2.5.2 If a bill of exchange is certified by a financial institution other than a chartered bank then it must be accompanied by a letter or stamped certification confirming that the financial institution is in a t least one of the categories referred to in CS2.5.3

2.5.3 an approved financial institution is

2.5.3.1 any corporation or institution that is a member of the Canadian Payments Association,

2.5.3.2 a corporation that accepts deposits that are insured by the Canada Deposit Insurance Corporation or the Régie de l'assurance-dépôts du Québec to the maximum permitted by law,

2.5.3.3 a credit union as defined in paragraph 137(6)(b) of the *Income Tax Act*,

2.5.3.4 a corporation that accepts deposits from the public, if repayment of the deposit is guaranteed by Her Majesty in right of a province, or

2.5.3.5 The Canada Post Corporation.

2.5.4 the bonds referred to in CS2.4.2 shall be

2.5.4.1 made payable to bearer, or

2.5.4.2 accompanied by a duly executed instrument of transfer of the bonds to the Receiver General for Canada in the form prescribed by the Domestic Bonds of Canada Regulations, or

2.5.4.3 registered, as to principal or as to principal and interest in the name of the Receiver General for Canada pursuant to the Domestic Bonds of Canada Regulations, and

2.5.4.4 provided on the basis of their market value current at the date of the contract.

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat	
Security Classification / Classification de sécurité	

SECURITY REQUIREMENTS CHECK LIST (SRCL)
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine	2. Branch or Directorate / Direction générale ou Direction
National Research Council	ASPM

3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant

4. Brief Description of Work / Brève description du travail
Construct semi-detached research houses in the NRC Montreal Road campus.

5. a) Will the supplier require access to Controlled Goods? Le fournisseur aura-t-il accès à des marchandises contrôlées?	☒ No Non	☐ Yes Oui
5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?	☒ No Non	☐ Yes Oui
6. Indicate the type of access required / Indiquer le type d'accès requis		
6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) (Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)	☒ No Non	☐ Yes Oui
6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.	☐ No Non	☒ Yes Oui
6. c) Is this a commercial courier or delivery requirement with no overnight storage? S'agit-il d'un contrat de messagerie ou de livraison commerciale **sans** entreposage de nuit?	☒ No Non	☐ Yes Oui

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès

Canada ☒	NATO / OTAN ☐	Foreign / Étranger ☐

7. b) Release restrictions / Restrictions relatives à la diffusion

Canada	NATO / OTAN	Foreign / Étranger
No release restrictions / Aucune restriction relative à la diffusion ☒	All NATO countries / Tous les pays de l'OTAN ☐	No release restrictions / Aucune restriction relative à la diffusion ☐
Not releasable / À ne pas diffuser ☐		
Restricted to: / Limité à : Specify country(ies): / Préciser le(s) pays : ☐	Restricted to: / Limité à : Specify country(ies): / Préciser le(s) pays : ☐	Restricted to: / Limité à : Specify country(ies): / Préciser le(s) pays : ☐

7. c) Level of information / Niveau d'information

Canada	NATO	Foreign / Étranger
PROTECTED A / PROTÉGÉ A ☐	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ ☐	PROTECTED A / PROTÉGÉ A ☐
PROTECTED B / PROTÉGÉ B ☐	NATO RESTRICTED / NATO DIFFUSION RESTREINTE ☐	PROTECTED B / PROTÉGÉ B ☐
PROTECTED C / PROTÉGÉ C ☐	NATO CONFIDENTIAL / NATO CONFIDENTIEL ☐	PROTECTED C / PROTÉGÉ C ☐
CONFIDENTIAL / CONFIDENTIEL ☐	NATO SECRET / NATO SECRET ☐	CONFIDENTIAL / CONFIDENTIEL ☐
SECRET / SECRET ☐	COSMIC TOP SECRET / COSMIC TRÈS SECRET ☐	SECRET / SECRET ☐
TOP SECRET / TRÈS SECRET ☐		TOP SECRET / TRÈS SECRET ☐
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) ☐		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) ☐

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

PART A *(continued)* / PARTIE A *(suite)*

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets? ☒ No / Non ☐ Yes / Oui
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS?
If Yes, indicate the level of sensitivity:
Dans l'affirmative, indiquer le niveau de sensibilité :

9. Will the supplier require access to extremely sensitive INFOSEC information or assets? ☒ No / Non ☐ Yes / Oui
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate?

Short Title(s) of material / Titre(s) abrégé(s) du matériel :
Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

☒ RELIABILITY STATUS / COTE DE FIABILITÉ	☐ CONFIDENTIAL / CONFIDENTIEL	☐ SECRET / SECRET	☐ TOP SECRET / TRÈS SECRET
☐ TOP SECRET– SIGINT / TRÈS SECRET – SIGINT	☐ NATO CONFIDENTIAL / NATO CONFIDENTIEL	☐ NATO SECRET / NATO SECRET	☐ COSMIC TOP SECRET / COSMIC TRÈS SECRET
☐ SITE ACCESS / ACCÈS AUX EMPLACEMENTS			

Special comments:
Commentaires spéciaux : _____

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.
REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work? ☒ No / Non ☐ Yes / Oui
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail?
If Yes, will unscreened personnel be escorted? ☐ No / Non ☐ Yes / Oui
Dans l'affirmative, le personnel en question sera-t-il escorté?

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises? ☒ No / Non ☐ Yes / Oui
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS?

11. b) Will the supplier be required to safeguard COMSEC information or assets? ☒ No / Non ☐ Yes / Oui
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC?

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises? ☒ No / Non ☐ Yes / Oui
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ?

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data? ☒ No / Non ☐ Yes / Oui
Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS?

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency? ☒ No / Non ☐ Yes / Oui
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale?

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

PART C - *(continued)* / PARTIE C - *(suite)*

For users completing the form **manually** use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.
Les utilisateurs qui remplissent le formulaire **manuellement** doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form **online** (via the Internet), the summary chart is automatically populated by your responses to previous questions.
Dans le cas des utilisateurs qui remplissent le formulaire **en ligne** (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET	NATO RESTRICTED / NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL / NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ A	PROTECTED / PROTÉGÉ B	PROTECTED / PROTÉGÉ C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRES SECRET
Information / Assets / Renseignements / Biens	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Production	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
IT Media / Support TI	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
IT Link / Lien électronique	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?
La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

☒ No / Non ☐ Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".
Dans l'affirmative, classifier le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?
La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

☒ No / Non ☐ Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).
Dans l'affirmative, classifier le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquer qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat	
Security Classification / Classification de sécurité	

PART D - AUTHORIZATION / PARTIE D - AUTORISATION

13. Organization Project Authority / Chargé de projet de l'organisme

Name (print) - Nom (en lettres moulées)	Title – Titre	Signature
Robin Craig	Construction Project Manager	Robin Craig

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
613-993-6869	613-957-9828	Robin.Craig@nrc-cnrc.gc.ca	2016 Dec 18

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées)	Title – Titre	Signature
Charlotte Carrier	Controlled Goods and Contracts Security Coordinator	

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
601-993-8956	613-990-0946	Charlotte.Carrier@nrc-cnrc.gc.ca	2016 Dec 18

15. Are there additional instructions (e.g. Security Guide, Security Classification Guide) attached?
Des instructions supplémentaires (p. ex. Guide de sécurité, Guide de classification de la sécurité) sont-elles jointes?

☒ No / Non ☐ Yes / Oui

16. Procurement Officer / Agent d'approvisionnement

Name (print) - Nom (en lettres moulées)	Title – Titre	Signature
M. BEDARD	Senior Contracting Officer	M Bédard

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
613 993-2274			17-2-16

17. Contracting Security Authority / Autorité contractante en matière de sécurité

Name (print) - Nom (en lettres moulées)	Title – Titre	Signature

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date

Natural Resources Canada
Ressources naturelles Canada

SOLAR ready GUIDELINES

for solar domestic hot water and photovoltaic systems

TABLE OF CONTENTS

CanmetENERGY/Housing, Buildings and Communities

Version 1.1

Canada

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Aussi disponible en français sous le titre : « Prêt pour le solaire » au Canada

I. INTRODUCTION & KEY BENEFITS

The Solar Ready Guidelines specify a number of design considerations and modifications builders can make to new attached and detached homes in preparation for the installation of a future solar system. The design considerations and modifications include the following elements: roof space, SDHW and solar PV conduits, plumbing connections to an existing hot water heater, an electrical outlet, mechanical room floor space and mechanical / electrical room wall space. Structural loading considerations are not addressed explicitly in the Guidelines.

These Guidelines are intended to be simple and inexpensive to implement, while enabling significant savings in installation costs should a homeowner choose to install a complete solar system in the future. The Solar Ready Guidelines are specifically targeted towards the installation of solar domestic hot water systems (SDHW) and/or solar photovoltaic systems (solar PV) as tested and/or certified according to Canadian Standards Association (CSA) relevant test standards; and as installed by certified installers. For more information on relevant CSA test standards and certified installers, see Section III, Part 8.

See Section IV for an explanation of the anticipated performance of SDHW and/or solar PV systems for homes built Solar Ready.

This Guideline is intended to help increase builder and consumer awareness of the opportunity solar energy affords.

A SOLAR READY HOME BENEFITS:

- Homeowners, by enabling them to save money on the installation of a future SDHW and/or solar PV system while increasing the value of their home;
- Builders, by offering them the tools to provide an environmentally-conscious, low-cost upgrade to new homes; and
- Manufacturers and installers, by encouraging market uptake of solar energy systems.

The Solar Ready Guidelines can be found on NRCan's website *nrcan-rncan.gc.ca*. Builders should ensure they are working with the most recent version.

SOLAR READY BACKGROUND: *Natural Resources Canada partnered with the Canadian Solar Industries Association to develop the technical specifications of these Solar Ready Guidelines, while builder-led pilot projects provided an opportunity to demonstrate the Solar Ready concept. The pilot projects found that a few simple and inexpensive design modifications made "up front" in the design and construction phase of a new home would enable homeowners to save significantly on the future installation costs of a complete SDHW system.*

II. TECHNICAL SPECIFICATIONS

SOLAR ready GUIDELINES for solar domestic hot water and photovoltaic systems

Each of the following requirements should be completed by the builder. See Section III for additional information.

1. On The Roof

Builders should:

1.1 identify on the house plans at least 3.7 m (12') x 3.0 m (10') of unobstructed area (clear of chimneys, roof vents, skylights, gables and other protrusions and it should not be foreseen to be significantly shaded by building elements, surrounding buildings or mature trees at any time of the year);

1.2 ensure the roof area identified in 1.1 has an orientation ranging from east to west facing corresponding to azimuth angles of 90º to 270º from true north;

1.3 ensure the roof area identified in 1.1 is located below the roof ridge (of a sloped roof), does not extend beyond the roof edges and is located above the wall line (away from overhang areas);

1.4 consider designing the roof to a recommended (not required, see Section III, Part 1) roof pitch of 5/12 to 18/12, corresponding to angles of between 23º and 56º above horizontal (0º).

NOTE: *Structural loading considerations are outside the scope of the Solar Ready Guidelines. Builders may wish to ensure the roof structure as designed not only meets all applicable building code requirements, but will also support additional loads associated with common solar energy systems. Refer to Section III, Part 1, "Loading" for related commentary. Builders may wish to consult with building code authorities for guidance on issues associated with installing solar systems on roof structures.*

2. PV Conduit

2.1 To prepare for Solar PV, one solar PV conduit of at least 2.5 cm (1") nominal diameter constructed of rigid or flexible metal conduit, rigid PVC conduit, liquid tight flexible conduit or electrical metallic tubing (as per Section 12 of the Canadian Electrical Code Part 1 concerning "raceways") should be installed. The conduit should be continuous from an accessible attic or roof location to the designated wall space for the PV electrical hardware (continuous, straight as possible; bends / elbows will be fine). **Reference: PV and the Electrical Code, CanSIA, 2004, Section 8.8**

3. SDHW Conduit(s)

3.1 Ideally, two 7.6 cm (3") nominal diameter, or a minimum of two 5.1 cm (2") nominal diameter, or one 10.2 cm (4") nominal diameter conduit(s) that run straight and continuous (very slight bends are acceptable; elbows are not) should be installed from an accessible attic or roof location to a designated location (as close as possible to the floor space allocated in 5.5) in the mechanical room and securely fastened. The conduit(s) should be installed entirely within the home envelope (except for the roof termination if applicable).

3.2 Pipe conduit materials should be chosen with consideration of the maximum temperatures and pressures encountered in SDHW systems (PVC pipe certified to ASTM D1785, Schedules 40, 80 or 120 will be suitable). **Reference: CSA Standard F383-08, Section 7.**

NOTE: *Most PVC conduits meeting ASTM D1785, Schedule 40, 80 or 120 have a maximum service temperature of 60°C (140°F) and a melting point of 93°C (200°F). These temperature ratings could be exceeded in cases involving the eventual installation of an evacuated tube SDHW system with conduit that runs through attic insulation. The scope of this concern is beyond that of the Solar Ready Guidelines. However, should this case be encountered or foreseen, it is recommended that the installer insert a conduit sleeve of a minimum of 2.5 cm (1") additional diameter over the existing conduit with a suitable spacer in such a way that an air space is maintained between the conduit containing the solar pipe and the attic insulation.*

The choice of conduit number and size should be noted in the Solar Ready Checklist.

DESIGN EXCEPTION:

Where straight and continuous conduit(s) are not possible, builders may consider the installation of complete SDHW pipe runs according to the specifications outlined in Appendix 1, SDHW Pipe Runs.

4. Termination of Conduits

Attic (applicable where attics are present)

4.1A. Workspace should be allowed for around the termination of conduits in the attic; 15.2 cm (6") above the attic insulation while allowing about 45.7 cm (18") of vertical distance between the conduit(s)/solar pipe end(s) and the underside of the roof decking will be sufficient.

4.2A. As with all attic protrusions, solar PV and SDHW conduits terminating in the attic should be properly sealed around the attic penetration(s) and capped to maintain home air tightness and fire ratings.

Roof (applicable to homes with no attic, e.g., cathedral ceilings)

4.1R. As with all roof protruding elements, solar PV and SDHW conduits terminating on the roof must be sealed and flashed around the roof penetration using a rubber or corrosion-resistant metal flange/boot with a gasket around the conduits, and capped to maintain air and water tightness. If the solar PV and SDHW conduits also pass through an attic, but terminate on the roof, the attic penetrations must be properly sealed to maintain home air tightness.
Reference: CSA Standard F383-08 Clause 9.1

Mechanical Room

4.1M. Solar PV and SDHW conduits must be properly sealed at the mechanical room penetration point and capped and sealed to maintain home fire ratings.

4.2M. As was the case in the attic, there should be workspace allotted around the termination point of conduits in the mechanical room. For the SDHW conduit(s), 10.2 cm (4") of vertical space between the termination point and any impeding element (e.g., basement I-beam); and 30.5 cm (12") of horizontal space in one direction will be sufficient to allow future installers to access the conduit and bend solar pipe runs as required.

4.3M. For the solar PV conduits, 5 cm (2") of vertical space between the termination point and any impeding element (e.g., basement I-beam); and 15.2 cm (6") of horizontal space in one direction to allow future installers to access the conduit and snake wire through as required, will be sufficient.

5. Plumbing, Mechanical and Electrical

Plumbing Connections to Existing Domestic Hot Water Heater

The following applies to standard tank-type water heaters, instantaneous water heaters and boilers with domestic water heating loop. See Section III, Part 5, example 3 for plumbing connections to solar tank-type water heaters (e.g. drainback systems).

5.1. Two copper (ASTM certified) "tee" connections should be installed on the existing water heater's cold water inlet line.

5.2 One copper or bronze ball valve (ASTM certified) should be installed on the pipe between the "tees" and left in the "open" position.

5.3 Two copper or bronze ball valves (ASTM certified), left in the "closed" position, should be connected to both "tees" specified in 5.1 via a short length of copper pipe.

5.4 The two ball valves installed in 5.3 should be capped off to prevent flow-through if valves were to be inadvertently opened by the homeowner.

Floor space in Mechanical Room for Future SDHW Storage Tank

5.5 Floor space should be set aside in the mechanical room to allow for the future installation of a SDHW storage tank. 91.4 cm (36") x 91.4 cm (36") with a clearance height of 182.9 cm (72") with design load limits capable of supporting a minimum weight of 453.6 kg (1000 lb) located as close as possible to the existing domestic water heater, in such a way that an installed tank would not impede doorways, hallways and emergency exits and would not reduce access to appliances, plumbing or heating, ventilation and air conditioning equipment will be suitable.
Reference: CSA Standard F383-08, Section 6

DESIGN EXCEPTION:

Builders installing solar tank type water heaters for drainback SDHW systems (see Section III, Part 5, Example 3) should allocate an area above the installed tank or on a shelf or table next to the installed tank of 50.8 cm (20") x 50.8 cm (20") with a clearance height of 76.2 cm (30") capable of supporting a minimum weight of 74.8 kg (165 lb).

5.6 One 110 volt standard outlet should be installed/allocated to the SDHW system within 182.9 cm (72") of the area allocated in 5.5 (dedicated circuit not necessary).
Reference: Canadian Electrical Code, Part 1

Wall Space for SDHW / Solar PV Hardware

5.7 Wall space should be allocated in the mechanical room for the future installation of a SDHW controller, expansion tank (if required) and pump(s) and/or solar PV system inverter, controls and connection hardware: 91.4 cm (36") x 91.4 cm (36") will be suitable.

6. Code Compliance

6.1. Building, electrical and plumbing work should be completed in compliance with the most current versions of the National Building Code of Canada, the Canadian Electrical Code, Part 1 and the National Plumbing Code of Canada including provincial/municipal amendments where applicable. Refer to Section III, Part 8 of the Solar Ready Guidelines for a list of useful documents and links.

1. ON THE ROOF

Roof Space, Orientation and Mounting Angle

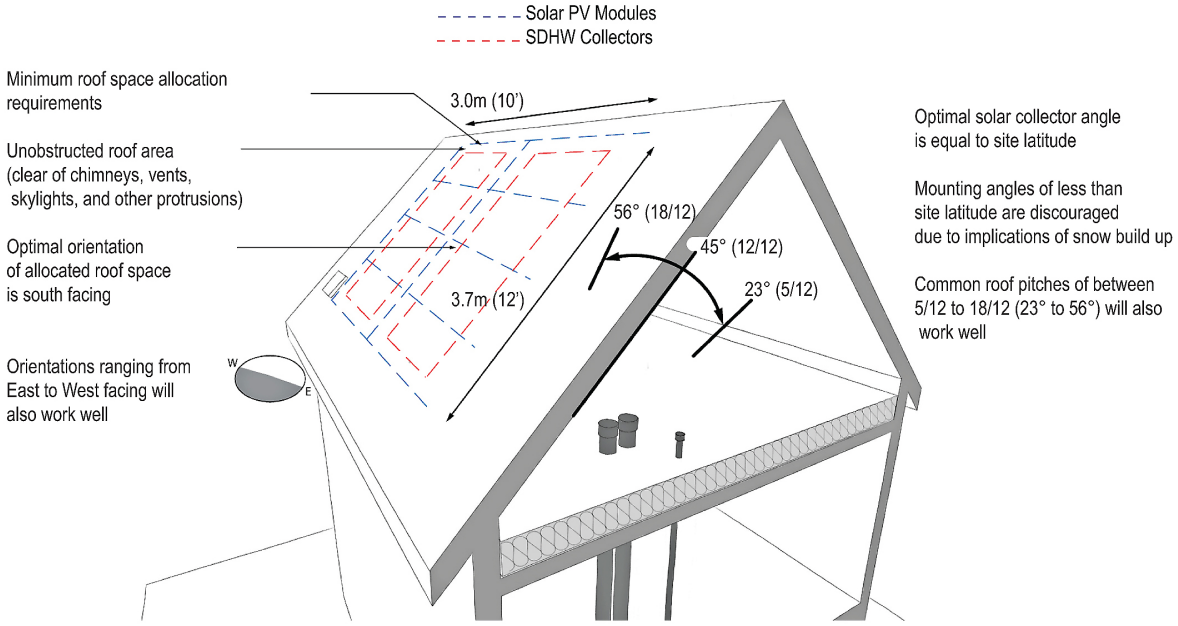

Figure 1: Roof space, orientation and mounting angle of SDHW collectors and solar PV modules

ROOF SPACE

In most residential applications, roof-mounted equipment is the most cost effective way to install solar energy systems. The roof space specifications for Solar Ready enable the rooftop installation of a minimum of: two 1.2 m (4') x 2.4 m (8') flat-plate solar thermal collectors (allowing 30.5 cm (12") of work space around each collector); or one evacuated tube collector consisting of about 30 tubes; or approximately eight 0.9 m (3') x 1.5 m (5') solar PV modules. Figure 1 describes the recommended roof space, orientation and mounting angle of the SDHW collectors and/or solar PV modules. A site inspection of surrounding building structures and consultation with landscaping plans will ensure the allocated area will not be significantly shaded by surrounding buildings / mature trees at any time of the year. Solar Ready shading considerations are described in Figure 2.

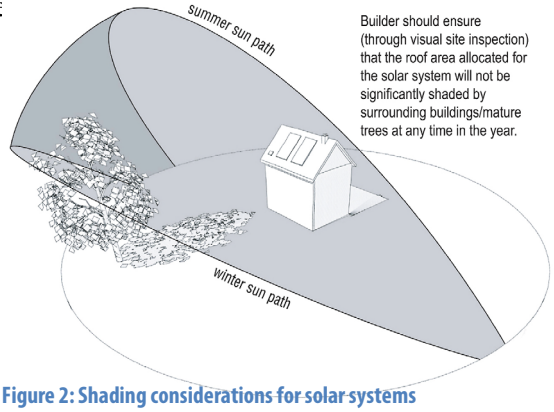

Figure 2: Shading considerations for solar systems

NOTE TO BUILDERS - LOADING

To ensure roof structures can support additional loads associated with common solar systems, builders can consult with their local building code authorities.

This commentary is provided to give builders a starting point from which to consider accommodating additional loads resulting from future solar system installations. A National Building Code Standing Committee is working to address the issue of installing solar systems. This section will be revised to reference their work once it is completed.

DEAD LOAD

Builders can design their roof structures so that they have additional structural capacity to carry typical solar systems.

When designing the roof structure to accommodate a solar system, an additional design dead load of 0.24 kPa (5 psf) accommodates the weight of SDHW collectors and/or solar PV modules as well as all mounting hardware and internal fluids for the majority of CSA certified systems when they are mounted in parallel to the roof surface. Systems mounted at an angle to the roof surface (i.e., rack mounted systems), ballasted systems and/or SDHW systems incorporating the use of roof mounted storage tanks may incur additional loads beyond the 0.24 kPa (5 psf) dead load.

It is the installer's responsibility to both select and install a solar system so that it meets the building code load requirements.

METHOD OF ATTACHMENT

There are a variety of methods for attaching solar systems to the roof structure. When installing solar systems on Solar Ready homes, solar installers should identify the appropriate attachment method given the requirements of the system to be installed and the design capacity of the roof structure.

It should be noted that to use a desired attachment mechanism on a roof that is designed to withstand the additional load of a solar system, an installer may need to provide additional reinforcement to transfer loads appropriately to structural elements of the roof system. Particular consideration to future attachment mechanisms may be needed where attic space is difficult to access, such as the case for roofs above cathedral ceilings.

TRUSS DESIGN PROCEDURE

In 2011, the Truss Plate Institute of Canada (TPIC) developed a "Solar Ready Truss Design Procedure" for solar systems installed on truss-based roofs. This procedure focuses on truss systems designed to carry the additional dead load and support typical methods of attachment currently being used by solar installers. This is one design option builders may wish to use to address dead load and methods of attachment (refer to www.tpic.ca, Technical Bulletin #7 for details).

SDHW COLLECTOR / SOLAR PV MODULE MOUNTING ANGLE

From the standpoint of maximizing the annual solar energy collected, the ideal collector/module mounting angle is generally equal to site latitude. Builders can consult the Solar Resource Maps of Canada (see Section III, Part 8). Vertical mounting of solar collector/modules is also possible, but should generally be limited to extreme northerly locations (see comments regarding seasonal optimisation below).

It should also be noted that systems mounted at low angles (generally 45º (12/12) pitch or less) will not shed snow as well as systems mounted at slightly steeper angles and will thus not perform as well in winter months.

For Solar Ready, the recommended roof pitch is 5/12 to 18/12, corresponding to angles of between 23º and 56º above horizontal (0º). Roof mounting kits are available for low slope or flat roofs to achieve the desired mounting angle. Builders/installers should be aware of load implications associated with using such kits if chosen.

SDHW COLLECTOR / SOLAR PV MODULE ORIENTATION

From the standpoint of maximizing solar energy collected, the ideal collector/module orientation is south facing. However, based on a design target of not less than 70% of maximum performance, and taking into consideration that some lots will not allow for optimal orientation, Solar Ready recommends roof space orientations varying between east and west facing.

SEASONAL OPTIMISATION

Solar systems can be designed to perform best in summer or winter, depending on the intended use and site location. As most SDHW installations tend to "over-perform" in summer and "under-perform" in winter, some builders, particularly in extreme northerly locations, may wish to design for improved winter performance by allocating a steeper sloping area of roof space (or wall space) and/or allocating roof space with a modified orientation. As a general rule of thumb, SDHW systems optimized for winter performance will perform best at mounting angles 10 degrees greater than site latitude and oriented slightly west of due south. The effects become more pronounced the further north the site is located.

This same tendency applies to solar PV systems, however, since solar PV systems are typically intended to maximize summer output, steeper mounting angles may be less desirable.

Should builders wish to allocate wall space for the SDHW installation, they should first consult a solar professional and ensure compliance with CSA Standard F383-08, Clause 5.6.

2. SOLAR PV CONDUIT

Solar Ready suggests one solar PV dedicated conduit of at least 2.5 cm (1") diameter for a potential future solar PV system installation. For homes designed to accommodate larger solar PV system arrays or systems designed to use micro-inverters, builders may wish to install a 5 cm (2") diameter conduit. This conduit need not be straight, as wiring can be "snaked" around elbows. The solar PV conduit details are described in Figure 3.

3. SDHW CONDUIT(S)

Note: All SDHW conduit(s) should be installed entirely within the house envelope (except for conduits terminating on the roof).

The goal for SDHW conduits is to run a pair of conduits or one conduit from an accessible attic space or roof location straight to an accessible location in the mechanical room (terminating as close as possible to the hot water heater) to allow for the future installation of fluid lines, insulation around the fluid lines and sensor wires. Slight bends in the conduit(s) will work fine, but elbows may obstruct future installation of the fluid lines. Two 7.6 cm (3″) nom diameter pipes provide the greatest inst flexibility and space for insulation. The conduit details are described in Figure

In a two-storey home, the provision of wall that goes from the mechanical roo the attic will facilitate straight conduit Building plans may require some redesign to get a common stacked wall location. The stacked wall location should be designed such that it does not fall directly below a truss or terminate directly above an I beam. Workspace recommendations described in Section III, Part 4 have been devised to cover this aspect.

SDHW PIPE RUNS

Where the planned route for SDHW conduit(s) between the attic or roof space and the utility room will necessitate the use of elbows, the actual SDHW pipe runs between the attic or roof space and mechanical room should be installed. *See Appendix 1: Specifications for SDHW Pipe Runs for details.*

Builders should be aware that pre-installation of SDHW pipe runs may limit the selection of SDHW system types and suppliers at the time of purchasing a solar water heating system.

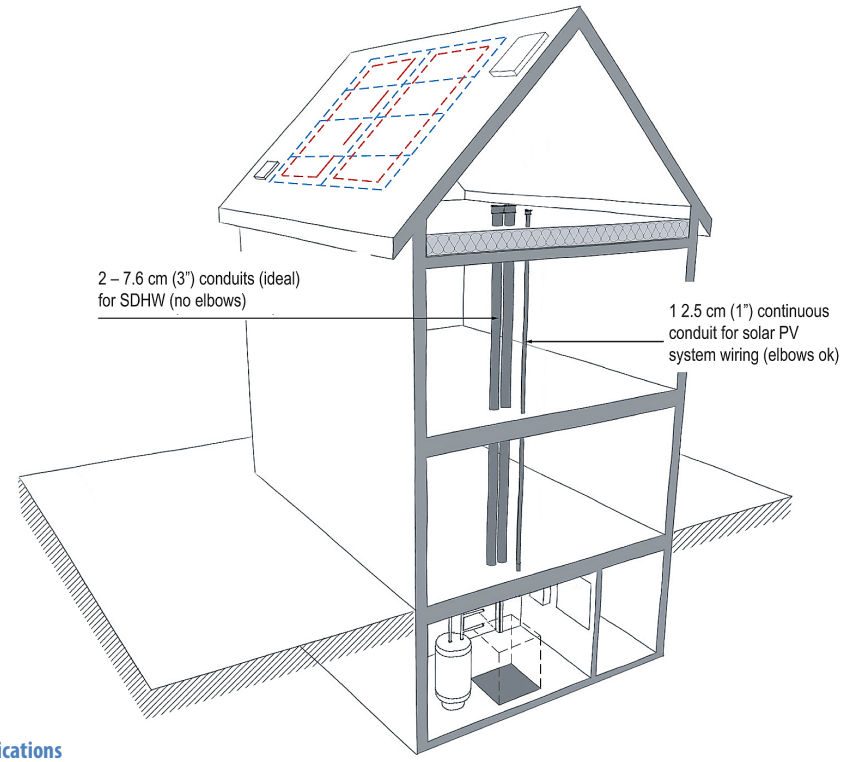

Figure 3: SDHW and solar PV conduit specifications

4. TERMINATION

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explained in Figu

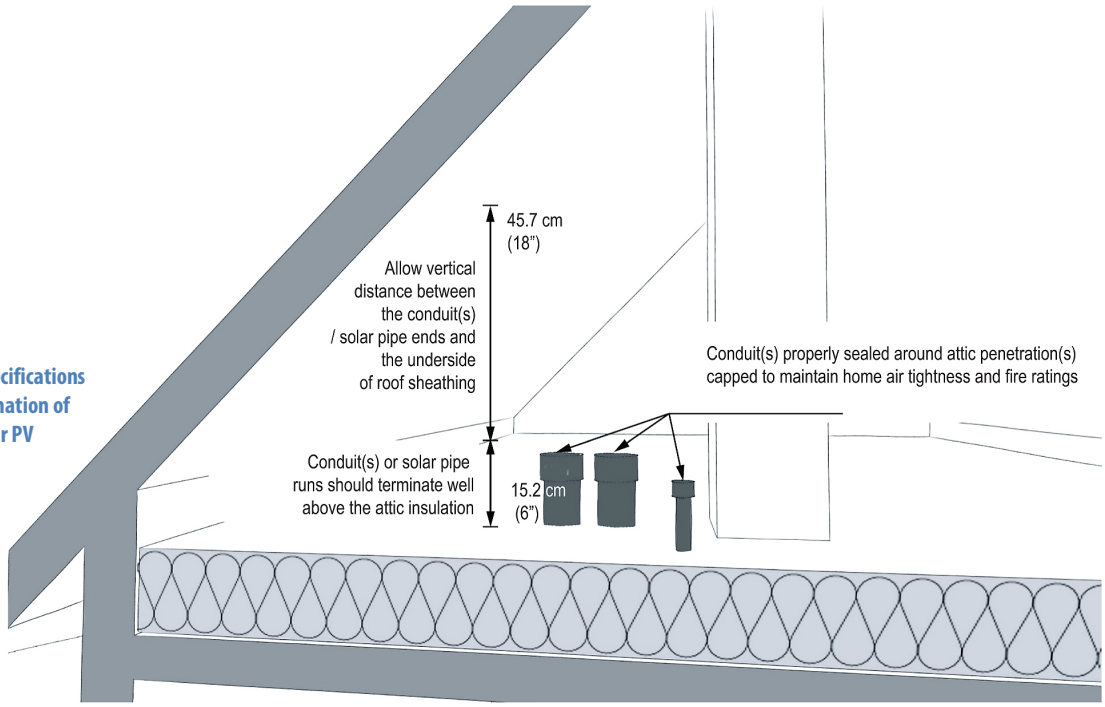

Figure 4: Workspace specifications for attic termination of SDHW and solar PV conduits

The optimal location of the roof protrusions needed for a future solar system is difficult to ascertain ahead of time. It is for this reason that termination in the attic is the preferred option. However, for situations where attic termination is not feasible (e.g., cathedral ceilings), roof terminations are also possible. For roof terminations, the builder should make every effort to locate the conduit protrusion(s) as close as possible to the perimeter of the allocated roof space.

As with any roof protruding element, the builder should ensure the protruding conduits are sealed and flashed to maintain envelope water tightness. Roof termination is not shown graphically.

Conduit terminations in the mechanical room should also be completed with sufficient surrounding workspace such that future SDHW or solar PV system installers will be able to readily access the conduit ends. See Figure 5 for guidance.

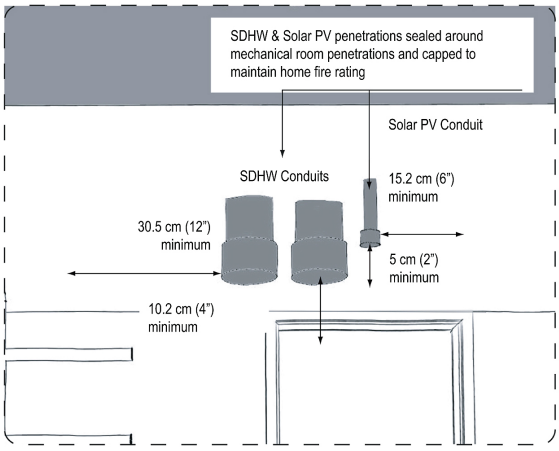

Figure 5: Workspace specifications for mechanical room termination of SDHW solar PV conduits

5. PLUMBING, MECHANICAL & ELECTRICAL

The existing domestic hot water heater may be a standard tank type water heater (as described in Figure 6); instantaneous water heater/boiler with domestic water heating loop (as described in Figure 7); or solar tank type water heater with drainback reservoir (as described in Figure 8).

EXAMPLE 1: PLUMBING CONNECTIONS TO EXISTING STANDARD TANK TYPE WATER HEATER

Builders should complete plumbing connections for Solar Ready to prepare the existing hot water heater for connection to a future solar tank. These connections are in addition to isolation valves and/or mixing valves that may be required by applicable codes. The builder should ensure ball valves (marked with a number 3 as shown) are installed in the "closed" position and capped (to prevent leaks if the homeowner inadvertently switches the ball valves to the "open" position). The ball valve marked with a number 2 should be installed in the "open" position.

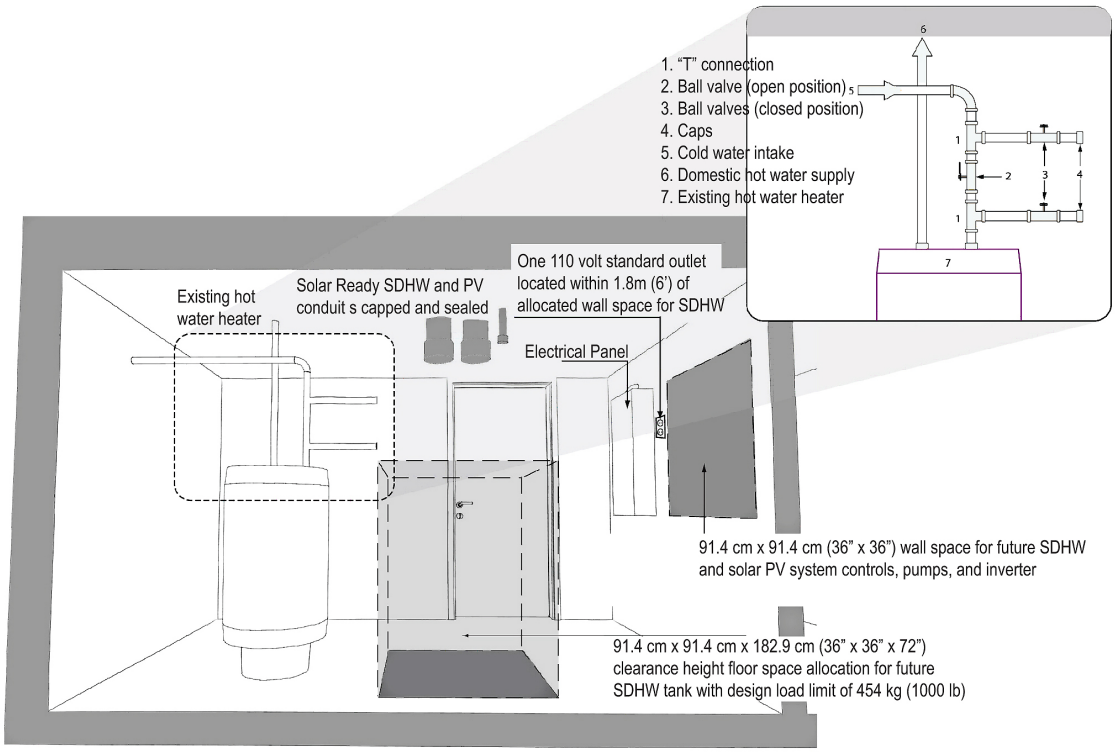

Figure 6: Plumbing, mechanical and electrical specificationsfor a standard tank type water heater

5. PLUMBING, MECHANICAL & ELECTRICAL

EXAMPLE 2: PLUMBING CONNECTIONS TO EXISTING INSTANTANEOUS WATER HEATER / BOILER BASED SYSTEM

This arrangement applies to instantaneous and boiler-based systems. In this case, builders should source systems that modulate firing rates according to incoming water temperature and allow flow-through without firing when preheated water is of a sufficiently high temperature. Condensing systems may be affected when operated in conjunction with solar preheating.

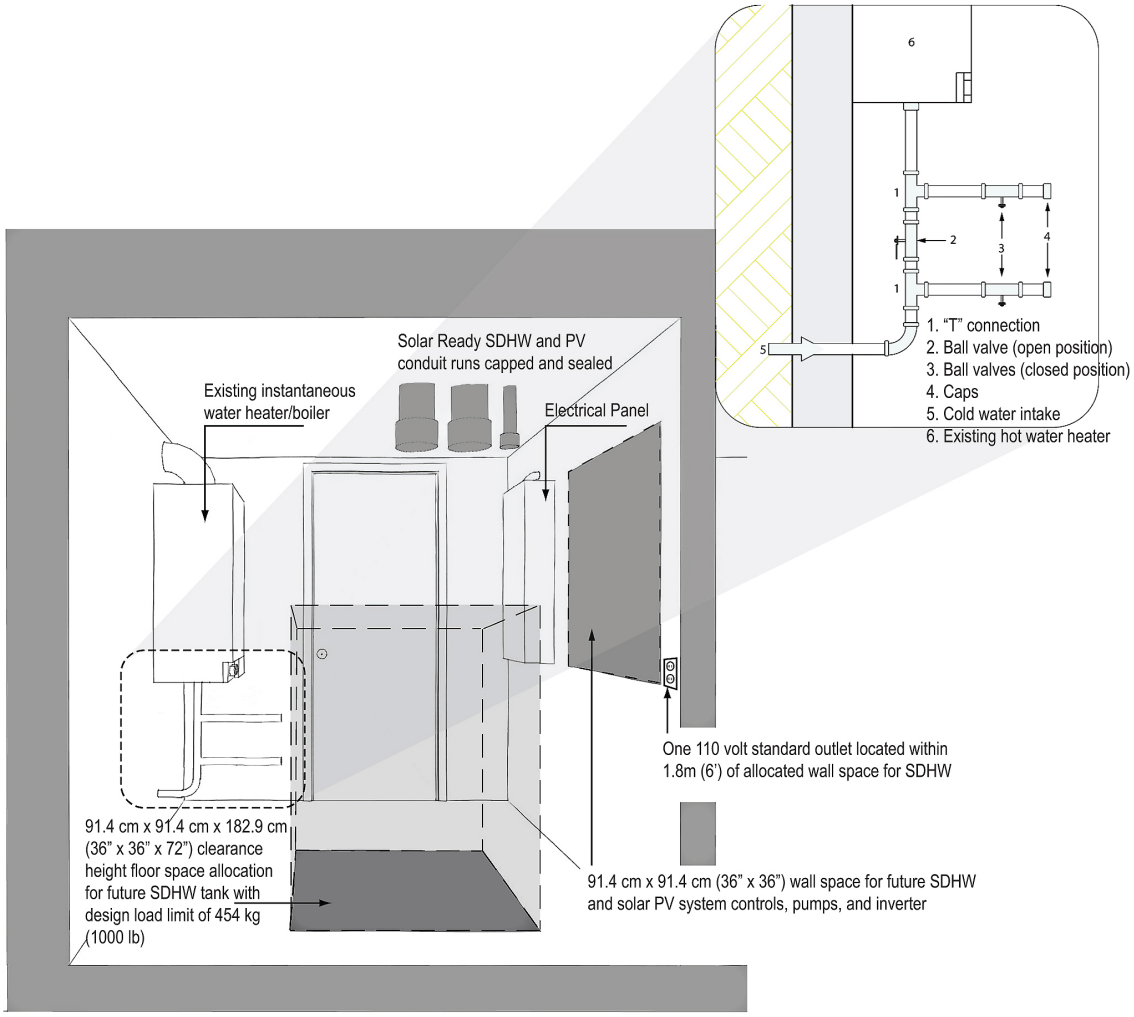

Figure 7: Plumbing, mechanical and electrical specifications for an instantaneous water heater/boiler with domestic water heating loop

5. PLUMBING, MECHANICAL & ELECTRICAL

EXAMPLE 3: PLUMBING CONNECTIONS TO EXISTING SOLAR TANK-TYPE WATER HEATER WITH DRAINBACK RESERVOIR

This arrangement applies to solar tank-type water heaters. Builders should note that this arrangement will require up front installation of a solar storage tank with two additional top or side ports for connection to an indirect solar loop.

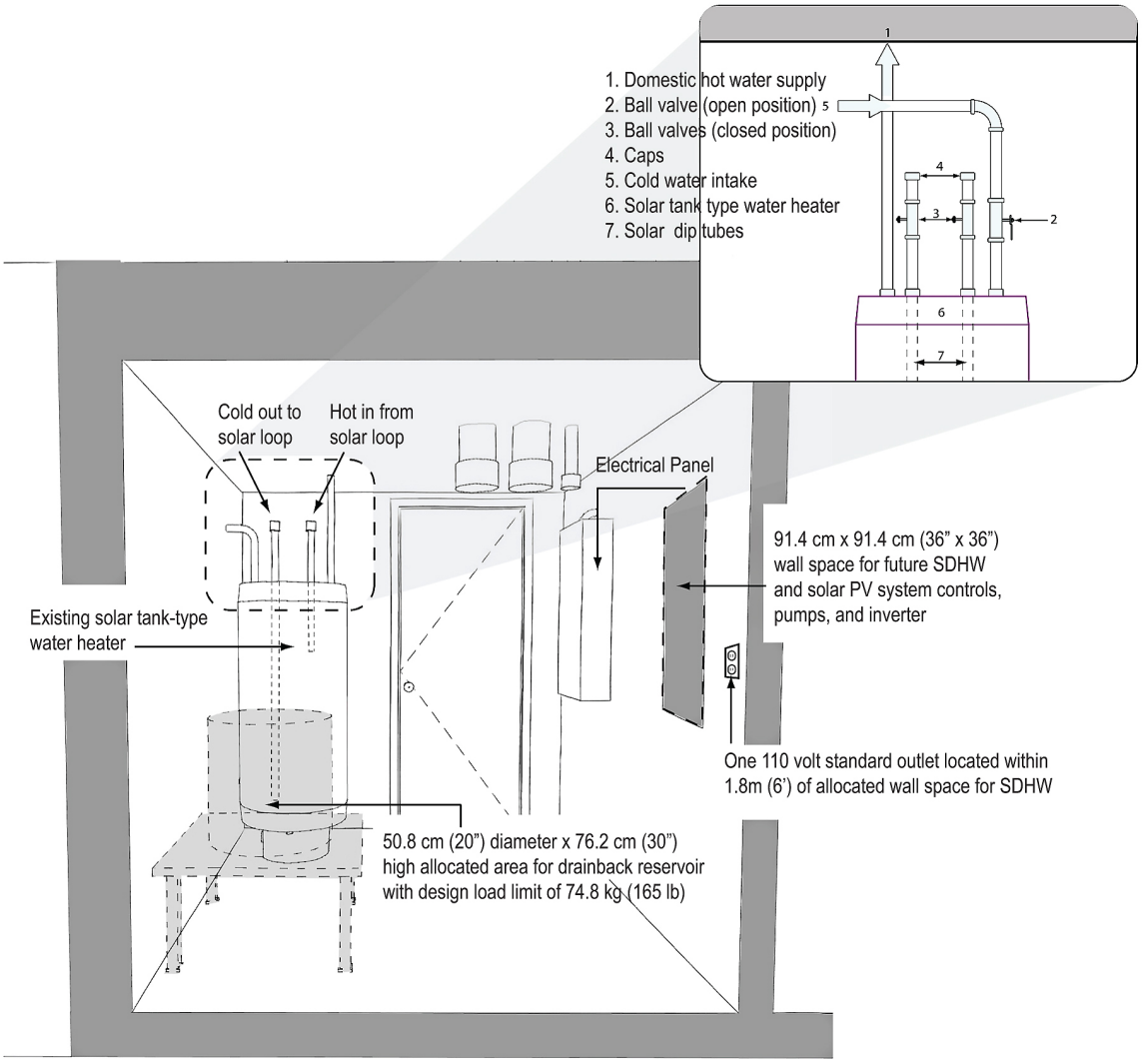

Figure 8: Plumbing, mechanical and electrical specifications for a solar tank-type water heater with drainback reservoir

5. PLUMBING, MECHANICAL & ELECTRICAL

FLOOR SPACE IN MECHANICAL ROOM FOR FUTURE SDHW SOLAR TANK

Builders should also allocate floor space with suitable design loads for the future solar tank as indicated in Specification 5.5. While the mechanical room in most homes will be located in a basement with cement/concrete floors, in some cases instantaneous water heaters/boilers with domestic water heating loops may be installed in a location other than the mechanical room. In these cases, builders should take extra precaution to ensure the chosen floor space can withstand the associated load. (Refer to Figure 6, Figure 7 and Figure 8 for system specific floor space specifications).

SDHW ELECTRICAL OUTLET

Most SDHW systems will require an electrical outlet for the pump or control operation. The builder should ensure a 110 volt receptacle is easily accessible (a dedicated circuit is not necessary).

WALL SPACE FOR SDHW/ SOLAR PV HARDWARE

Wall space should be allocated for the SDHW controller, pump(s) and pressure vessel (if required) as well as for the solar PV system controls and inverter hardware. (Refer to Figure 6, Figure 7 and Figure 8 for system specific wall space specifications).

6. CODE COMPLIANCE

Builders should ensure that all elements related to the Solar Ready Guidelines are completed in accordance with the National Building Code of Canada, the Canadian Electrical Code, Part 1 and the National Plumbing Code of Canada including provincial/municipal amendments thereto.

7. IDENTIFICATION OF SOLAR READY COMPONENTS

PROVIDED BY THE BUILDER TO THE HOMEOWNER:

A completed copy of the Solar Ready Checklist & Builder's Declaration should be provided to homeowners for their records.

8. USEFUL DOCUMENTS AND LINKS

Builders and others may find the following documents and links useful towards their implementation of the Solar Ready Guidelines:

CODES:

Canadian Solar Industries Association. PV and the Electrical Code. Version 1.2. 2004.
http://www.cansia.ca
Canadian Standards Association. Canadian Electrical Code, Part 1.
http://www.csa.ca/cm/ca/en/standards/products/electrical
National Research Council. National Building Code of Canada, 2005.
http://www.nationalcodes.ca/eng/nbc/index.shtml
National Research Council. National Plumbing Code of Canada, 2005.
http://www.nationalcodes.ca/eng/npc/index.shtml

CERTIFIED PRODUCTS LISTING :

Canadian Standards Association. Certified Products Listings
http://directories.csa-international.org/directorymain.asp

SDHW AND SOLAR PV TEST AND INSTALLATION STANDARDS:

Canadian Solar Industries Association. CSA Standards.
http://www.cansia.ca/government-regulatory-issues/national-/-federal/csa-standards

SDHW SYSTEM CERTIFIED INSTALLERS:

Canadian Solar Industries Association. List of Certified Solar Hot Water System Installers.
http://www.cansia.ca/training-employment/cansia-certified-hot-water-system-installers

SOLAR PV SYSTEM CERTIFIED INSTALLERS:

Canadian Standards Association. Construction Electrician (NOC 7241) Solar Photovoltaic (PV) Systems (SPVC)
http://www.csa.ca/documents/pc/SPVC-Handbook-Application.pdf

OTHER REFERENCES :

National Renewable Energy Laboratory. PV Watt Solar Energy Calculator.
http://www.pvwatts.org
Natural Resources Canada. Comprehensive Energy Use Tables, Tables 39, 40, 42, and 43. 2007.
http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/trends_res_ca.cfm
Natural Resources Canada. Performance Directory of Solar Domestic Hot Water Systems.
http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/solar_thermal/sdhw_directory.html
Natural Resources Canada. Photovoltaic Potential and Solar Resource Maps of Canada.
https://glfc.cfsnet.nfis.org/mapserver/pv/index_e.php
Natural Resources Canada. National Survey Report of PV Power Applications in Canada. 2008.
http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/standalone_pv/publications.html?2009-128
Natural Resources Canada. Solar Water Heating Systems, A Buyer's Guide. 2003.
http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/publications.html?ISBN:0-662-28486-0
Natural Resources Canada. Survey of Active Solar Thermal Collectors, Industry and Markets in Canada. 2008.
http://canmetenergy.nrcan.gc.ca/renewables/solar-thermal/publications/788
Natural Resources Canada. WATSUN Software for Performance of Residential Solar Water Heating Systems.
http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/software_tools.html

APPENDIX 1: Specifications for SDHW Pipe Runs

SOLAR ready GUIDELINES for solar domestic hot water and photovoltaic systems

NOTE: *This Solar Ready design exception requires the installer to have read and understood CSA Standard F383 in addition to completing the installation according to the following specifications:*

SPR 1. Two ASTM certified, drawn or annealed, Type M, L or K copper pipes or flexible tubes of 0.9 cm (⅜"),1.3 cm (½"), 1.6 cm (⅝"), or 1.9 cm (¾") nominal diameter, able to withstand a pressure of 10.3 bar (150 PSI) at a temperature of 170 ºC (338 ºF), should be installed from an accessible attic or roof location to a designated location in the mechanical room and securely fastened at regular intervals of at least every 1.8 m (6') to prevent tube sag when filled with fluid, and using fastening materials that will not corrode the copper pipes/tubes.

NOTE: *If flexible tubes are used, additional length of flexible line (that adheres to the applicable Specifications listed below) may be coiled up in the attic (and capped off) such that future SDHW system installers need only extend the coiled tube to connect to future SDHW collector(s).*

SPR 2. If 1.9 cm (¾") nominal size solar pipes (supply and return lines) are installed, they should be installed so that they will completely gravity drain, with a slope towards their beginning in the mechanical room of a minimum 1 in 50 slope or 0.6 cm (¼") vertical drop for every 30.5 cm (12") horizontal distance.
Reference: CSA Standard F383-08, Section 7.1.5

SPR 3. All solar piping should be pressure tested to 10.3 bar (150 PSI) for not less than 30 minutes.
Reference: CSA Standard F383-08, Clause 13.2.1

SPR 4. Upon successful completion of the pressure test (i.e., no leaks detected for 30 minutes), solar pipes should be insulated with insulation material having a minimum temperature rating of 105 ºC (221 ºF). If insulation types not specified by the manufacturer of a certified system are used for solar pipe runs that terminate on the roof, the last 1.8 m (6') of solar pipe should be insulated with insulation material having a minimum temperature rating of 170 ºC (338 ºF). All insulation material used should have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50 (as tested in accordance with CAN/ULC-S102). All insulation materials should be a minimum 1.3 cm (½") thickness. Insulation seams should be positioned so as to be located along the underside of the solar pipes.
Reference: National Building Code of Canada, 2005, Volume 1, Division B, Part 3, Clause 3.1.12 or local codes where applicable, CSA Standard F379-09, Clause 6.11.1 and CSA Standard F383-08, Clause 10.2.1, 10.2.3 and 10.4.1.

SPR 5. Sensor wiring (American Wire Gauge (AWG) 20, twisted pair, shielded is recommended) should not come in direct contact with the solar pipes and should be secured with strapping at intervals of at least one strap per 91.4 cm (36") of solar pipe run with at least 3.1 m (10') of extra length left coiled up in the attic, and enough additional wire length left coiled in the utility room to enable connection to the future solar storage tank.
Reference: CSA Standard F383-08, Clause 11.6

SPR 6. Solar pipe ends should be capped at both ends of the solar pipe run to maintain home fire ratings.

SPR 7. For solar pipe runs that penetrate the attic and terminate in the attic, or terminate on the roof, the attic penetration point should be properly sealed to maintain home air tightness and fire ratings.

SPR 8. For solar pipe runs that terminate on the roof, areas exposed to the ambient environment should be covered with conduit, the conduit should be capped, and the roof penetration point should be sealed and flashed.

SPR 9. The penetration point of solar pipe runs into the mechanical room should be sealed to maintain home fire ratings.

SPR 10. Workspace requirements for the termination of solar pipe runs should be completed according to Section III, Part 4, Figure 4 and Figure 5 of the Solar Ready Guidelines.

IV WHAT HOMEOWNERS CAN EXPECT FROM SOLAR READY HOMES

The Solar Ready provisions will simplify and lower the costs of the future installation, within the minimum allocated roof area and based on current technologies, of:

- Solar thermal collectors for a roof-mounted solar domestic hot water system (designed to provide about 50% of a typical family of 2-6 people's hot water needs)
  OR
- A 1.4 to 1.9 kilowatt roof mounted solar PV system to generate electricity
  OR
- Some combination of solar thermal and solar PV modules.

Homeowners can expect to save about $1000 on the installation of a SDHW system and/or solar PV system in a home built Solar Ready versus a home that has not been built Solar Ready. Note also that some provisions of Solar Ready may be useful for the future installation of solar systems used to generate hot water for heating or warm air for space heating.

The following paragraphs explain the anticipated performance of solar installations as per the Solar Ready Guidelines. Installed system performance may vary according to, among other factors, site location, system type and size and household hot water and electricity usage.

SOLAR DOMESTIC HOT WATER HEATING – PUT IN PERSPECTIVE

In Canada, an average solar domestic hot water heating system (sized to the needs of a family of four occupants) will produce about 2500 to 3000 kWh (9 to 10.8 GJ) of energy annually (depending on site location, system type and size and household hot water usage among other factors) (Source: See Section III Part 8). The average Canadian household uses about 5400 kWh (19.4 GJ) of energy for water heating (Source: See Section III Part 8).

Thus, the potential contribution of a SDHW system installed on the roof space allocated as per the Solar Ready minimum roof space requirements would cover about 50% of the annual energy required to meet the domestic hot water needs of the average Canadian household.

SOLAR PHOTOVOLTAICS – PUT IN PERSPECTIVE

Canada has an average solar PV resource of about 1150 kWh (4.1 GJ) / kW peak (Source: The Potential for Solar PV Power in Canada, presentation made at the CanSIA/NRCan PV Forum 2008). For location specific resource details, consult Section III Part 8.

With the minimum roof space requirement of Solar Ready, the installation of 1.4 to 1.9 kW of solar PV modules is possible (e.g., eight 180-235 W modules of about 0.9m (3') x 1.5m (5')). At optimal tilt and orientation (south facing, and tilt equal to site latitude), this represents an average system electrical output of the Solar Ready roof space of at least 1500-2000 kWh (5.4 to 7.2 GJ) annually (based on average weather conditions for urban centres across Canada, with a system derate factor of 0.77 (Source: See Section III Part 8). The average Canadian household uses approximately 6000 kWh (21.8 GJ) of electricity for lighting and appliances annually (Source: See Section III Part 8). Thus, the electrical production of solar PV modules installed on the minimum roof space allocated as per Solar Ready roof space requirements would be sufficient to cover approximately 30% of annual household lighting and appliance electricity use.

LOADING: *Structural loading considerations are outside the scope of the Solar Ready Guidelines. Homeowners should be aware that, depending on the solar system they choose to install, structural reinforcements of the roof may be needed. Homeowners should consult their builder, solar installer or local building code authority for potential structural implications of having solar systems installed on their Solar Ready home.*

V SOLAR READY CHECKLIST & BUILDER'S DECLARATION

SOLAR ready GUIDELINES for solar domestic hot water and photovoltaic systems

Each of the following specifications should be completed by the builder.

COMPLETED	SOLAR READY CHECKLIST (Items below should be completed by the builder according to Section II of the Solar Ready Guidelines)
☐	**1. On the Roof**
☐	Orientation and mounting angle
☐	Unobstructed roof space
☐	**2. Solar PV Conduit**
☐	Solar PV: one conduit of 2.5 cm (1")
☐	**3. SDHW Conduit**
☐	SDHW conduit(s) must be installed within home envelope
Check one of:	**Conduits**
☐	SDHW: two 7.6 cm (3") conduits **OR**
☐	SDHW: two 5.1 cm (2") conduits **OR**
☐	SDHW: one 10.2 cm (4") conduit
OR	**OR**
☐	**SDHW Pipe Runs**
☐	**4. Termination of Conduits**
☐	Mechanical room workspace, conduit ends capped
Check one of:	
☐	Attic termination workspace, conduits capped and sealed
	OR
☐	Roof termination, conduits capped, sealed and flashed

NOTE: *Structural loading considerations are outside the scope of the Solar Ready Guidelines. Builders may wish to ensure the roof structure as designed not only meets all applicable building code requirements, but will also support additional loads associated with common solar energy systems. Builders may wish to consult with building code authorities for guidance on issues associated with installing solar systems on roof structures.*

COMPLETED	SOLAR READY CHECKLIST (Items below should be completed by the builder according to Section II of the Solar Ready Guidelines)
☐	**5. Plumbing, Space and Electrical**
☐	SDHW electrical outlet
☐	SDHW and solar PV wall space
☐	SDHW floor space
☐	**6. Code Compliance**
☐	**7. Identification of Solar Ready Components**

NOTE: *Builders should leave a copy of the final two pages of these Guidelines (Sections IV and V with the homeowner*

I hereby confirm that (please print)

_____

(name of builder)

has installed a Solar Ready upgrade in this house according to Section II of NRCan's Solar Ready Guidelines.

Builder Representative

_____

_____

(signature)

Home Address (please print)

_____

_____

_____

Date _____

Solar Ready Technical Specifications developed by
Natural Resources Canada's CanmetENERGY, nrcan-rncan.gc.ca

Canada

Appendix II: Descriptions of Figures

Figure 1. Specifications for roof space, orientation and mounting angle of SDHW collectors and solar PV modules:

- Minimum roof space allocation requirements include an area at least 3.7 m (12') x 3.0 m (10')
- The area should be unobstructed (clear of chimneys, roof vents, skylights, gables and other protrusions)
- Optimal orientation of the allocated roof space is south facing
- Orientations ranging from East to West facing will also work well
- Optimal solar collector angle is equal to site latitude (figure shows 12/12 pitch (45°) as an example)
- Mounting angles of less than site latitude are discouraged due to implications of snow build up
- Common roof pitches of between 5/12 to 18/12 (23° to 56°) will also work well

Figure 2. Specifications for shading considerations of solar systems:

- The builder should ensure (through visual site inspection) that the roof area allocated for the solar system will not be significantly shaded by surrounding buildings/mature trees at any time in the year.

Figure 3. SDHW and solar PV conduits specifications:

- Two 7.6 cm (3") conduits are ideal for a future SDHW system (no elbows)
- One 2.5 cm (1") continuous conduit is recommended for future solar PV system wiring (elbows ok)

Figure 4. Workspace specifications for attic termination of SDHW and solar PV conduits:

- Allow 45.7 cm (18") vertical distance between the conduit(s) / solar pipe ends and the underside of the roof sheathing
- Conduit(s) or solar pipe runs should terminate at least 15.2 cm (6") above the attic insulation
- Conduit(s) should be properly sealed around attic penetration(s) and capped to maintain home air tightness and fire ratings

Figure 5. Workspace specifications for mechanical room termination of SDHW solar PV conduits:

SDHW and solar PV penetrations through the mechanical room ceiling should be sealed around the mechanical room penetrations and capped to maintain home fire ratings

Workspace specifications include:

- 30.5 cm (12") of horizontally accessible workspace on one side of the SDHW conduit(s)
- 10.2 cm (4") of vertically accessible workspace underneath the SDHW conduit(s)
- 15.2 cm (6") of horizontally accessible workspace on one side of the solar PV conduit
- 5 cm (2") of vertically accessible workspace underneath the solar PV conduit

Figure 6. Plumbing, mechanical and electrical specifications for a standard tank type water heater:

- An existing tank type water heater is shown with a "callout" to plumbing specifications. Plumbing work to be completed, in order of the flow direction of incoming water from the domestic cold water supply includes:
  - First, one "T" connection followed by a short length of tube with a ball valve and end cap (ball valve to be left in the closed position). This line is intended to allow flow of cold water to the cold inlet port of a future SDHW storage tank type water heater.
  - Following the "T", a ball valve is installed (ball valve to be left in the open position). This ball valve is intended to divert flow to a future SDHW storage tank type water heater.
  - Lastly, below the ball valve that has been left in the open position, a second "T" connection followed by a short length of tube with a ball valve and end cap (ball valve to be left in the closed position). This line is intended to allow flow of solar heated water coming from a future SDHW storage tank type water heater to the existing water heater.

Figure 6. (cont'd)

- SDHW and solar PV conduits protruding through the mechanical room ceiling are capped and sealed.
- A 91.4 cm x 91.4 cm (36" x 36") wall space for future SDHW and solar PV system controls, pumps and inverter
- One 110 volt standard electrical outlet located within 1.8 m (6') of the allocated wall space
- A 91.4 cm x 91.4 cm x 182.9 cm (36" x 36" x 72") clearance height floor space allocation for future SDHW tank with a design load limit of 454 kg (1000 lb)

Figure 7. Plumbing, mechanical and electrical specifications for an instantaneous water heater/boiler with domestic water heating loop:

- An existing instantaneous water heater/boiler is shown with a "callout" to plumbing specifications. Plumbing work to be completed, in order of the flow direction of incoming water flow from the domestic cold water supply includes:
  - First, one "T" connection followed by a short length of tube with a ball valve and end cap (ball valve to be left in the closed position). This line is intended to allow flow of cold water to the cold inlet port of a future SDHW system.
  - Following the "T", a ball valve is installed (ball valve to be left in the open position). This ball valve is intended to divert flow to a future SDHW storage tank.
  - Lastly, below the ball valve that has been left in the open position, a second "T" connection followed by a short length of tube with a ball valve and end cap (ball valve to be left in the closed position). This line is intended to allow flow of solar heated water coming from a future SDHW system to the existing water heater.
- SDHW and solar PV conduits protruding through the mechanical room ceiling are capped and sealed.
- A 91.4 cm x 91.4 cm (36" x 36") wall space for future SDHW and solar PV system controls, pumps and inverter
- One 110 volt standard electrical outlet located within 1.8 m (6') of the allocated wall space
- A 91.4 cm x 91.4 cm x 182.9 cm (36" x 36" x 72") clearance height floor space allocation for future SDHW tank with a design load limit of 454 kg (1000 lb)

Figure 8. Plumbing, mechanical and electrical specifications for a solar tank-type water heater with drainback reservoir:

- An existing solar tank-type water heater is shown with a "callout" to plumbing specifications. These specifications are outlined below.
  - A solar storage tank will have two top or side connections (in addition to the standard hot and cold connections) intended for connecting the tank to a drainback reservoir. Each of the two connections should have the following installed:
    - A short length of tube with a ball valve and end cap installed (ball valve to be left in the closed position).
    - One of these lines is intended to allow flow of cold water out of the solar storage tank to a future drainback reservoir. The second line is intended to allow flow of solar heated hot water from a future drainback reservoir to the existing solar storage tank.
  - A ball valve is installed on the cold water supply (ball valve to be left in the open position).
- SDHW and solar PV conduits protruding through the mechanical room ceiling are capped and sealed.
- A 91.4 cm x 91.4 cm (36" x 36") wall space for future SDHW and solar PV system controls, pumps and inverter
- One 110 volt standard electrical outlet located within 1.8 m (6') of the allocated wall space
- A 50.8 cm (20") diameter x 76.2 cm (30") high allocated area for a drainback reservoir with design load limit of 74.8 kg (165 lb)

Geotechnical Investigation Report

Proposed M24E Townhouses,
National Research Council Canada, Montreal Road Campus, Ottawa, ON

Prepared for:
National Research Council Canada
1200 Montreal Road,
Ottawa, ON

Prepared by:
Stantec Consulting Ltd.
400 – 1331 Clyde Avenue
Ottawa, ON K2C 3G4

Project No. 122411154

December 2015

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LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by National Research Council Canada (NRCC) to carry out consulting services including a geotechnical Investigation and a topographic survey of the proposed area for the M24E townhouses. The proposed townhouses are located between existing building M24 and the existing M24 test houses, within the National Research Council Canada Montreal Road campus, Ottawa, ON (the "Site").

This report has been prepared specifically and solely for the geotechnical investigation and recommendation of the above-noted development. It provides the factual results of the geotechnical investigation and preliminary geotechnical engineering comments regarding the foundation design for the proposed townhouses.

Limitations associated with this report and its contents are provided in the statement of conditions included in Appendix A.

2.0 PROPOSED DEVELOPMENT

The site of the proposed development is located just off Legget Avenue within the NRCC Montreal Road campus which is located at 1200 Montreal Road in Ottawa, Ontario. The site location is shown on the Key Plan, Drawing No.1 in Appendix B. The proposed layout at the site is shown on Drawing No. 2 in Appendix B which is based on drawings provided by Stantec Consulting Ltd.

It is understood that the proposed development on this site may include the two townhouses with a basement each covering a footprint of approximately 88.2 square meters. A new road between the new townhouses and existing test houses M24A and M24B and new sidewalks is also proposed as part of the development.

3.0 SCOPE OF WORK

The scope of work for the geotechnical investigation includes the following:

- Carry out a field drilling investigation, consisting of two (2) boreholes, for the purpose of characterizing the soil and groundwater conditions in the study area;
- Carry out a topographic survey (Stantec Geomatics Ltd.);
- Perform laboratory tests including moisture content, grain size distribution, Atterberg Limits, and corrosion analysis (pH, sulphate, resistivity and chlorides) on selected soil samples;
- Document the results of the field and laboratory programs in a geotechnical engineering report with preliminary geotechnical comments and recommendations concerning the following:
  - Geotechnical Resistances (ULS and SLS) for foundation design;
  - Excavation and backfill requirements;
  - Frost protection recommendations;

- Site preparation (stripping, grading, filling);
- Modulus of subgrade reaction for slab-on-grade design;
- Groundwater level estimate;
- Pavement structure recommendations;
- Seismic site classification according to the 2012 Ontario Building Code (OBC);
- Bedding and backfill for services.

4.0 INVESTIGATION PROCEDURES

4.1 DRILLING INVESTIGATION

Prior to carrying out the investigation, Stantec marked the proposed borehole locations on the site. As a component of our standard procedures and due diligence, Stantec arranged to have the borehole locations cleared of both private and public underground utilities.

The field drilling program was carried out on November 10, 2015, and consisted of two (2) boreholes, designated BH15-1 and BH 15-2. The borehole locations are shown on Drawing No. 2 in Appendix B.

The boreholes were advanced using a truck mounted drill rig equipped for soil sampling operations. The subsurface stratigraphy encountered in the boreholes was recorded in the field by experienced Stantec personnel while performing Standard Penetration Tests (SPT). Split spoon samples were collected at regular depth intervals in the boreholes. The undrained shear strength of cohesive soil was measured using the in-situ shear vane apparatus. The boreholes were backfilled with augered material.

All recovered soil samples were stored in moisture-proof bags, labelled accordingly and returned to the Stantec Ottawa laboratory for detailed classification and testing.

4.1 SURVEY

An elevation and location survey of the boreholes was carried out by Stantec Geomatics Ltd. Geodetic elevations at the borehole locations are shown on the Borehole Records in Appendix C.

4.2 LABORATORY TESTING

All samples returned to the laboratory were subjected to detailed visual examination and additional classification by a geotechnical engineer. Select samples were tested for moisture content, Atterberg Limits and gradation analysis. One (1) soil sample was submitted to Paracel Laboratories in Ottawa, Ontario for the determination of pH, chloride content, soluble sulphate and resistivity.

Samples remaining after testing will be placed in storage for a period of three months after issuance of this report. After the storage period, the samples will be discarded unless we are directed otherwise by the Client.

5.0 RESULTS OF INVESTIGATION

In general, the subsurface soil profile at the borehole location consisted of topsoil underlain by clay. Detailed descriptions of the subsurface soil conditions are presented on the Boreholes Records provided in Appendix C. Laboratory test results are shown on the Borehole Records as well as in Appendix D.

The borehole records depict conditions at a particular location and at the particular times indicated. Subsurface soil and groundwater conditions between borings and at locations away from the borehole locations could vary from those indicated on the borehole logs.

An explanation of the symbols and terms used on the Borehole Records also provided in Appendix C.

5.1 SUBSURFACE SOIL CONDITIONS

The following sections summarize the soil and groundwater conditions.

5.1.1 Fill

A very thin layer of fill was encountered in both boreholes. It consisted of poorly graded sand, with a thickness of approximately 50 mm in BH 15-1 and 100 mm in BH 15-2. The moisture content of the fill was 4%.

5.1.2 Fat Clay (CH)

The fill was underlain by a deposit of clay in both boreholes. The clay extended to the termination depths of the boreholes. A 700 and 800 mm thick dark grey clay layer was encountered directly beneath the fill. This layer appeared to be the same material as the native clay; however it appeared remoulded and could possibly have been native material that was re-worked during landscaping.

The consistency of the clay material was stiff as indicated by the measured in-situ shear strengths which ranged between 56 and 89 kPa. Pocket penetrometer readings of the clay ranged between 37 and 137 kPa indicating a firm to very stiff state.

The moisture content of the clay ranged from 28% to 84%.

Grain size analysis and Atterberg limit tests were carried out on select samples of the clay. The grain size distribution of the clay indicated a soil composition of 0% gravel, 1% sand, 35% silt and 64% clay. The plastic and liquid limit of the clay was 27 and 81, respectively. The grain size distribution curves and the plasticity chart are shown in Figures 1 and 2 in Appendix D.

This material was classified as fat clay (CH) in accordance with the Unified Soil Classification System (USCS).

5.2 GROUNDWATER

Groundwater was observed at the time of drilling in the open boreholes. The inferred groundwater levels are shown in Table 5.1.

Table 5.1: Inferred Groundwater Levels

Borehole No.	Depth (m)	Elevation (m)
BH 15-1	4.9	90.2
BH 15-2	6.4	88.8

The groundwater levels are inferred over a short period of time and could be influenced from the drilling. Fluctuations due to seasonal variations or precipitation events should be anticipated.

6.0 DISCUSSIONS AND RECOMMENDATIONS

6.1 GENERAL

The following geotechnical issues are deemed to be significant to the proposed development:

- A 800 mm thick vegetation cover, fill and remoulded clay should be stripped and removed from the proposed building footprint.
- The existing native soil conditions observed at the borehole location is considered acceptable for spread footing foundations and slab-on-grade for lightly loaded structures. The detailed recommendations are provided in Section 6.3.
- Serviceability Limit State (SLS) Bearing Capacities of shallow footings depend on the foundation load, live load and the load imposed by grade raise. Thus, the amount of the consolidation settlements triggered by grade raise should be limited. The detailed recommendations are provided in section 6.3.
- The grade raise should be restricted due to the settlement potential of the clay deposit. The acceptable range is discussed in sections 6.2 and 6.3.
- Tree planting restrictions would need to be considered to avoid potential shrinkage of the clay due to tree roots.
- Groundwater or surface water runoff may be encountered during excavation and may require the use of dewatering techniques.

6.2 SITE PREPARATION

6.2.1 Grading

Where shallow foundations are proposed, it is recommended that site grading be limited to 1.0 m above existing grades. If higher grade raises are being proposed a preloading or surcharging program will need to be evaluated for the site.

6.2.2 Building Shallow Foundations

All existing vegetation cover, topsoil, fill (remoulded clay), buried organics should be excavated and removed from beneath the building foundation. Bearing soils will require inspection by geotechnical personnel to verify design bearing pressures. Building foundations should be placed directly on the undisturbed native soil or on Structural Fill placed on native soils.

Structural Fill should be used to raise the grade where required. Structural Fill should consist of OPSS Granular B Type II or OPSS Granular A. It should be placed in lifts no thicker than 300 mm and compacted to at least 100% Standard Proctor Maximum Dry Density (SPMDD).

6.2.3 Floor Slab

All surficial vegetation, topsoil, organic material and other deleterious materials should be entirely removed from beneath the slabs. Prepared subgrades should be inspected by geotechnical personnel prior to placement of fill or concrete. A layer of free draining granular material such as OPSS Granular A at least 200 mm in thickness should be placed immediately beneath the floor slab for leveling, drainage and support purposes. This material should be compacted to at least 100% Standard Proctor Maximum Dry Density.

6.2.4 Re-Use of Site Generated Material

The overburden soils observed on site consist primarily of clay. The existing site materials may be reusable as grading fills or subgrade fill. It is noted that compaction is highly dependent on the moisture content of the material, thus the amount of re-useable material will be dependent on the natural moisture content, weather conditions and the construction techniques at the time of excavation and placement. The measured moisture content of the clay suggest that material below a depth of 2.5 m will not be suitable for re-use due to the high moisture content.

6.2.5 Paved Areas

All existing surficial vegetation, topsoil and other deleterious materials should be entirely removed from beneath the proposed paved areas to the satisfaction of the geotechnical personnel. The exposed subgrade should be proof-rolled in the presence of a geotechnical inspector using heavy compaction equipment. All soft or disturbed areas revealed during subgrade inspections or proof-rolling should be removed to a depth of 500 mm and replaced with compacted Subgrade Fill, as defined below.

Subgrade fill should consist of OPSS Select Subgrade Material (SSM). It should be placed in lifts no thicker than 300 mm and compacted to at least 95% Standard Proctor Maximum Dry Density (SPMDD).

Where wet conditions are encountered, a filter fabric may be required on the subgrade surface. Transitions around sub-excavations within 1.2 m of finished grade where backfill and native soils are not of similar nature should be sloped at 3 horizontal to 1 vertical.

6.2.6 Additional Considerations

Surface water run-off from precipitation should be controlled during construction. Subgrade surfaces will be prone to disturbance by weather and traffic. Preparation of subgrade should be scheduled such that the protective cover of overlying granulars or concrete is placed as quickly as possible.

If the winter construction is anticipated, the following is recommended to be included in the contract:

- Foundations shall be constructed on non-frozen ground only; where non-frozen ground includes the material at surface and all underlying soils. The non-frozen nature of the ground must be confirmed by a geotechnical inspection within 1 hour of concrete placement.
- Following construction of footings, temporary frost protection must be provided to avoid freezing of the bearing surface and for protection of the concrete during curing.
- Foundations shall be backfilled with free-draining granular material and drainage shall be provided to prevent lifting of the foundations due to adfreeze during the construction period.
- Full-time inspection and testing services is required during earthworks in winter conditions.

6.3 FOUNDATIONS

Conventional spread and strip footing foundations could be considered for lightly loaded structures. It is anticipated that the new foundations can be founded on the native soils or Structural Fill on native soils.

We have calculated the resistances at Ultimate Limits States (ULS) and reactions at Serviceability Limits States (SLS) for new spread (square) and strip footings for the new development. The values are provided below in Table 6.1.

Table 6.1: Geotechnical Resistance for Shallow Footings

Founding Element	Footing Width (m)	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Resistance at SLS (kPa)
Spread footing on clay crust (1)	1.0 to 3.0	175	100
Strip footing on clay crust (1)	0.5 to 2.0	150	100
Spread footing on stiff clay (2)	1.0 to 3.0	130	100
Strip footing on stiff clay (2)	0.5 to 2.0	150	100

Notes:

(1) The underside of footings are placed at the geodetic elevation 92.0 m or higher.
(2) The underside of footings are placed below geodetic elevation 92.0 m.

The factored geotechnical bearing resistance at ULS incorporates a resistance factor of 0.5. The geotechnical reactions at SLS were developed consistent with a total settlement of 25 mm.

The unfactored horizontal resistance of spread footings may be calculated using the following unfactored coefficients of friction:

0.55 between OPSS Granular A and cast-in-place concrete
0.30 between clay and cast-in-place concrete

A resistance factor against sliding of 0.8 should be applied to obtain the resistance at ULS.

6.3.1 Frost Penetration Depth

The typical design frost penetration depth for Ottawa is 1.8 m. It is recommended that footings be founded at or below this depth. Equivalent insulation to 1.8 m of soil cover is required to protect the soil beneath the footings from frost penetration if the full soil cover is not provided.

The former practice in Ottawa of founding perimeter footings of heated buildings at 1.5 m is discouraged since improved building insulation practices has reduced the amount of building heat loss which formerly reduced the frost penetration immediately adjacent to buildings. Similarly, the practice of relying on snow cover to reduce frost protection is discouraged since wind scour frequently removes snow immediately near foundations and frequently our coldest winters have very little snow.

6.4 FLOOR SLAB

The recommendations provided herein are based on the assumption that the average net slab loads will not exceed 12 kPa. Should a greater average load be proposed, the geotechnical consultant should review the recommendations presented herein.

The floor slab constructed as recommended above may be designed using a soil modulus of subgrade reaction, k, of 20 MPa/m. Non-structural slab-on-grade units should float independently of all load-bearing walls and columns.

Where construction is undertaken during winter months, floor slab subgrades should be protected from freezing. Alternatively, the floor slab subgrade must be completely thawed then proof rolled prior to placing concrete.

The native soils at this site are susceptible to frost heave. Potential damage from frost heave beneath exterior slabs-on-grade can be minimized by placing 100 mm of insulation beneath the concrete. Alternatively, exterior slab on grades must be placed on a non-frost susceptible granular material at least 1.2 m thick.

6.5 TEMPORARY EXCAVATIONS & GROUNDWATER CONTROL

The overburden soils should be classified as Type 3 soil as defined by the Occupational Health and Safety Act and Regulations for Construction Projects. Within Type 3 soils, open cut excavations must be sloped no steeper than one horizontal to one vertical (1H:1V) from the bottom of the trench.

Excavations deeper than 2 m and within 10 m of adjacent structures may require a temporary shoring system and should be reviewed by a geotechnical engineer. It is the responsibility of the contractor to select and design the excavation and support method. It is recommended that the successful bidder be required to submit an excavation/shoring plan.

In the case of temporary shoring design the following lateral earth pressure parameters are recommended for preliminary design.

Table 6.2: Lateral Soil Parameters

Parameters	OPSS Granular A	OPSS Granular B Type II	Native Silty Clay
Unit Weight (kN/m^3)	22.8	20.0	18
Angle of Internal Friction, (degrees)	35º	30º	27º
Coeff. of Active Earth Pressure, K_a	0.27	0.33	0.38
Coeff. of Passive Earth Pressure, K_p	3.69	3.0	2.66
Coeff. of Earth Pressure at Rest, K_o	0.43	0.50	0.55

Groundwater and/or surface run-off may be encountered during excavation and construction. It is expected that groundwater may be controlled by sump and pumping methods. The clay deposit encountered in the borehole is a low permeability material. It is anticipated that construction activities and groundwater dewatering can be carried out at less than 50,000 L/day, thus a Ministry of the Environment Permit to Take Water (PTTW) is not required for temporary groundwater dewatering of excavations.

The quality of groundwater that may be removed during the construction activities should be assessed at that time to determine if it may be disposed of directly to the local sanitary/storm sewer without treatment, under a permit that would be required from the City of Ottawa Sewer Use Program. Construction contractor has the responsibility to obtain a permit under the City of Ottawa Sewer Program and testing/discharge of water to sanitary or storm sewer. Discharge of pumped groundwater to the environment is not considered.

The provision of geotextile will likely be required at some locations on this site to stabilize wet subgrade or excavation surfaces.

6.6 ASPHALT PAVEMENTS AND CONCRETE SIDEWALKS

The proposed development includes a new road, driveway and new concrete sidewalks. It is anticipated that the new road will be used by cars and maintenance vehicles. The recommended pavement structures are illustrated in Table 6.3.

Table 6.3: Recommended Asphalt Pavement Structure Design

Material	Standard Duty Driveway/Parking Areas	Access Road/Fire Routes	Compaction Requirements
SP 12.5 (surface course asphalt)	50 mm	40 mm	92 % MTRD
SP 19 (base course asphalt)	--	50 mm	92 % MTRD
OPSS Granular A Base	150 mm	150 mm	100 % SPMDD
OPSS Granular B Type II Sub-base	450 mm	450 mm	100 % SPMDD

In preparation for construction of new pavements, the finished sub-grade surface should be proof-rolled and compacted to identify the presence of soft, wet, or deflecting areas; such areas should be removed and replaced with approved engineered fill.

The finished sub-grade surface must be compacted to achieve a minimum of 95% of the materials SPMDD immediately prior to placement of the granular materials.

6.6.1 General Pavement Comments

The finished sub-grade surface should be graded to promote positive drainage away from the area of the pavements. It is recommended that the sub-grade surface be sloped towards catch basin structures at a minimum cross-fall of 2% across the parking lots and reduced to 1% along the perimeter curb line. Sub-drain stubs with a minimum length of 3 m extending from the catch basin and manhole locations are recommended at low points in the sub-grade to prevent ponding of water and promote positive drainage.

6.6.2 Concrete Sidewalks

The design and construction of the sidewalks slabs should include a granular base layer consisting of a minimum of 200 mm of compacted OPSS Granular A. The design should also include positive drainage away from the edge of the building and beyond the limits of the concrete. Frost heave of sidewalks could be minimized by constructing frost tapers and extending the granular base to 1.2 m ground surface.

6.7 SEISMIC CONSIDERATIONS

The site soils are not considered to be susceptible to soil liquefaction.

The range of the undrained shear strength of clay is between 50 and 100 kPa. Therefore the recommended site classification for seismic site response for this site is Site Class D in accordance with Table 4.1.8.4. A of the 2012 Ontario Building Code.

6.8 TREE PLANTING RESTRICTIONS

Due to the presence of clay at the site tree planting restrictions should be considered to avoid clay shrinkage due to tree roots from medium and high water demand trees. The City of Ottawa Street Tree Manual (March 14, 2014) tree planting guidelines for Champlain Sea Clay should be used to determine an appropriate tree setback.

6.9 CEMENT TYPE AND CORROSION POTENTIAL

One representative soil sample from each of the proposed guard house locations was submitted to Paracel Laboratories in Ottawa, Ontario, for analysis of pH, water soluble sulphate and chloride concentrations, and resistivity. The testing was completed to determine the potential for degradation of the concrete in the presence of soluble sulphates and the potential for corrosion of exposed steel used in foundations and buried infrastructure. The analysis results are summarized in the following table.

Table 6.4: Chemical Testing Results

Borehole No.	Sample No.	Depth (m)	pH	Chloride µg/g	Sulphate µg/g	Resistivity (Ohm-m)
BH15-1	SS-3	1.5 – 1.8	7.2	<5	119	46

The concentration of soluble sulphate provides an indication of the degree of sulphate attack that is expected for concrete in contact with soil and groundwater at the site. The soluble sulphate result was 119 µg/g. Soluble sulphate concentrations greater than 1000 µg/g generally indicate that sulphate attack is expected for concrete in contact with soil and groundwater. Type GU (General Use) Portland Cement should therefore be suitable for use in concrete at this site.

The pH, resistivity and chloride concentration provide an indication of the degree of corrosiveness of the subsurface environment.

- The neutral pH value is 7.0 and the normal range for soils is from 5.5 to 9.0. The measured pH values of the soil samples are above the neutral value of 7.0 and within the normal range.
- The chloride concentration threshold value of 500 µg/g is typically used to designate soil or water as being corrosive. The measured chloride concentration is <5 µg/g.
- A scale of soil corrosiveness based on resistivity is as follows (British Standard BS-1377):
  - resistivity > 100 Ωm: slightly corrosive
  - 50 < resistivity < 100 Ωm: moderately corrosive
  - 10 < resistivity < 50 Ωm: corrosive
  - resistivity < 10 Ωm: severe

The degree of soil corrosiveness based on resistivity should be considered corrosive.

The pH, chloride and resistivity values presented in Table 6.4 may be used by structural designers in assessing the potential for chemical attack on buried steel and as an aid in selecting coating and corrosion protection systems for buried steel objects.

7.0 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of the National Research Council Canada who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Limited should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

This report was prepared by Bridgit Bocage and reviewed by Christopher McGrath.

Yours very truly,

STANTEC CONSULTING LTD.

Bridgit Bocage, M.Eng, E.I.T.

Chris McGrath, P.Eng.
Associate – Senior Geotechnical Engineer

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8.0 REFERENCES

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APPENDIX A

Statement of General Conditions

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

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

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

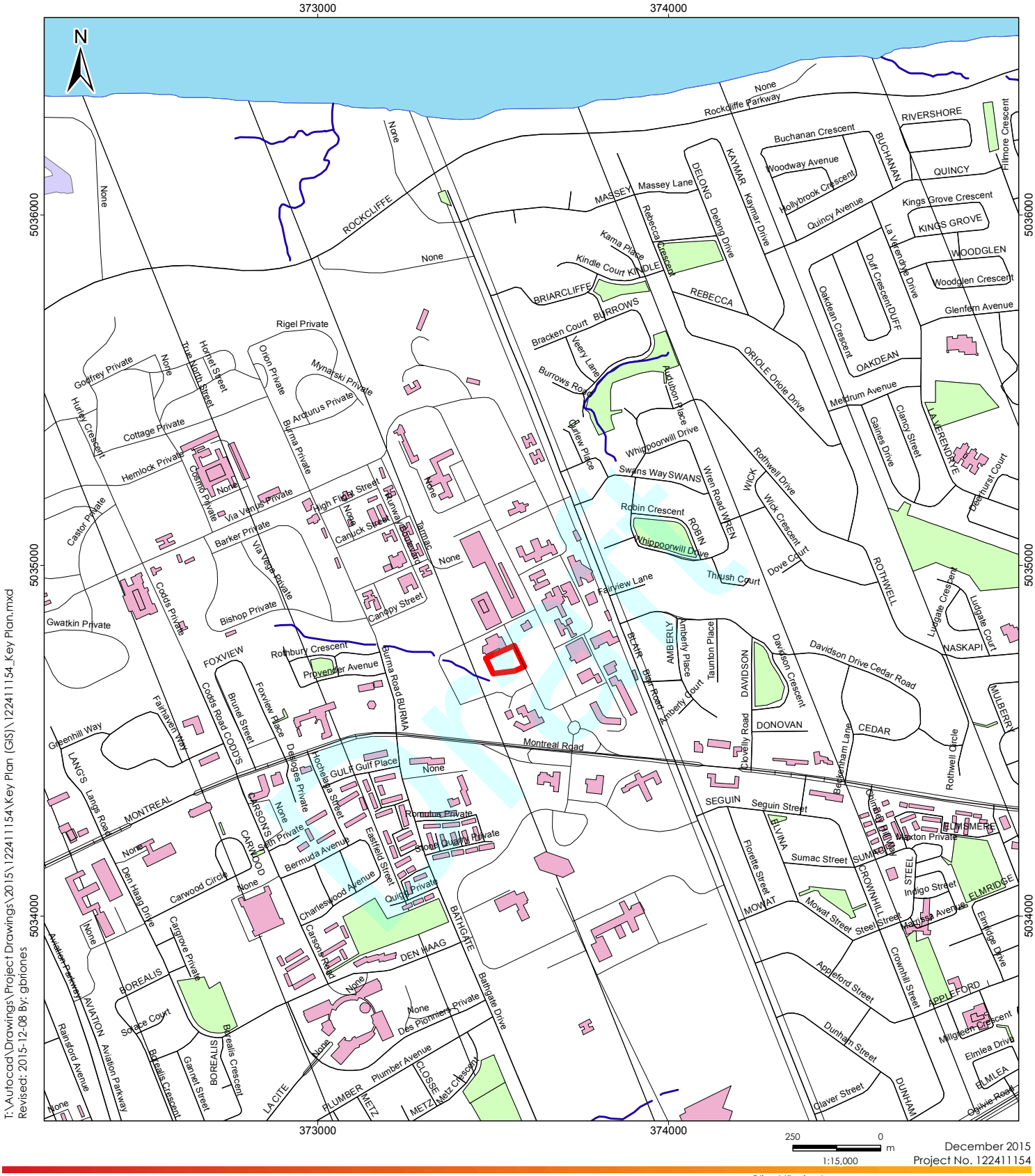
VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial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

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

APPENDIX B

Drawing No. 1 – Key Plan

Drawing No. 2 – Borehole Location Plan



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Revised: 2015-12-08 By: gbriones

Legend

- Road
- Creek
- Water
- Area of Investigation
- Building
- Parkland

Notes

1. Coordinate System: NAD 1983 MTM Zone 9.
2. Base features from City of Ottawa.

Stantec

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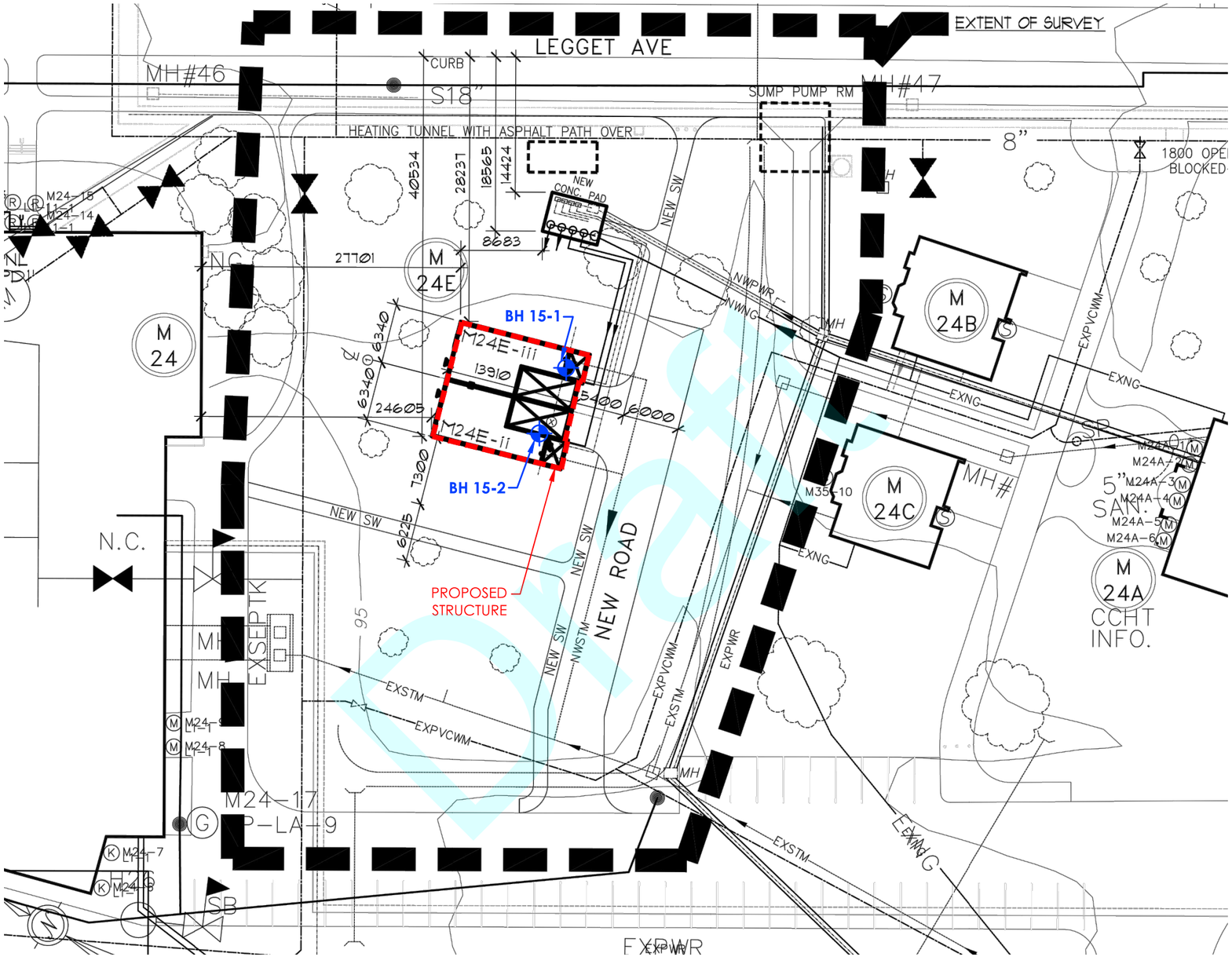
Client/Project
NRC
GEOTECHNICAL INVESTIGATION
BUILDING M24E, LEGGET AVENUE
OTTAWA, ONTARIO

Drawing No.
1

Title
KEY PLAN



DECEMBER 2015
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LEGEND

BOREHOLE

NOTES

1. COORDINATE SYSTEM: NAD 1983 MTM ZONE 9.
2. BASE PLAN FROM NRC,
   FILENAME: 5034-STANTEC-03NOV2015 (SK-01-OPT A2).pdf.

Client/Project
NRC
GEOTECHNICAL INVESTIGATION
BUILDING M24E, LEGGET AVENUE, OTTAWA, ONTARIO

Drawing No.
2

Title
BOREHOLE LOCATION PLAN

APPENDIX C

Symbols and Terms Used on Borehole and Test Pit Records

Borehole Records

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

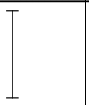
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

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BOREHOLE RECORD

N: 5 033 030 E: 451 426

BH 15-1

CLIENT National Research Council — BOREHOLE No. BH 15-1

LOCATION NRCC Montreal Road Campus, Ottawa, ON — PROJECT No. 122411154

DATES: BORING 10 November 2015 — WATER LEVEL — DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	**95.06**							
	95.0	FILL: brown poorly graded sand			SS	1	460	9
		Dark grey fat CLAY (CH) - remoulded (POSSIBLE FILL)						
	94.2							
1		Very stiff grey fat CLAY (CH)			SS	2	610	12
		(Clay Crust)						
2					SS	3	610	10
	92.8							
		Stiff grey fat CLAY (CH)			SS	4	610	5
3					SS	5	610	2
4								
5				▽	SS	6	610	0
6					SS	7	610	0
	88.4							
		End of Borehole						
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd _____

Date _____

Stantec

BOREHOLE RECORD

N: 5 033 029 E: 451 419

BH 15-2

CLIENT National Research Council — BOREHOLE No. BH 15-2

LOCATION NRCC Montreal Road Campus, Ottawa, ON — PROJECT No. 122411154

DATES: BORING 10 November 2015 — WATER LEVEL — DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	**95.19**							
	95.1	FILL: brown poorly graded sand			SS	1	200	6
		Dark grey fat CLAY (CH)						
	94.4	- remoulded (POSSIBLE FILL)						
1		Very stiff grey fat CLAY (CH)			SS	2	460	17
		(Clay Crust)						
2					SS	3	610	9
	92.9							
		Firm to stiff grey fat CLAY (CH)			SS	4	610	6
3					SS	5	610	2
4								
5					SS	6	610	1
6				▽	SS	7	610	1
	88.5							
7		End of Borehole						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

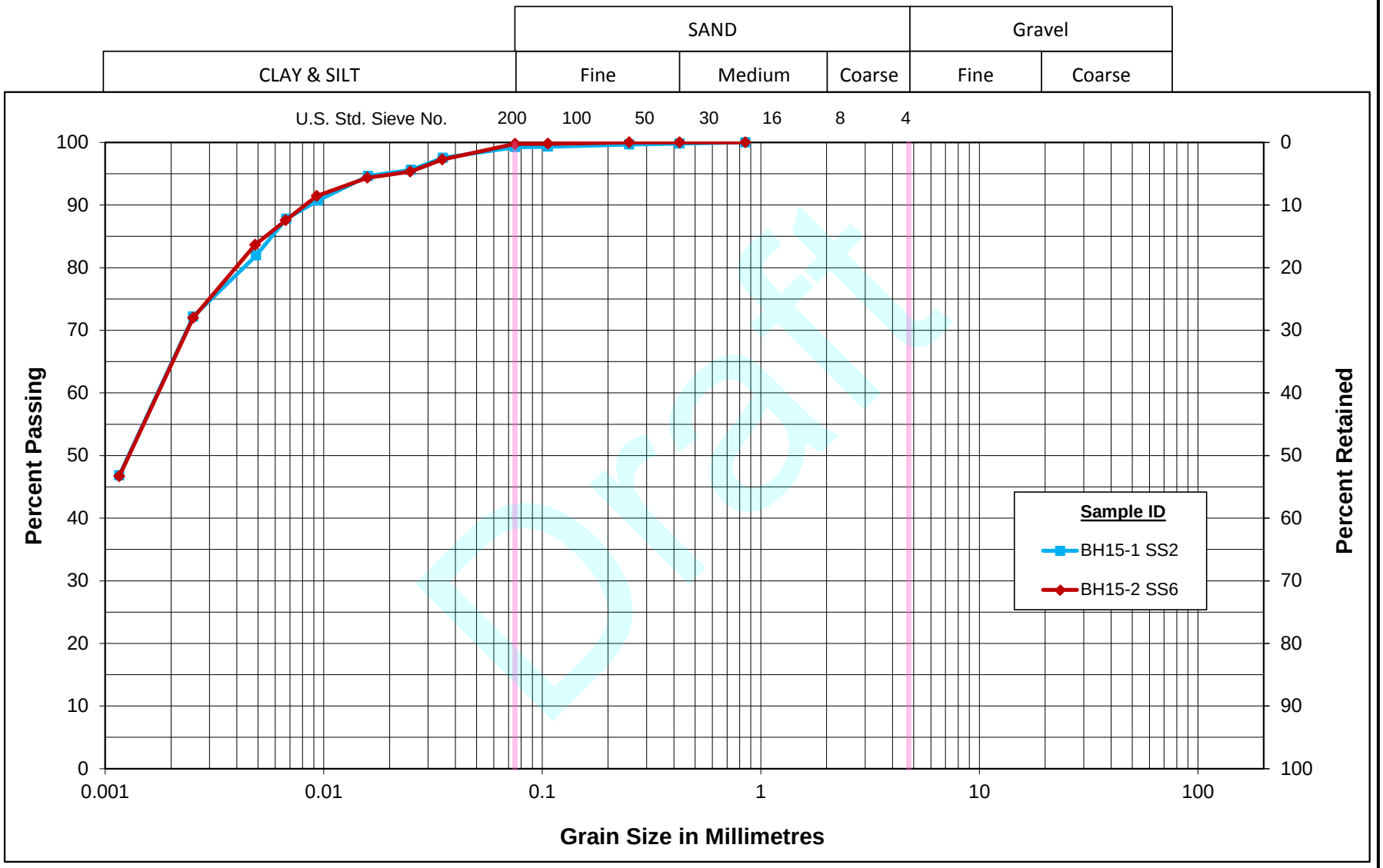
App'd

Date

APPENDIX D

Laboratory Test Results

Unified Soil Classification System



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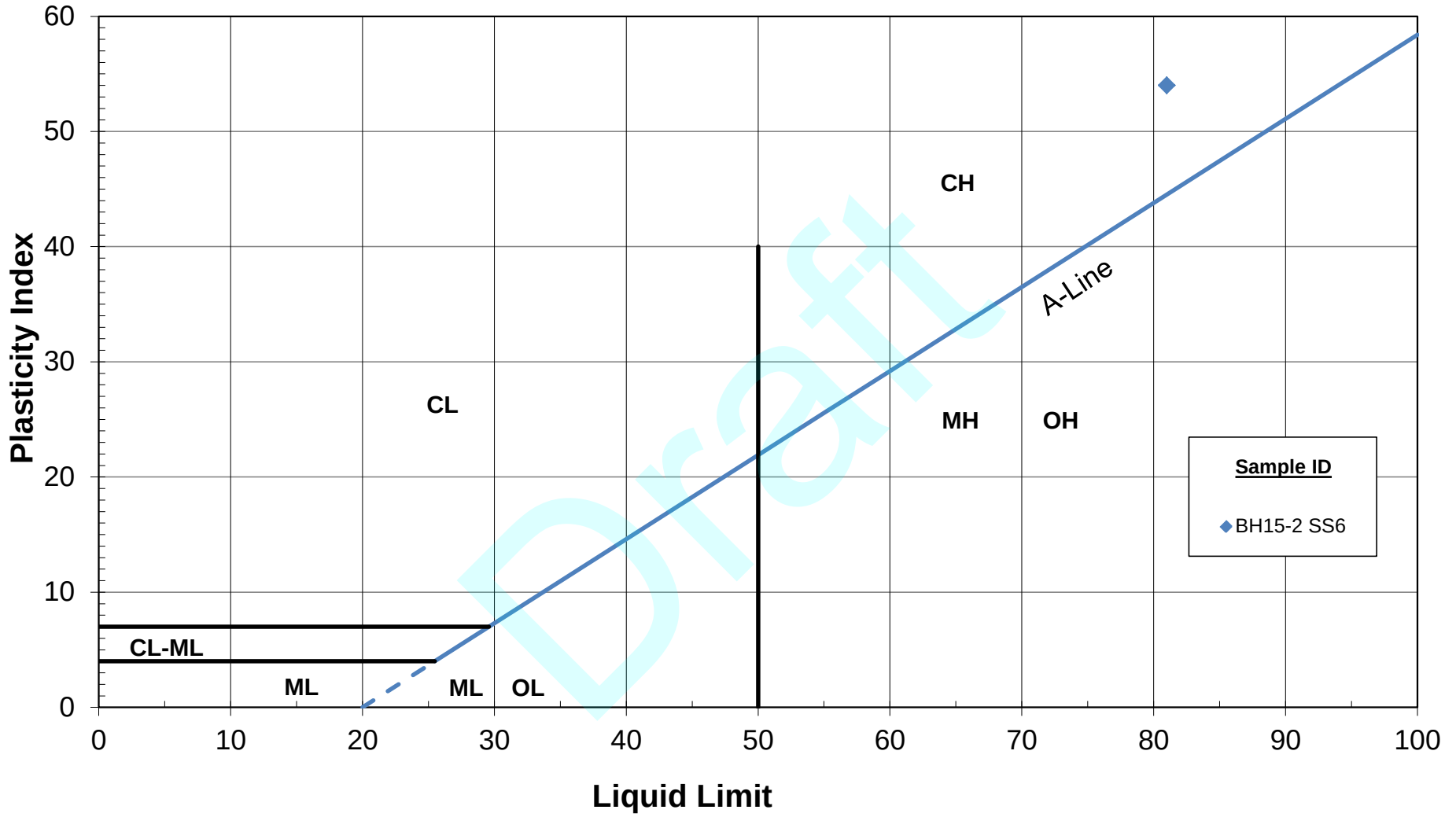
GRAIN SIZE DISTRIBUTION

Fat Clay (CH)

Figure No. 1

Project No. 122411154



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PLASTICITY CHART

Figure No. 2

Project No. 122411154