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Canadian Coast Guard | Garde côtière canadienne

60.96m (200 ft) GUYED TOWER INSTALLATION
ESTEVAN POINT LIGHT STATION
BRITISH COLUMBIA

CANADIAN COAST GUARD
MARITIME AND CIVIL INFASTRUCTURE

CONTRACT F1705-160169

Date: Feb 2, 2017

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SECTION: 011100 GENERAL INSTRUCTIONS

PART 1 - GENERAL

1.1 Minimum Standards

.1 Perform work in accordance with National Building Code of Canada (NBC) and any other code of provincial or local application. In the case of any conflict or discrepancy, the more stringent requirements shall apply.

.1 Meet or exceed requirements of:

.1 Contract documents;

.2 Specified standards, codes and referenced documents.

1.2 Description of Work

.1 Work under this Contract includes but is not limited to the provision of all labour, materials, and equipment to install a guyed communications tower at the Estevan Point Light Station. The existing 61 m (200 ft) Le Blanc and Royal (LR24) tower is to remain in place. Work includes, but is not limited to:

.1 Design, supply, and installation of new 60.96 m (200 ft) guyed tower

.2 Design, supply, installation and new foundation and anchors for guyed tower.

.3 Installation of new antennas and all associated cabling.

.4 Design, supply and installation of new grounding system.

.5 Design, supply and installation of wave guide bridge and foundations.

1.3 Work Location

.1 Work is to be completed at the Estevan Point Light Station located on the west coast of Vancouver Island on the western tip of the Hesquiat Peninsula. Appendix A: Site Location / Photos gives site location details and includes some photos of the existing site. Site coordinates are 49°23.3’ N - 126° 33’ W. Site Plan Drawing WM-126-1001 shows the location of the existing tower and the proposed new tower.

.1 The site is typically only accessed via helicopter. The contractor is responsible for providing all transportation services of materials, equipment and crew to and from the site during construction. This also includes any trips required during tendering.

.2 The Canadian Coast Guard will be responsible for the transportation of materials and equipment at the start of the project prior to any construction. Once construction beings the contractor will be responsible for the transportation of crews and supplies to and from the site.

.3 Before tender closing, Contractors should familiarize themselves with the location, scope of work, site restrictions, and temporary measures required for completing the work as specified.

.2 Contractor should note that this work is to be performed on the site of an existing operational tower where microwave and radio frequency transmission and reception is occurring.

1.4 Submittals

.1 Mandatory submittals and schedule for submission are detailed below and in Appendix B Summary of Submittals. The following identifies general requirements only. The relevant sections must be consulted for a complete listing of mandatory content. This summary is not an exhaustive list of all submissions required for the duration of the project, as additional submissions may be required after award.

.2 Technical bid proposal items:

.1 Deadline: Submit with bid

.2 Deliverables:

.1 Design profile drawing of the proposed tower that includes tower section type, section splice detail, section weight and foundation loads.

.2 Contractor Qualifications, to include:

.1 Listing of subcontractors

.2 Proof of five (5) previous tower design build contracts of a similar construction and remote site or helicopter access complexity. Examples of similar contracts are to be steel lattice towers in the 61m height range that were installed in remote locations with no road access.

.3 Schedule:

.1 Deadline: Submit with bid.

.2 Deliverables:

.1 The contractor shall furnish a high level schedule that identifies completion dates for the following milestones: design, fabrication, mobilization, installation and project completion. Schedule shall also clearly define the anticipated start and finish of the project.

.4 Design Package:

.1 Deadline:

.1 Within 28 calendar days of contract award.

.2 Deliverables:

.1 Design Engineer qualifications to include:

.2 Drawings stamped and signed by a qualified Professional Engineer registered in the Province of British Columbia. Drawings to conform to all requirements outlined in Section 033000 and Section 133613.

.5 Tower Fabrication Plan:

.1 Deadline:

.1 Within 28 calendar days of contract award.

.2 Deliverables:

.1 Tower supply company qualifications to include:

.1 Canadian Welding Bureau (CWB) Certification

.2 Proof of five (5) previous tower design/fabricate contracts of a similar construction and remote site/helicopter use complexity.

.2 Tower fabrication plan as per the requirements in Section 133613

.6 Construction Plan:

.1 Deadline:

.1 Within 28 calendar days of contract award.

.2 Deliverables:

.1 A Construction Plan of sufficient detail to demonstrate that the Contractor has considered all the challenges of the project and is prepared to undertake the works in a competent and professional manner in accordance with all legislation, including:

.1 Contractor Qualifications, to include:

.1 Core Project member contact information (site foreman and project manager);

.2 Complete listing of all Subcontractors.

.2 Project specific safety program (Section 013530);

.3 Project environmental protection plan (Section 013543);

.4 Concrete construction plan (Section 033000);

.5 Tower erection plan (Section 133613);

.7 Supplemental Material

.1 Deadline:

.1 21 calendar days following acceptance of the works

.2 Deliverables:

.1 Tower design and field erection drawings

.2 Tower foundation and anchorage drawings

.3 Project as-built drawings

.4 Concrete test results

1.5 Fees, Permits, and Certificates

.1 Contractor shall provide authorities having jurisdiction with all information requested.

.1 Contractor shall provide copies to Coast Guard of any documentation submitted to other authorities related to the work described in this document.

.2 Contractor shall pay fees and obtain certificates and permits required.

.3 Contractor shall furnish certificates and permits when requested.

1.6 Temporary Facilities

.1 Existing Radio Building can be used for electrical power and small dry storage.

.1 Site powered by two diesel generators; a 15 kW generator and a back-up 25 kW generator that runs during high load requirements. The generators do not run at the same time. Electrical power is available to the Contractor through the generators, however any power requirements beyond the site's capabilities must be provided by the Contractor.

.2 Sanitary facilities are available to Contractor as noted in Section 011400.

.3 If additional facilities are required, provide sanitary facilities for work force in accordance with governing regulations and ordinances. Arrange, pay for, and maintain temporary electrical power supply and water supply as required, in accordance with governing regulations and ordinances.

.4 A Kubota B2601 Tractor / Back Hoe will be available at the station to assist with excavations.

1.7 Protection of Existing Work

.1 Care shall be taken to safeguard any existing structures and/or equipment. Upon completion of the work, all rejected materials, materials declared surplus by Coast Guard, and debris shall be removed from the site.

1.8 Reference Documents

.1 The most recent publication or edition of any document referenced in this specification should be used unless the referencing clause states that this clause does not apply.

PART 3 - EXECUTION

3.1 Deadline

.1 Tower fabrication must be completed prior to August 15, 2017.

.2 All construction materials to be mobilized to site by CCG including tower and associated equipment, to be supplied by contractor to CCG Victoria Base at 25 Huron Street Victoria, BC by August 31, 2017.

.1 Alternate material transport requests or drop off locations will be reviewed by CCG, but are not guaranteed.

.3 All other aspects of the project must be completed before December 15, 2017.

SECTION: 011400 WORK RESTRICTIONS

PART 1 - GENERAL

1.1 Access and Egress

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including foundations, guy anchors, storage areas, ramps or ladders, and independent of finished surfaces in accordance with relevant municipal, provincial and other regulations.

1.2 Helicopter Operations

.1 Helicopters and helicopter cranes used for external load lifting during construction, maintenance and demolition activities shall comply with any and all applicable regulations of the Canadian Aviation Regulations (CAR), SOR/96-433 for helicopter external sling load operations.

.2 Every practical precaution shall be taken to provide for the protection of the employees from flying objects in the rotor downwash. All loose gear, equipment and materials within 100 feet of the load lifting area and setting the load, and all other areas susceptible to rotor downwash, shall be secured or removed.

.3 There shall be constant, reliable communication between the pilot, competent rigger. Signal systems between aircrew and ground personal shall be checked and understood in advance of hoisting the load. This applies to either radio or hand signal systems.

.4 The construction crew performing the work shall be trained in advance of any helicopter external sling operations.

1.3 Use of Site and Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to Radio Building and provide for Canadian Coast Guard staff access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Canadian Coast Guard will assign sanitary facilities and on-site accommodations for use by Contractor's personnel. Keep facilities clean.

.1 On site lodging and sanitary facilities are available in the crew house.

.2 The crew house is furnished and has three (3) bedrooms, kitchen, living room, full bathroom and basement.

.3 The crew house has water and electricity. Water supply is from rain harvesting which is filtered and stored three external poly tanks. Water usage restrictions are in affect. Any water requirements above what is available in the external tanks is the contractor's responsibility to provide.

.4 The cost is $10.00 per person per night payable to the Light Station staff as directed by Coast Guard designated project manager.

.5 Use of the crew house shall be scheduled in advance with the Canadian Coast Guard.

.5 Closures: protect work temporarily until tower and antenna installation contract work is completed.

1.4 Alterations, Additions or Repairs to Existing Works

.1 Execute work with least possible interference or disturbance to normal use of premises and continuous operation of Light Station maintained by staff or Canadian Coast Guard. Arrange with Coast Guard to facilitate execution of work.

1.5 Existing Services

.1 Notify Coast Guard of intended interruption of services and obtain required permission.

.1 A 61 m (200 ft) existing guyed communications tower is in service and will remain in operation for the duration of the project.

.2 Where work involves breaking into or connecting to existing services, give Coast Guard 5 working days of notice for necessary interruption of mechanical or electrical services throughout course of work. Keep duration of interruptions to a minimum.

1.6 Special Requirements

.1 Carry out noise generating work from 8:00 to 17:00 hours, work outside these hours can be coordinated with or at the discretion of the site staff.

.1 Submit Construction Plan a minimum three weeks prior to mobilizing to site.

.2 Coordinate delivery of materials and equipment with Coast Guard after approval of Construction Plan and prior to mobilization.

.3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.4 Keep within limits of work and avenues of ingress and egress.

.5 Ingress and egress of Contractor vehicles at site is limited to time and locations that will not disrupt the continuous operation of Light Station maintained by staff or Canadian Coast Guard.

1.7 Security

.1 Where security has been reduced by work of contract, provide temporary means to maintain security.

1.8 Building Smoking Environment

.1 Comply with smoking restriction. Smoking is not permitted.

SECTION: 013300 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 General

.1 This section specifies general requirements and procedures for the Contractor's submissions of documents to Coast Guard for review.

.2 Do not proceed with the work until submitted documents or samples have been reviewed by Coast Guard.

.3 Where items or information is not produced in SI Metric units, converted values are acceptable.

.4 Contractor's responsibility for errors and omissions in submission is not relieved by Coast Guard's review of the submitted documents.

.5 Notify Coast Guard, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Coast Guard's review of submission, unless Coast Guard gives written acceptance of specific deviations.

.7 Make any changes to submissions that Coast Guard may require consistent with Contract Documents and resubmit as directed by Coast Guard.

.8 Provide Coast Guard with a written notice, when resubmitting, of any revisions other than those requested Coast Guard.

1.2 Submission Requirements

.1 Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.2 Allow three (3) working days, or as stipulated in the specifications, for Coast Guard to review the submission.

.3 The Contractor's Engineer shall stamp and sign any submissions requiring a Professional Engineer's seal certifying his approval of samples, verification of field measurements, and compliance with Contract Documents.

.4 Accompany submission with cover letter, in duplicate, containing:

.1 Date;

.2 Project title and number;

.3 Contractor's name and address;

.4 Identification and quantity of each document or sample;

.5 Other pertinent data.

.5 Submissions shall also include:

.1 Preparation and revision dates;

.2 Project title and number;

.3 Name and address of: Subcontractor, Supplier, and Manufacturer.

.6 Once reviewed by Coast Guard, copies should be distributed.

1.3 Engineering Plans

.1 Engineering plans supplied by the Contractor must be original plans in paper form and CD-ROM, giving all details required by these specifications and the information specified in the S37-13. The unit system shall be the metric system. The plans must be approved by Coast Guard before proceeding with fabrication or construction, as the case may be.

.2 Engineering plans shall be sealed by a Professional Engineer licensed to practice in the province of British Columbia, and shall have at least 5 years of experience in tower design to CSA S37.

.3 Any changes to Engineering Plans must be approved by Coast Guard. Changes will be highlighted on Engineering Plans and an As-Built set of Engineering Plans will be submitted at the conclusion of the project.

.4 Engineering Plans shall contain (but not be limited to) the following data:

.1 Reference design standard.

.2 All design loads for specified load conditions.

.3 All analysis, calculations, and reactions for foundations, guys, and tower. A capacity profile of tower giving designed % load capacity for tower legs, diagonals, guys, and foundations should also be provided.

.4 Leg diameters for each section, types of connections and typical details.

.5 Details of ice guards, attachments of antennas, anti-climb devices and transmission line placement.

.6 Details of the grounding system and cable requirements.

.7 Any other information deemed relevant by the Design Engineer

.5 As-Builts shall be provided with digital photographs and scanned redline drawings, within 30 days following completion of the installation to the CCG Project Manager in a CD format. The CD should be labelled for easy identification. Refer to attached As Built Checklist for the list of requirements needed to complete As-Builts.

.6 As-Builts shall contain (but not be limited to) the following data:

.1 As built CD Cover requirements:
- .1 Contractor name
- .2 Project title
- .3 Date as built was created.

.2 As Built Content requirements:
- .1 One page report/summary of work completed or not completed.
- .2 Details/notes provided in summary must match details/instructions on redlined/marked up drawings. All pages of the document must be stamped "AS-BUILT", dated and signed.

.2 Redlined drawings.

.1 Any changes or variation from the original design must be clearly indicated in red markings on the drawings provided within the work order.

.2 Antenna type and model must be specified when there is a change in the scope of work.

.3 Contractor hired to complete a portion of scope of work must clearly indicate work completed and not completed in a summary.

.3 Labeled/Redlined photographs saved as **SiteName_item-name_date.jpeg.**

.1 Photographs must be taken of work completed clearly showing location of installed equipment. Photographs of the tower/pinwheels/antenna booms/site compound/cabinets/platforms should be taken further back to clearly indicate as much information as possible, which will help for future additions.

.2 Photographs should not exceed 2Mb in size and should only be saved in JPEG format.

.3 Modifications must be referenced on the corresponding photograph.

.4 Drawings of new hardware *(if applicable)*

.5 Antenna and cable test results as per section 3.12.

.6 Pulse charts.

.7 Any other information deemed relevant by the Design Engineer

SECTION: 013530 HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 General

.1 Observe construction safety measures of National Building Code of Canada 2015, Worksafe British Columbia, Workers' Compensation Board and municipal authorities provided that in any case of conflict or discrepancy the more stringent requirements shall apply.

.2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada and Health and Welfare Canada.

.3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations

.4 Comply with Province of British Columbia Workers Compensation Act, RSBC 1996 – Updated 1996 and Worksafe British Columbia's Occupational Health and Safety Regulation.

.5 Deliver copies of WHMIS data sheets to Coast Guard on delivery of materials.

.6 The Contractor shall implement a safety program which shall address all elements of the work.

1.2 Contract Submittals

.1 Within 28 calendar days of award of Contract, submit to Coast Guard two copies of Contractor's and Sub-Contractor's Project specific safety program including:

.1 A listing of all activities specific to the project and their Health & Safety risks or hazards.

.2 Detailed descriptions of how the activities are to be carried out as well as methods for mitigating hazards and risks.

.3 A listing of personnel responsible for health and safety measures, and Emergency procedures.

.4 Proof of training for all employees working at heights and proof of rescue training for at least one employee working on site.

1.3 Safety Assessment

.1 Perform site specific safety hazard assessment related to the project.

1.4 General Requirements

.1 Develop written site site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Coast Guard may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.5 Responsibility

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 Unforeseen Hazards

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Coast Guard verbally and in writing.

SECTION: 013543 ENVIRONMENTAL PROCEDURES

PART 1 - GENERAL

1.1 Scope of Work

.1 The Contractor must implement and enforce the following procedures throughout the duration of the work to mitigate potential negative impacts on the surrounding environment.

1.2 References

.1 Work under this section shall be undertaken in strict conformance with all listed references, In the case of any conflict or discrepancy the more stringent requirements shall apply.

.1 Canadian Environmental Protection Act

1.3 Submittals

.1 Contractor shall submit an environmental protection plan

.1 Deadline:

.1 With Construction Plan

.2 Deliverables:

.1 Submit a plan addressing procedures to be implemented to mitigate any negative impact on the environment. Detail:

.1 Equipment features (age, spill containment);

.2 Staging, refueling, and cleaning areas;

.3 Clean-up and/or containment procedures (including concrete/grout);

.4 Waste disposal methods and sites;

.5 De-watering plan.

PART 2 - PRODUCTS

2.1 General

.1 Avoid use of hazardous products. Use environmentally friendly products where practical.

PART 3 - EXECUTION

3.1 Construction Area

.1 Confine construction activities to as small an area as practical.

.2 Establish material storage, cleaning, and refueling areas where impacts to the surrounding environment will be negligible or readily mitigated.

3.2 Stockpiling of materials

.1 Materials must be stockpiled as far from the shoreline as practical. Tarps must be used to control dust and run-off.

.2 Stockpiled excavated materials shall be skirted using filter fabric to control run-off of fines during rain.

3.3 Disposal of Wastes

.1 Clean-up the site at the end of each working day.

.2 All waste material to be disposed of in a legal manner at a site approved by local authorities. Transporter/hauler must be appropriately licensed.

.1 Recycle or reuse materials where possible.

.3 Fires and burning of rubbish on site not permitted.

.4 Do not bury rubbish and waste materials on site.

3.4 Clearing and Grubbing

.1 Only clear vegetation that interferes with construction.

.2 Minimize stripping of topsoil and vegetation.

.3 Restrict tree removal to areas indicated or designated by Coast Guard.

3.5 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.1 Suspend works during periods of heavy rainfall and add temporary covers to discourage run-off.

.2 Water pumped from excavation shall be adequately treated to ensure that water returning to the watercourse contains minimal fines. Procedures anticipated for preventing the pumping of fines shall be identified in the environmental protection plan, and may include the following:

.1 The use of filter bags;

.2 Straw bale check dams or silt fence;

.3 Discharge through naturally occurring vegetation.

.3 The means for controlling silt run-off shall be dependent on the site and the quantity of water pumped, and shall be to the discretion of the Coast Guard site staff.

.4 Sediment control measures shall be inspected and improved/cleaned/replaced as necessary.

3.6 Pollution Control

.1 Provide methods, means, and facilities to prevent the contamination of soil, water, and atmosphere from the discharge of pollutants produced by construction operations.

.2 Vehicles, machinery, and equipment shall be in good repair, equipped with emission controls as applicable and operated within regulatory requirements.

.3 Avoid noise generating activities during evenings.

.4 Avoid unnecessary idling of vehicles or heavy machinery.

.5 Limit use of equipment around the shoreline where possible.

.6 Implement and maintain dust and particulate control measures in accordance with provincial requirements:

.1 All bulk material haul equipment shall be appropriately tarped. Watertight vehicles shall be used to haul wet materials

.7 Designate a cleaning area for tools to limit water use and runoff. Do not allow deleterious materials to enter waterways. Ensure emptied containers are sealed and stored safely for disposal.

.8 The contractor shall take all necessary precautions to guard against the release of any noxious substance or pollutant to the environment. In the event of any spill the Contractor shall take immediate action to contain the release and mitigate any impact.

.1 Materials and equipment to intercept, contain, and clean-up any spill or other

release shall be maintained on site throughout the construction period and must be readily accessible at all times.

.2 Any uncontrolled release of a known contaminant (spills, fire/smoke) shall be reported to appropriate Provincial Authority and Coast Guard. Spills of deleterious substances to be immediately contained and cleaned up in accordance with federal and provincial regulatory requirements.

3.7 Traffic

.1 Avoid the use of heavy machinery in areas of sensitive slopes and high water tables. Avoid using machinery on land during wet weather.

SECTION: 014500 QUALITY CONTROL

PART 1 - GENERAL

1.1 Inspection

.1 Canadian Coast Guard or its representative shall have access to the work at all times. If parts of the work are prepared off-site or in a shop, access shall be given to such work throughout the duration of the project.

.2 In the event the work must be submitted to special testing, inspection or approvals prescribed by Canadian Coast Guard in these specifications or provided for in work-site regulations, the request for inspection must be made without unreasonable delay.

.3 The below list identifies key milestones where the Canadian Coast Guard will require an opportunity to take samples/inspect:

.1 Tower fabrication: The Coast Guard will inspect the tower and associated components after the fabrication work is complete.

.2 Subgrade verification: The Coast guard will inspect the subgrade upon completion of the excavation.

.3 Concrete testing: The contractor will be responsible to test concrete for air, slump and strength during the pour.

.4 Final completion: The Coast guard will conduct a final inspection upon completion.

1.2 Procedures

.1 Provide Canadian Coast Guard with advance notice whenever testing is required in accordance with these specifications, so that all parties involved can be present.

.2 Provide necessary manpower and installations for obtaining and handling samples and material on site.

.3 Provide access to site if the site is of remote nature whereby the contractor is responsible for providing access to the site

1.3 Rejected Work

.1 Remove defective work, whether incorporated into the work or not, which has been

rejected by Canadian Coast Guard as failing to comply with the contract documents. Replace or re-execute in accordance with the Contract Documents.

1.4 Tests and Mixture Formulas

.1 Supply test reports and required mixture formulas.

1.5 Factory Tests

.1 Submit test certificates as prescribed in the relevant section of the specifications.

1.6 Acceptance of Work

.1 Canadian Coast Guard will make acceptance visits of work executed by the Contractor at critical milestones identified in the Tower and Construction Plans.

.2 The Contractor shall inform Canadian Coast Guard at least three (3) working days before these inspection visits.

.3 All work shall be completed in compliance with the specifications before requesting the visit for inspection. If the work is not completed or deemed non-compliant, the Contractor shall be responsible for all costs incurred for subsequent inspections.

SECTION: 033000 CONCRETE WORK

PART 1 - GENERAL

1.1 Scope of Work

.1 Work of this section includes the design of:

.1 One [1] reinforced concrete tower foundation.

.2 Three [3] reinforced concrete guy anchors.

.3 Waveguide bridge foundations

.2 Work of this section includes the supply of all labour, material, and equipment, necessary to complete the following activities:

.1 Construction of the tower foundation, and guy anchors;

.2 Construction of waveguide bridge foundations.

.3 A Coast Guard representative shall inspect sub-grade upon completion of any excavation where a design bearing surface is to be achieved. If sub-grade is deemed unsuitable, a Coast Guard representative shall advise repair requirements.

1.2 References

.1 Work under this section shall be undertaken in strict conformance with all listed references, In the case of any conflict or discrepancy the more stringent requirements shall apply.

.1 Canada Labour Code Part II - January 2008

.2 NRC-CNRC National Building Code of Canada 2015

.3 Worksafe British Columbia Occupational Health and Safety Regulation

.4 CAN/CSA-A23.1-04 Concrete Materials and Methods of Concrete Construction

.5 CAN/CSA A23.2-04 Methods of Test and Standard Practices for Concrete

.6 CAN/CSA A23.3-04 Design of Concrete Structures

.7 CAN/CSA-G30.18 Billet Steel Bars for Concrete Reinforcement

.8 CAN/CSA S269.3 Concrete Formwork

.9 ACI Specification 306 Cold Weather Concreting (if relevant)

1.3 Performance Requirements

.1 The foundation shall be designed to perform as reasonably expected for a life of 50 years.

1.4 Submittals

.1 Submittals shall be forwarded to Coast Guard in accordance with the provisions of section 013300.

.1 Foundation Design Package

.1 Deadline:

.1 Within 28 calendar days of contract award

.2 Deliverables:

.1 Foundation design package shall include drawings(s) showing plan and section views of the foundation.

.2 Drawing shall be sealed and signed by an engineer licensed to practice in the province of British Columbia.

.2 Foundation Construction Plan:

.1 Deadline:

.1 Furnish with Construction Plan (Section 011100)

.2 Deliverables:

.1 Provide a high level summary of mix properties and admixtures to demonstrate compliance with Coast Guard Criteria and completed foundation design;

.2 Concrete placing plan, identifying the location of the source of ready mix concrete, the transport and placement plan and any other relevant information required to demonstrate a plan for getting the concrete into the forms in the required amount of time;

.3 Finishing procedures;

.4 Curing methods and schedule;

.5 Clean-up procedures; and,

.6 Mitigation measures to account for hot or cold temperatures where reasonably anticipated during the construction period.

1.5 Quality Assurance

.1 Coast Guard's minimum inspection requirements are detailed below. The Contractor shall be responsible to notify Coast Guard of the date and time that the works may be inspected. Notice must be provided no less than three (3) working days in advance to permit scheduling of quality assurance testing. All deficiencies in the works identified at the time of inspection shall be remedied to the satisfaction of Coast Guard, by the Contractor at their expense. Work shall not progress until inspections have been completed and the Contractor has been provided with written notice to proceed with the works.

.1 Upon completion of formwork and placement of reinforcement.

.2 During execution of concrete placement.

.2 The Contractor shall be responsible to arrange for concrete testing on site the day of the pour. This shall include at minimum a test for slump, air entrainment and strength (6 cylinders, one [1] 7 day, two [2] 28 day and 3 extras).

.1 Extra concrete cylinders shall be cast and broken to determine foundation strength prior to tower erection. This will be coordinated by CCG staff upon request from the contractor.

PART 2 - MATERIALS

2.1 General

.1 All materials shall conform to specifications referenced in CAN/CSA-A23.1-04.

2.2 Concrete

.1 Concrete mix to be determined by Contractor and shall be indicated on Engineering plans.

.1 The use of calcium chloride as an admixture is not permitted.

PART 3 - EXECUTION

3.1 General

.1 Concrete must be placed, finished, and cured in accordance with the Contractor's

submitted construction plan and the contractor's engineered drawings.

3.2 Design Requirements

.1 Foundations

.1 The Contractor's Engineer must design a suitable load bearing foundation for the tower in consideration of the specific soil conditions obtained through a subsurface geotechnical investigation as detailed in Appendix E: Geotechnical Assessment Report SGL16-045: Estevan Point Communications Tower dated December 15, 2016. A foundation design based on "normal" soil conditions is unacceptable.

.2 The foundation design shall account for loads imparted by the new tower and any other loads that could be reasonably anticipated to affect the foundation. All loads shall be identified on the finalized drawings.

.3 The drawings shall be signed and stamped by an engineer licensed to practice in the province of British Columbia.

.4 The drawings shall include references to all applicable standards. This being a design for a federal agency, the Canada Labour Code and National Building Code of Canada (most recent editions) shall be included.

.5 The design shall clearly indicate in the notes all loads considered in the design of the foundation.

.6 The design shall include the results of the geotechnical investigation as detailed in Appendix E: Geotechnical Assessment Report SGL16-045: Estevan Point Communications Tower dated December 15, 2016.

3.3 Preparation

.1 Preparation shall not commence until bearing surfaces have been inspected by Coast Guard.

.2 Remove all loose and deleterious material.

.3 Construct forms and reinforcement in accordance with the engineer's specifications.

.4 All exposed 90° edges shall be chamfered.

3.4 Placement

.1 Concrete placement shall not commence until formwork and reinforcement have been inspected by Coast Guard.

.2 Contractor shall place finish and cure concrete as per CAN CSA A23.1 making all adjustments necessary to account for climatic conditions anticipated during the curing

period.

.3 The water table at some of the foundation locations has been identified in the geotechnical assessment report SGL16-045: Estevan Point Communications Tower Dec 15 2016. Pumping of water at excavation sites may be required.

.4 Concrete shall be placed in one continuous pour.

.1 The development of cold joints shall be avoided. Alternately, cold joints must be previously approved in writing by Coast Guard.

.5 Finish exposed concrete surfaces to provide a lightly brushed non-skid surface, unless otherwise specified in the submitted design.

.6 All exposed concrete edges must be appropriately chamfered.

.7 Cut control joints where specified.

.8 Contractor shall provide samples as required during placement operation for the performance of quality assurance testing.

.9 Concrete shall be finished so as to slope gently away from the center of the slab. No water shall pond on the finished surface.

3.5 Curing

.1 Shall be undertaken in accordance with CAN CSA A23.1 and the Contractor's approved Construction Plan.

.1 Curing regiment employed must take into account local climatic conditions reasonably anticipated to occur during the curing period.

3.6 Inspection

.1 Concrete pour(s) to be witnessed by Coast Guard representative. Concrete testing to CAN/CSA-A23.2 by testing laboratory is the responsibility of the contractor. Contractor shall provide samples as required during concreting operation for test purposes.

SECTION: 133613.13 STEEL TOWERS

PART 1 - GENERAL

1.1 Scope of Work

.1 Work in this section consists of the following:

.1 Design, supply, and installation of the new 60.96m (200 ft) guyed tower.

.2 Supply and install of a trylon cougar rail fall arrest system.

.3 Design, supply, and install of anti-climb system.

.4 Install CCG supplied **VHF** antennas and cabling.

.5 Install CCG supplied obstruction lights and cabling.

1.2 References

.1 CSA S37-13 - Antenna Towers and Antenna Supporting Structures

.2 CAN/CSA-W47.1 - Certification of Companies for Fusion Welding of Steel Structures

.3 CAN/CSA W59 - Welded Steel Construction (Metal-Arc Welding)

.4 Canada Labour Code Part II – January 2008

.5 Health and Welfare Canada Limits of Exposure to Radio-Frequency Fields Frequencies from 3KHz – 300GHz, Safety Code 6

.6 Worksafe British Columbia Occupational Health and Safety Regulation

.7 National Building Code of Canada – 2015

.8 TC CAR Standard 621.19 - Standards Obstruction Markings

.9 SSPC-SP 1 Solvent Cleaning

.10 SSPC-SP 7/NACE No. 4, Brush-Off Blast Cleaning

1.3 Submittals

.1 Submittals shall be forwarded to Coast Guard in accordance with the provisions of section 013300.

.2 Erection Plan:

.1 Deadline:

.1 With construction plan.

.2 Deliverables:

.1 Plan must clearly demonstrate procedures and methods to be employed to:

.1 Place new tower on new foundation;

.2 Monitor that turn of nut has been completed;

.3 Field remedies to address any damage to the coating system incurred during erection;

.4 Coast Guard reserves the right to request additional documentation verifying the suitability of the proposed labour and equipment anticipated to be employed in the erection of the tower.

.3 Tower Design Package

.1 Deadline:

.1 Within 28 calendar days of contract award.

.2 Deliverables:

.1 Tower design package shall include drawings(s) showing plan and section views of the tower, as well as all other requirements identified in this section.

.2 Drawing shall be sealed and signed by an engineer licensed to practice in the province of British Columbia.

1.4 Guarantee

.1 The Contractor shall guarantee that all material and workmanship used in the fabrication and construction of this tower is in accordance with all applicable specifications listed in this Section.

.2 For a period of one year from the date of the installation, the Contractor shall replace, free of charge, all defective components. A failure of 10% or more of a particular item shall be interpreted as failure in all similar units. All these items shall be replaced by units of a superior design at no cost to Coast Guard.

.3 The contractor is responsible for the testing of all cables and antennas after installation. Test results must be included with the as-built completion package. All the equipment manufacturers' recommendations must be followed in the testing. Refer to Item 3.12 for guidance on documentation and submission.

1.5 Materials Supplied by Coast Guard

.1 Kubota B2601 Tractor / Back Hoe will be available at the station. Operation of the tractor will granted at the discretion of the CCG, upon proof of experience or relevant certification.

1.6 Quality Assurance

.1 Coast Guard's minimum inspection requirements are detailed below. The Contractor shall be responsible to notify Coast Guard of the date and time that the works may be inspected. Notice must be provided no less than three (3) working days in advance to permit scheduling of quality assurance testing. All deficiencies in the works identified at the time of inspection shall be remedied to the satisfaction of Coast Guard, by the Contractor at their expense. Work shall not progress until inspections have been completed and the Contractor has been provided with written notice to proceed with the works:

.1 During erection to confirm all procedures are being followed.

PART 2 - MATERIALS

2.1 General

.1 Structural steel shall conform to CSA Standard G40.21, Grade 300W, or better. All materials used in the tower to be new and in conformance with requirements of CSA S37-13.

.2 All mounts, mount hardware, and line hangers shall be heavy-duty hot dip galvanized (ASTM A123/123M).

.3 Guys shall be one continuous length Grade 180 Guy Strand for diameters 13mm (1/2 in) and below, or Bridge Strand for diameters greater than 13mm (1/2 in) unless otherwise approved by Coast Guard. Cut ends of strand shall be capped with a stainless steel hose clamp or ear clips. Provide full articulation at each end of guy as per CAN/CSA S37-13 by means of shackles.

.4 All tower and anchor hardware, where possible, including turnbuckles, thimbles and shackles shall be Crosby products or approved equivalent, manufactured from AISI 1035 steel, heat treated, and shall be hot dip galvanized. Provide locking device for turnbuckle, vinyl coated cable or approved equal.

.5 Bolts shall be hot-dip galvanized with hexagonal heads and be supplied with hexagonal nuts. The unthreaded part of the bolt shall be long enough for full bearing of the adjoining parts and enough washers shall be placed on each bolt under the nut to prevent the nut from reaching the end of the bolt threads when tightened.

PART 3 - EXECUTION

3.1 Design

.1 The 60.96m (200 ft) tower shall be designed in accordance with CSA S37-13 to support all antennas indicated in Appendix C: Antenna and Cable Schedule. The tower must also be capable of supporting all initial and future antenna loading requirements as listed in Appendix C: Antenna and Cable Schedule.

.2 The Contractor shall design all tower accessories, including new mounts for all antennas, climbing facility with a fall arrest assembly, anti climb panels, and ice shields.

.3 All antennas, lines and mounts should be incorporated in the tower design.

.4 The tower shall be designed by a qualified professional engineer registered in Canada, holding a certificate to practice, with a minimum of 5 years experience in tower design to CAN/CSA S37-13.

.5 The tower shall be designed to resist all loads specified in CAN/CSA S37-13 as well as maximum loads caused by all equipment installed in the towers as described in these specifications and plans. Site specific wind pressure is to be used as per CAN/CSA S37-13.

.6 Unless otherwise specified, loads shall be determined in accordance with CAN/CSA S37-13 Antennas, Towers and Antenna Supporting Structures, latest edition; reliability Class I.

.7 Tower shall be designed for a wind load as specified in Appendix D: Site Specific Wind Pressure Report – July 5, 2016.

.8 Tower shall be designed for a radial ice load of +25mm (Class II).

.9 The operational requirements for maximum twist and tilt are 0.5 degrees.

.10 Tower sections are to be parallel for the length of the structure (no tapered sections may be used).

.11 Each tower section must weigh no more than 636 kg (1400 lbs).

.12 The bottom section of the tower is to have articulation to the tower base foundation. Tower manufacturer is to supply an unpainted galvanized 'star mount base' assembly or other approved structural fitting and a receiving plate mount that attaches to the tower base foundation.

.13 Anchorage steel below grade that is not encased in concrete shall be galvanized and further corrosion protection shall be provided.

.14 Contractor shall submit Engineering Plans outlining materials, dimensions, loading and any other pertinent details for tower construction to Coast Guard for approval prior to fabrication.

.15 The tower design package shall include pulse tables for the new tower. The pulse tables shall be provided at 5°C increments for temperatures ranging between -20°C and 40°C.

3.2 Fabrication

.1 The Contractor shall provide a copy of Canadian Welding Bureau (CWB) certification to the Coast Guard for the tower fabricating company and for each worker assigned to this project.

.2 Each tower segment shall be designated with a number that is easily read after galvanizing. This mark shall be stamped into each piece in such a manner, or in such a place, as will not injure or reduce the strength of the piece. The marks on like pieces shall be in the same relative position on each piece. The markings indicated on each piece shall correspond with that shown on the erection drawings.

.3 All members shall be fabricated in accordance with the Engineering Plans and as per CSA S37-13.

.4 All like parts shall be interchangeable. All like parts shall have the same number.

.5 In any bending or reworking of any material, methods employed shall ensure that the physical properties of the material are not impaired.

.6 All welding shall be performed in accordance with CSA Standard W59 latest revision and shall be undertaken by a fabricator approved by the Canadian Welding Bureau to the requirements to CSA Standard W47, latest revision.

.7 Special mounting arrangements shall be incorporated into the tower sections for the secure mounting of:

.1 All hoisting grips, cable clamps, and grounding kits for each run of cables.

.2 All lighting fixtures, junction boxes, and cable supports.

.3 Fall arrest system extension where it extends above the top of the tower;

.4 Ground lugs or grounding attachments at the bottom level of the star mount.

.8 The Contractor shall ensure that electrical continuity exists between all tower sections.

3.3 Climbing Apparatus

.1 The tower shall be equipped with a climbing apparatus complete with a fall arrest rail, in compliance with applicable CSA S37-13 requirements.

.2 The climbing apparatus shall provide an unobstructed climbing path and maintain the required climbing clearance radius as per CSA S37-13.

.3 Climbing apparatus configuration, shall comply with CSA S37-13 and Canada Labour Code. Rungs shall be horizontal, have adequate clearance and line up vertically.

3.4 Fall Arrest System

.1 The Contractor shall supply and install a Fall Arrest Rail to meet CSA S37-13 requirements and CSA Z259.2.4-15.

.2 The fall arrest rail shall be free from obstructions for the complete height of the tower.

.3 The fall arrest rail shall be supported at spans not more than 1 m, or to meet the manufacturer's instructions.

.4 The fall arrest rail shall run up the tower or ladder in a manner to facilitate climbing. The fall arrest rail shall be straight and true to prevent trolley binding.

.5 The extension of the fall arrest rail beyond the top of the tower must be structurally supported for the entire height.

.6 Proper manufactured stop hardware is to be installed at the top of the fall arrest rail to prevent accidental dislodging of the trolley from the rail.

3.5 Anti-Climb Panels

.1 The tower shall include one (1) set of anti-climb panels.

.2 The anti-climb panels each will have a barrier panel internal to the tower at the top, bottom, or mid-level to prevent access.

.3 The anti-climb shall be hinged on the climbing face;

.4 Panels shall be hinged on one vertical side, with a combined latching mechanism.

3.6 Galvanizing

.1 All materials, structural steel, pipe and fittings, including bolts, nuts and washers shall be hot dip galvanized to the requirement of CSA S37-13 and CSA-G164 and as otherwise specified therein.

.2 All materials shall be completely fabricated before galvanizing (except the tapping of nuts).

.3 Before galvanizing, the steel shall be thoroughly cleaned of all paint, grease, rust, scale or other materials that will interfere with proper binding of the zinc with the steel.

.4 Tests for thickness and uniformity of coating shall be made as considered necessary by Coast Guard. Tests shall be conducted in full accordance with the requirements of CSA S37-13. If required, contractor shall pay for testing, all costs to be included in the tender price.

.5 The Contractor shall touch up in the field all steel members of the tower where the galvanized finish has been scraped or chipped during erection using zinc-enriched or Galvicon paint, or an approved equal.

.6 Steel members that have a slightly damaged finish shall be given three coats of zinc-enriched paint applied according to the manufacturer's printed instructions.

.7 Contractor shall warranty all galvanizing work for a period of not less than three (3) years.

3.7 Surface Preparation

.1 Galvanized steel must be cleaned prior to painting in accordance with SSPC –SP-1 – "Solvent Cleaning".

.2 Light Sweep blast all surfaces in accordance with SSPC-SP-7 to remove any chromate treatment, or poorly adhered zinc salts that may be present to increase mechanical bonding through increased roughness.

.3 Care should be taken to remove as little zinc as possible while maintaining desired toughness.

.4 After sweep blasting, the coating system should be applied ideally the same day and a max of one day later.

.5 Grit shall not be recycled.

3.8 Handling of Material and Transportation

.1 The tower and parts are to be built so they may be safely transported to the site from the manufacturer's premises.

.2 Materials shall be handled and stored in the plant and on the job site in such a manner that no damage shall be done to the materials of any existing building or structure.

.3 Special care shall be taken to ensure that galvanizing is not damaged during handling and erection of materials.

.4 Storage of materials on the site will be the responsibility of the Contractor. Coast Guard will designate site storage and construction layout areas after Contractor has submitted their Construction Plan.

3.9 Tower Installation

.1 Prior to site mobilization, Contractor shall submit a Construction Plan detailing construction tasks, methods, and equipment required to complete work to Coast Guard for review. Construction Plan should include methods of completing work, equipment required, as well as hazards and mitigation for hazards for each work task.

.2 The contractor shall give Coast Guard a written notice TWO WEEKS prior to the commencement of the standing of the tower.

.3 The contractor shall be responsible to obtain accurate measurements pertaining to elevation differences between the tower base and guy anchors.

.4 The tower shall be erected in a manner that will not bend, scrape, distort, or injure the component parts of the galvanizing.

.5 Every failure of the tower sections to join together properly shall be reported to the Coast Guard.

.6 Upon completion of erection, the tower shall be inspected by the Contractor for damage. Any damaged or missing items, including nuts, bolts, etc., shall be replaced. The tightness of all bolts shall be rechecked at this time.

.7 The Contractor shall be responsible to ensure that no members of the tower are over stressed during erection.

.8 Any members damaged during erection shall be replaced at the Contractor's cost.

.9 The Contractor shall be responsible for any damages done to the work of others, or to adjoining structures and property during erection.

.10 The guy tensions shall be adjusted to within +15% and -5% of the stipulated design tensions noted in the design drawings and as per the requirements of CSA S37-13.

.11 The tension calculations shall consider the ambient temperature at the time of adjustment.

.12 Full consideration of anchor location with respect to the tower base must be incorporated into the calculation of correct guy tensions.

.13 Install no-climb sign on the access panel of the anti-climb (sign to be provided by Coast Guard).

3.10 Guys

.1 The top and bottom guy at each anchor location shall be equipped with guy guards installed in front of the guy grounding connections.

.2 Ice breaker rods must be installed on the tower guy lines.

3.11 Transmission Lines

.1 All transmission lines shall be as indicated in Appendix C: Antenna and Cable Schedule.

.2 All waveguide shall be of one continuous length. Splices are not acceptable without written approval from the Owner.

.3 RF cable shall be supported by non-corrosive hangers attached to galvanized steel feeder line brackets and the waveguide bridge. The only exception is where lines are placed in cable trays. Hangers must be of the proper size for the corresponding line type. Multiple lines in an oversize hanger is unacceptable.

.4 Waveguide cable shall be supported in such a manner that the maximum distance between hangers does not exceed one meter or the manufacturer's recommended spacing, whichever is less.

.5 Where required, waveguide hangers shall be attached to structural members using threaded rods and angle adaptors. The use of plastic wrap lock/tie wrap devices to secure TX lines is not acceptable.

.6 Hoisting grips shall be installed on cables every 60 meters according to the manufacturer's instructions and attached to a structural member using a shackle and or turnbuckle.

.7 The bending radius of all cables shall not exceed the manufacturer's recommendations, and all bends must be made in a careful manner.

.8 Feeder entry ports must be selected carefully. Ensure that feeders do not cross each other underneath the wave guide bridge are adequately protected against potential damage.

.9 The following are the mandatory connection and weatherproofing procedures.

The specifications are always provided with the connector installation instructions and vary according to connector size. A courtesy wrap of vinyl tape is required before application of additional weatherproofing to allow easy removal of the weatherproofing for future access. Andrew weatherproofing kits must be applied consistently with the manufacturer's specifications.

.10 All lines shall be mounted on the outside of the tower. Location of cabling is to be submitted to the Coast Guard for approval, and shall be represented on the stamped tower drawings

.11 All Cables to the VHF antennas shall be run from the CCG equipment building via a new waveguide bridge (see Section 323000) to the antennas. Transmission lines shall be routed through a new CCG installed building entry port. Contractor shall provide rubber boots for sealing the cable entry ports. These boots should be manufactured for the appropriate sized cable.

.12 Wave guide boots should be installed on both sides of ports once installation and testing of lines has been completed. Boots should be installed with the seams aligned vertically and towards the bottom of the ports. The boot seams and cable entry are to be sealed with an outdoor rated silicone compound. Boots must be the proper size for the port OD and corresponding line type. Multiple lines through an oversize cable entry hole is unacceptable.

.13 The feeder cable terminations that extend into the equipment building should be terminated no more than 2 ft. from the cable entry ports.

.14 Cables types are specified in Appendix C: Antenna and Cable Schedule.

.15 Antennas shall be mounted to the tower leg at the azimuth indicated in Appendix C: Antenna and Cable Schedule.

3.12 Testing of Cables

.1 The contractor is responsible for the testing of all cables and antennas after installation. Test results must be included with the as-built completion package.

.2 Each sweep test result (plot) must contain the following information:

.1 **Main Title:** Site Name /Location Code /Sweep Type /Sweepers Name /Sweepers Company Name

.2 **Subtitle:** Line Type / Antenna Type / Antenna function

.3 Sweep Plot

.1 Test date

.2 Start and stop frequencies on the horizontal scale

.3 Result of return loss in dB or distance to fault in VSWR on the vertical scale with the reference line well marked

.4 Note of any flexible or rigid sections, or pressure windows

.5 Calibration is “ON”

.6 Limit line set at value determined by link budget calculation.

.7 Markers set to values at either end of frequency range for return loss or at VSWR peaks for distance to fault.

SECTION: 260527 GROUNDING

PART 1 - GENERAL

1.1 Scope of Work

.1 Work in this section consists of design, supply and installation of ground system comprising: copper-clad steel ground rods and tinned copper ground cable complete with exothermic ground rod connections.

1.2 References

.1 Canada Labour Code Part II – January 2008

.2 Worksafe British Columbia Occupational Health and Safety Act and Regulation

.3 National Building Code of Canada – 2015

.4 CAN/CSA S37-13 Antennas, Towers, and Antenna-Supporting Structures

.5 CAN/CSA C22.1-15 Canadian Electrical Code

1.3 Disposal of Wastes

.1 All excess materials shall be disposed of in a legal manner by Contractor.

1.4 Submittals

.1 Submittals shall be forwarded to Coast Guard in accordance with the provisions of section 013300.

.2 Grounding System Design Package:

.1 Deadline:

.1 Within 28 calendar days of contract award.

.2 Deliverables:

.1 Tower grounding system design package shall include drawings(s) showing plan and section views of the grounding system, as well as all other requirements identified in this section.

.2 Drawing shall be sealed and signed by an engineer licensed to practice in the province of British Columbia.

.3 Construction procedures

.1 Deadline

.1 With Construction Plan

.2 Deliverables

.1 As-built drawings

1.5 Existing conditions

.1 The existing grounding system may not be reused.

.2 Before commencing work under this section the Contractor must establish the location of all buried services which may interfere with the execution of the work.

PART 2 - PRODUCTS

2.1 Quality Control

.1 Grounding work shall be undertaken to the Canadian Coast Lightning and Grounding Protection for MCTS Sites (Lightning and Grounding Protection -67-013-000-ES-EQ-001-eng document) any deviation from these industry standards shall be made known to Coast Guard.

PART 3 - EXECUTION

3.1 General

.1 Contractor shall field verify all dimensions and details before proceeding with work.

.2 Safeguard existing antennas, transmission lines, and other tower attachments, as well as the tower members and connections; do not alter or otherwise impair the performance of any of these items during the course of work without written approval from Coast Guard.

.3 Ensure buildings, towers, fuel tanks, generators, and site utilities are not disturbed by excavation and backfill activities.

.4 Any areas requiring excavation shall be investigated by Contractor to ensure they are free of any underground utilities. If the location of underground utilities interferes with the installation of grounding system, notify Coast Guard.

.5 In areas where topsoil is present, strip 152 mm (6 in) topsoil and stockpile. Upon completion of backfilling, spread topsoil evenly over affected areas.

SECTION: 265536 OBSTRUCTION LIGHTING

PART 1 - GENERAL

1.1 Scope of Work

.1 Work in this section consists of the reinstallation of an obstruction lighting system to conform to the latest edition of TC CAR Standard 621, National Electrical Manufacturers' Association (NEMA) and this specification.

1.2 References

.1 CSA S37-13 - Antenna Towers and Antenna Supporting Structures

.2 Canada Labour Code Part II – January 2008

.3 TC CAR Standard 621 - Obstruction Marking and lighting

.4 National Building Code of Canada – 2015

.5 Worksafe British Columbia Occupational Health and Safety Act and Regulation

PART 2 - MATERIALS

2.1 General

.1 Obstruction marking and lighting as per TC CAR Standard 621 – Obstruction Marking and lighting.

.2 Obstruction lighting shall include a controller.

.3 Power cables shall be supplied by CCG and installed by the contractor.

PART 3 - EXECUTION

3.1 Controller

.1 The lighting controller shall be located in the equipment building as per drawing WM-126-1001.

3.2 Photocell

.1 Lighting system shall be equipped with a photocell….

3.3 Installation Details

.1 The lighting system shall be installed as per manufacturers recommendations,

.2 All junction boxes shall have drip loops on all the cables in and out of the box.

SECTION: 312310 EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 General

.1 Work under this section consists of the excavation for the new guyed tower foundation and anchor locations.

1.2 References

.1 Canada Labour Code Part II – January 2008

.2 CSA-S37-13 - Antenna Towers and Antenna Supporting Structures

.3 Worksafe British Columbia Occupational Health and Safety Act and Regulation

PART 2 - EXECUTION

2.1 Excavation

.1 Excavation for tower foundations and anchors shall be undertaken as per Engineering Plans submitted by Contractor.

.2 Keep excavations free of water while work is in progress.

2.2 Backfill

.1 Backfill for tower foundations and anchors shall be undertaken as per Engineering Plans submitted by Contractor.

SECTION: 323000 SITE IMPROVEMENTS

PART 1 - GENERAL

1.1 Scope of Work

.1 This section covers the design, fabrication, supply and installation of miscellaneous site structures such as the waveguide bridge.

1.2 References

.1 CSA-S37-13 - Antenna Towers and Antenna Supporting Structures

.2 CAN/CSA-W47.1 - Certification of Companies for Fusion Welding of Steel Structures

.3 CAN/CSA W59 - Welded Steel Construction (Metal-Arc Welding)

.4 Canada Labour Code Part II – January 2008

.5 Worksafe British Columbia Occupational Health and Safety Act and Regulation

.6 National Building Code of Canada – 2015

PART 2 - EXECUTION

2.1 Waveguide Bridge

.1 The waveguide bridge shall provide support for cabling and complete protection for the antenna, and power cabling running from the Coast Guard equipment building. In addition, the waveguide bridge shall provide easy access to all cables it protects.

.2 Maximum spacing between waveguide bridge posts shall be 3.05 m (10 ft).

.3 The waveguide bridge must be independent of and not directly connected to the tower structure or building. The waveguide bridge shall be designed to carry all initial and proposed cables or conduits as indicated on the antenna and transmission line schedule. The waveguide bridge shall support the cables at intervals to prevent sagging and to meet the manufacturer's standards.

.4 The Contractor shall provide a suitable adjustable flair plate extension to the Waveguide Bridge to protect the cables.. This plate must provide optimum coverage for cables transitioning from the tower and equipment building to the waveguide bridge.

.5 Design, supply, and install a waveguide bridge from the existing Coast Guard equipment building to the new tower. Waveguide bridge shall support all lighting cables, as well as cables to antennas listed in Appendix C: Antenna and Cable Schedule.

APPENDIX A: SITE LOCATION / PHOTOS

49°23.3’ N - 126° 33’ W

Estevan Point Light Station

View from existing tower

Radio Building

Existing Communications Tower

Crew House (top), Radio Building (center) and Existing Tower

APPENDIX B: SUMMARY OF SUBMITTALS

Submission Description	Section(s)	Required Date
Design profile drawing of the proposed tower	011100 – 1.4.2.1	With Bid
Contractor Qualifications	011100 – 1.4.2.2	With Bid
Safety Policies	013530 – 1.2.1	28 days after award
Schedule	011100 – 1.4.3.1	With Bid
Design Package	011100 – 1.4.4.1	28 days after award
Tower Fabrication Plan	011100 – 1.4.5.1	28 days after award
Construction Plan	011100 – 1.4.6.1	28 days after award
Foundation Design Package	033000 – 1.4.1.1	28 days after award
Project Specific Safety Program (Can be merged with Project Construction Plan)	013530 – 1.3.1	28 days after award
Draft Field Erection Drawings		28 days after award
Final Field Erection Drawings - Sealed by a Professional Engineer		5 days after receipt of CCG approved Draft Field Erection Drawings
Tower Engineering Plans	133613.13 – 1.3.3.1	28 days after award
Welding Certifications	133613.13 – 3.2.1	Before fabrication
Concrete Engineering Plans	033000 – 1.4.1	28 days after award
Project Construction Program (Can be merged with Project Specific Safety Plan)	133613.13 – 3.9.1	28 days after award
As-Builds	013300 – 1.3.2	30 days after project completion

APPENDIX C: ANTENNA AND CABLE SCHEDULE

Initial Microwave / Antenna Loading Requirements

#	Elev (m)	Antenna	Owner	Azimuth	TX-Line
1	59.75	10 ft High Performance Microwave Antenna with Shield and Hypalon (7GHz)	CCG	347.4	EW77
2	59.75	8 ft High Performance Microwave Antenna with Shield and Hypalon (7GHz)	CCG	121	EW77
3	58.0	SY206-SF2SNM VHF Yagi Antenna	CCG	75	LDF4-50A
4	55.0	SY206-SF2SNM VHF Yagi Antenna	CCG	347.3	LDF4-50A
5	53.7	SY206-SF2SNM VHF Yagi Antenna	CCG	121	LDF4-50A
6	52.0	SY206-SF2SNM VHF Yagi Antenna	CCG	75	LDF4-50A
7	44.2	SY206-SF2SNM VHF Yagi Antenna	CCG	75	LDF4-50A
8	44.2	8 ft High Performance Microwave Antenna with Shield and Hypalon (7GHz)	CCG	321.5	EW77
9	21.4	SD212-SF2P4SNM (D00S-WABK) VHF Dipole Antenna	CCG		LDF4-50A

Future Microwave / Antenna Loading Requirements

#	Elev (m)	Antenna	Owner	Azimuth	TX-Line
1	52.0	8 ft High Performance Microwave Antenna with Shield and Hypalon (7GHz)	CCG	121	EW77
2	48.75	10 ft High Performance Microwave Antenna with Shield and Hypalon (7GHz)	CCG	347.4	EW77
3	29.0	8 ft High Performance Microwave Antenna with Shield and Hypalon (7GHz)	CCG	321.5	EW77

APPENDIX D: SITE SPECIFIC WIND PRESSURE REPORT

Estevan Point, BC 61m Tower

Site-Specific 10-yr. Wind Pressure Report (V2.1 2016-01-04 Format)

Site Information:

Name: Estevan Point, BC
Latitude: 49° 22' 59.89" N
Longitude: 126° 32' 34.84" W
Tower Height (m): 61
Elevation MSL (m): 9

Results:

Note: Following direction from the S37 Committee, Qe can no longer be provided.

Q_{nbc} (Pa):	530	$Q_{nbc} = 530(Z/10)^{0.2}$	V_{nbc} = 64.05 mph
Icing:	As per CAN/CSA S37-13		
Q_{Min} (Pa)	250	$Q_{Min} = 250(Z/10)^{0.2}$	V_{Min} = 43.99 mph

Wind Pressure Formula (for z in metres and result in Pa):

$$Q_h = 0.12919 \{[0.0000\, e^{(-0.0000\, z)} + 1.0000\, \ln(z/0.0500) / \ln(z/0.0500)]\, 63.90\}^2\, (z/10)^{0.200}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1\, e^{(-a2\, z)} + a_3\, \ln(z/z_h) / \ln(z/z_{01})]\, v_{01}\}^2\, (z/10)^{0.200}$$

Site Values of Coefficients:

$$a_1 = 0.0000,\ a_2 = 0.0000,\ a_3 = 1.0000,\ z_h = 0.0500,\ z_{01} = 0.0500,\ v_{01} = 63.90 \text{ mph}$$

Definitions

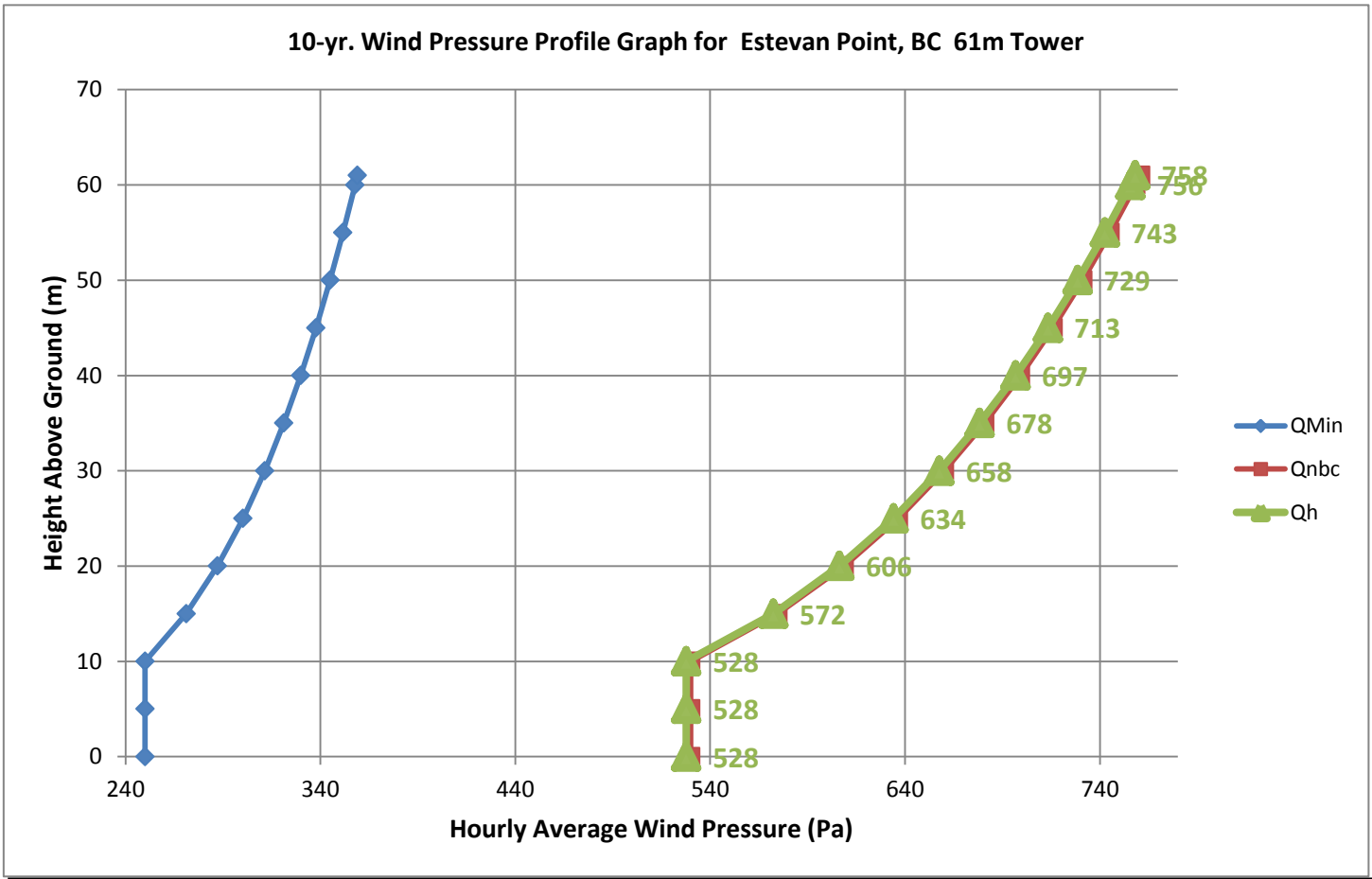
Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada and the Q_{nbc} value is profiled with the $^2/_{10}$ power law.
Q_{Min}: Minimum reference wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law as per Section 5.4.1 of S37-13.

Wind Pressure Formula: Formula for the design wind pressure as a function of height. (Ref.: S37-13, 5.3.1)
Height (Z): the vertical distance (m) above ground level at the base of the tower.

Note: No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].

Estevan Point, BC 61m Tower



Q_{nbc} Profile: Regionally representative reference wind profiled with the $^2/_{10}$ power law.
Q_{Min} Profile: Minimum site-specific wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law.
Q_h Profile: The site-specific wind pressure profile directly from the Taylor and Lee (1984) simple guidelines.

Explanatory notes regarding the new report format and changes to calculation methods.

1. The most significant change from the previous versions of the reports is that the exponent used in the Q_h equation is no longer fixed at 0.2. The exponent now varies continuously from 0.2 for open terrain to 0.32 for closed terrain.
2. A new Q_{min} profile has been added to the graphs and it represents the minimum acceptable reference wind pressure profile. It starts with the minimum 10-metre reference wind pressure of 320 Pa for a 50-year return period as per section 5.4.1 of S37-13 and then uses the same $^2/_{10}$ power law formulation as the Q_{NBC} profile to generate the curve. The corresponding 10-metre reference wind pressures for the 10-year and 30-year return periods are 250 Pa and 300 Pa respectively.
3. Q_h will always be plotted even when they are less than Q_{Min}. This will allow designers to see how Q_h varies over the height of the tower. Also, in rough terrain and for taller towers, the Q_h profile might cross the Q_{Min} profile.
4. The coefficients for the Q_h equation will now always be given regardless of the Q_{NBC} or Q_{Min} values.
5. The wind speeds will be given for each of the 4 equations (Q_h, Q_{NBC}, or Q_{Min}) too.

Estevan Point, BC 61m Tower

Site-Specific 30-yr. Wind Pressure Report (V2.1 2016-01-04 Format)

Site Information:

Name: Estevan Point, BC
Latitude: 49° 22' 59.89" N
Longitude: 126° 32' 34.84" W
Tower Height (m): 61
Elevation MSL (m): 9

Results:

Note: Following direction from the S37 Committee, Qe can no longer be provided.

Q_{nbc} (Pa):	630	$Q_{nbc} = 630(Z/10)^{0.2}$	V_{nbc} = 69.83 mph
Icing:	As per CAN/CSA S37-13		
Q_{Min} (Pa)	300	$Q_{Min} = 300(Z/10)^{0.2}$	V_{Min} = 48.19 mph

Wind Pressure Formula (for z in metres and result in Pa):

$$Q_h = 0.12919 \{[0.0000\, e^{(-0.0000\, z)} + 1.0000\, \ln(z/0.0500) / \ln(z/0.0500)]\, 69.94\}^2\, (z/10)^{0.200}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1\, e^{(-a2\, z)} + a_3\, \ln(z/z_h) / \ln(z/z_{01})]\, v_{01}\}^2\, (z/10)^{0.200}$$

Site Values of Coefficients:

$$a_1 = 0.0000,\ a_2 = 0.0000,\ a_3 = 1.0000,\ z_h = 0.0500,\ z_{01} = 0.0500,\ v_{01} = 69.94 \text{ mph}$$

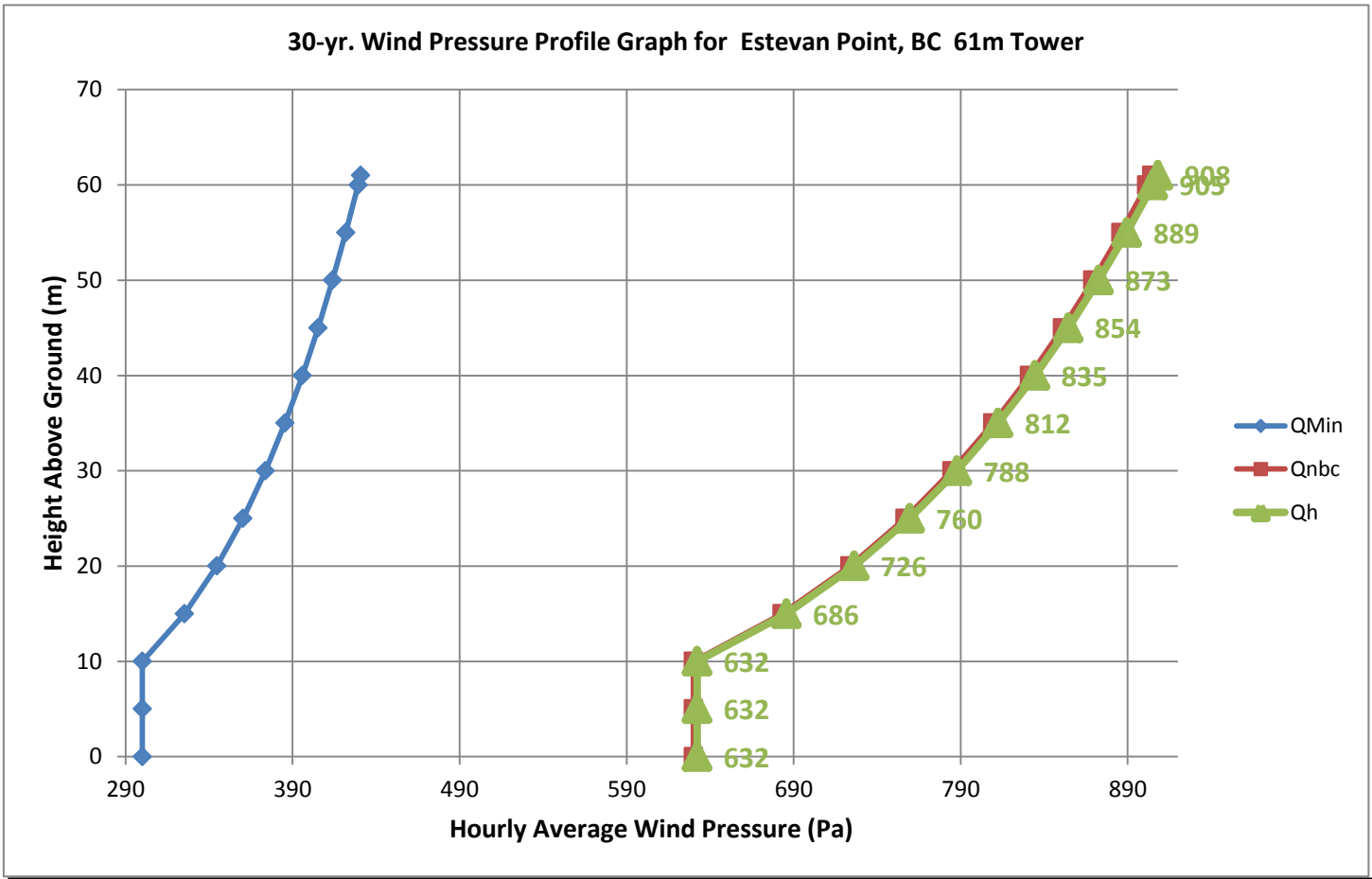
Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada and the Q_{nbc} value is profiled with the $^2/_{10}$ power law.
Q_{Min}: Minimum reference wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law as per Section 5.4.1 of S37-13.

Wind Pressure Formula: Formula for the design wind pressure as a function of height. (Ref.: S37-13, 5.3.1)
Height (Z): the vertical distance (m) above ground level at the base of the tower.

Note: No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



Q_{nbc} Profile: Regionally representative reference wind profiled with the $^2/_{10}$ power law.
Q_{Min} Profile: Minimum site-specific wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law.
Q_h Profile: The site-specific wind pressure profile directly from the Taylor and Lee (1984) simple guidelines.

Explanatory notes regarding the new report format and changes to calculation methods.

1. The most significant change from the previous versions of the reports is that the exponent used in the Q_h equation is no longer fixed at 0.2. The exponent now varies continuously from 0.2 for open terrain to 0.32 for closed terrain.
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3. Q_h will always be plotted even when they are less than Q_{Min}. This will allow designers to see how Q_h varies over the height of the tower. Also, in rough terrain and for taller towers, the Q_h profile might cross the Q_{Min} profile.
4. The coefficients for the Q_h equation will now always be given regardless of the Q_{NBC} or Q_{Min} values.
5. The wind speeds will be given for each of the 4 equations (Q_h, Q_{NBC}, or Q_{Min}) too.

Estevan Point, BC 61m Tower

Site-Specific 50-yr. Wind Pressure Report (V2.1 2016-01-04 Format)

Site Information:

Name:	Estevan Point, BC
Latitude:	49° 22' 59.89" N
Longitude:	126° 32' 34.84" W
Tower Height (m):	61
Elevation MSL (m):	9

Results:

Note: Following direction from the S37 Committee, Qe can no longer be provided.

Q_{nbc} (Pa):	680	$Q_{nbc} = 680(Z/10)^{0.2}$	V_{nbc} = 72.55 mph
Icing:	As per CAN/CSA S37-13		
Q_{Min} (Pa)	320	$Q_{Min} = 320(Z/10)^{0.2}$	V_{Min} = 49.77 mph

Wind Pressure Formula (for z in metres and result in Pa):

$$Q_h = 0.12919 \{[0.0000\, e^{(-0.0000\, z)} + 1.0000\, \ln(z/0.0500) / \ln(z/0.0500)]\, 72.70\}^2\, (z/10)^{0.200}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1\, e^{(-a2\, z)} + a_3\, \ln(z/z_h) / \ln(z/z_{01})]\, v_{01}\}^2\, (z/10)^{0.200}$$

Site Values of Coefficients:

$$a_1 = 0.0000,\ a_2 = 0.0000,\ a_3 = 1.0000,\ z_h = 0.0500,\ z_{01} = 0.0500,\ v_{01} = 72.70 \text{ mph}$$

Definitions

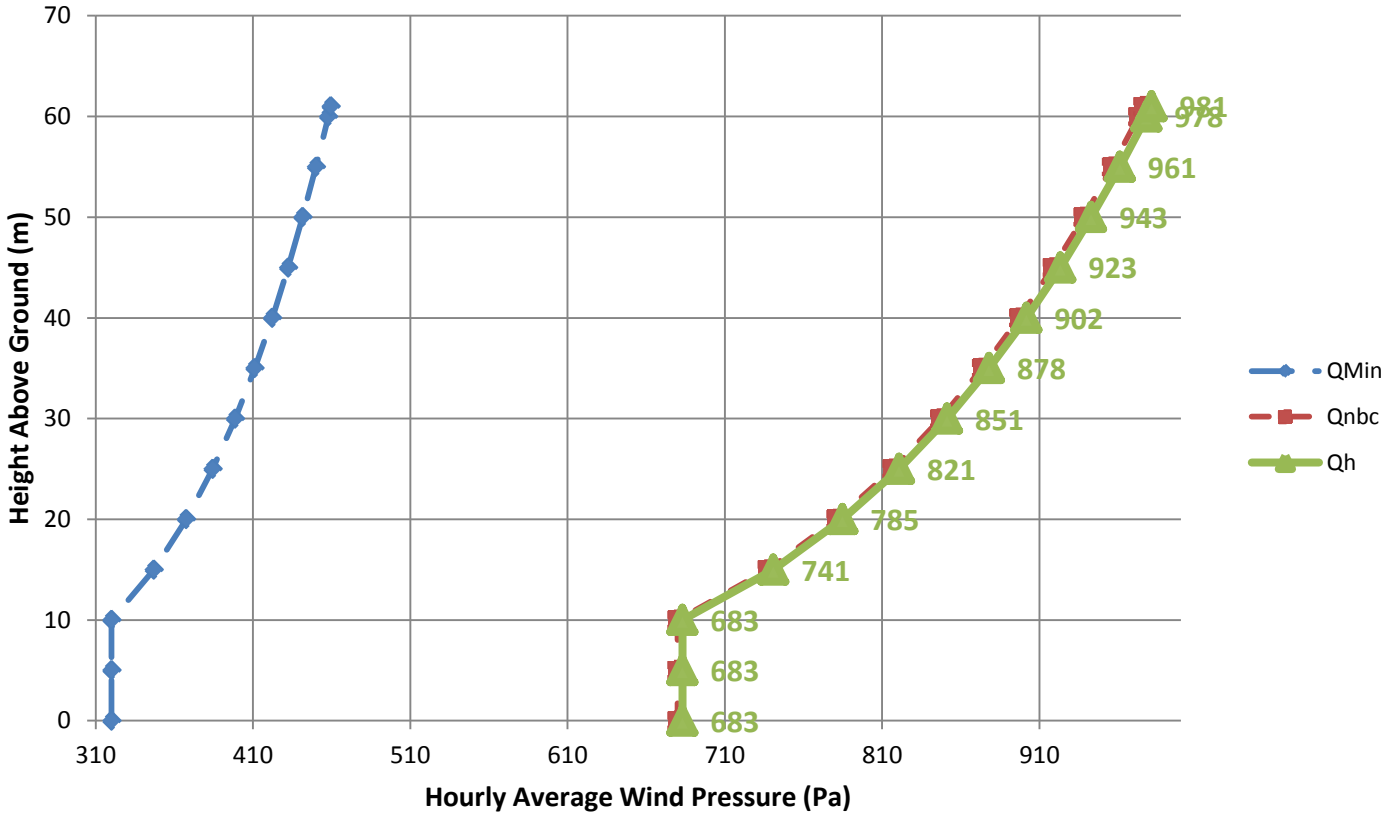
Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada and the Q_{nbc} value is profiled with the $^2/_{10}$ power law.
Q_{Min}: Minimum reference wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law as per Section 5.4.1 of S37-13.

Wind Pressure Formula: Formula for the design wind pressure as a function of height. (Ref.: S37-13, 5.3.1)
Height (Z): the vertical distance (m) above ground level at the base of the tower.

Note: No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].

Estevan Point, BC 61m Tower



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5. The wind speeds will be given for each of the 4 equations (Q_h, Q_{NBC}, or Q_{Min}) too.

APPENDIX E: GEOTECHNICAL ASSESSMENT REPORT

SIMPSON Geotechnical Ltd

December 15, 2016
File: SGL16-045

Canadian Coast Guard
25 Huron Street
Victoria, BC V8V 4V9

Attention: Mr. Joe Murray

Re: Report of Geotechnical Assessment for Proposed Estevan Point Light Station Communications Tower, Vancouver Island

INTRODUCTION

As requested, Simpson Geotechnical Ltd. (SGL) has conducted a preliminary geotechnical assessment for a 200 foot (60m) tall guyed communications tower at the Estevan Point Light Station that is located on the Hesquiat Peninsula on the west coast of Vancouver Island at approximately 49° 22' 59.89"N and 126° 32' 34.84"W. The proposed tower would replace an existing guyed communications tower currently located at the site. We understand that the tower would be designed and constructed in accordance with CSA S37-13 (Antennas, towers, and antenna- supporting structures) and good construction practice.

A preliminary site and subsurface assessment was conducted on September 2, 2016 at which time hand equipment only was utilized for the subsurface assessment. As the preliminary assessment was not able to investigate the subsurface soil to the anticipated depth required for the foundation and guy anchors due to limitations of hand excavation, a supplementary drilled borehole subsurface assessment was conducted on December 1, 2016.

BACKGROUND

We obtained geologic Map 2013-NVI-3 of the project area published by GeoScience BC. That map showed the site area to be underlain by Alluvium and glacio-fluvial gravel, sand and till atop Carmanah Group bedrock comprised of siltstone, shale, sandstone and conglomerate.

A site specific seismic hazard calculation was obtained from Natural Resources Canada. That calculation indicated a 10% in 50 year probability of exceedance peak ground acceleration (PGA) of 0.330g. The seismic hazard calculation output is appended.

SITE ASSESSMENT

The preliminary site assessment was conducted on September 2, 2016. The proposed tower base location was approximately 40m westward of the existing tower base. The three proposed guy anchor locations were located radially outwards from the base approximately 38m, as shown on Figure 1.

The proposed tower area was essentially level and primarily grass surfaced within the developed area of the light station. There were existing concrete walkways within the tower area that would cross below the proposed tower guywires. The general area was low-lying and at an elevation of less than 8m above sea level as seen in the contours shown on Figure 1.

The developed light station area was fringed with primarily mature conifer trees, beyond which were relatively flat slopes down to a shale bedrock beach and the Pacific Ocean on all sides except to the east, where there was a gentle slope upwards to a forested area. Shallow standing water was observed on the ground surface eastwards of the light station area and in the immediate vicinity of the Guy 3 location shown on Figure 1.

Test holes were hand excavated at the proposed tower base and guy anchor locations, and subsequently with a small Atlas Mole Rat auger drill rig. The drill rig was mobilized to the site by helicopter and operated by Drillwell Enterprises Ltd.

The hand excavated test hole at the Guy 1 location encountered organic silt topsoil overlying loose angular shale gravel that we interpret as random fill, overlying compact cobbly sand and silt at 0.5m depth. Heavy water seepage into the test hole was encountered at 0.25m depth that limited excavation and visibility below 0.5m depth.

The hand excavated test holes at the proposed Base and Guy 2 locations encountered thin organic silt topsoil overlying compact cobbly, bouldery sand with trace silt with a trace of roots to the maximum excavated depth of 1.0m. Water seepage into the Base test hole was encountered at 0.6m depth. No water seepage was encountered in the Guy 2 test hole to the maximum excavated depth of 0.5m.

Probing at the Guy 3 location suggested thick, saturated surficial organics with the groundwater level at the ground surface.

Five solid stem auger boreholes were subsequently advanced with the drill rig at the proposed tower base and guy anchor locations. Those boreholes encountered relatively consistent subsurface conditions that comprised cobbly gravel and sand, overlying moderately dense glacial till-like silty, gravelly sand, in turn overlying weak shale bedrock. The thickness of the soil layers varied considerable in the test holes, as shown in the table below. Peaty organics was encountered overtop the till materials at the Guy 3 borehole.

Groundwater was encountered in all the boreholes except Guy 2(1) at depths that ranged from ground surface (Guy 3 borehole) to 0.9m (Guy 2(2)). The subsurface conditions encountered in the boreholes are summarized in the table below and logs of the boreholes are appended.

Borehole Summary

Borehole No.	Depth to Glacial Till-like (m)	Depth to Shale Bedrock (m)	Depth to Groundwater (m)
Base	2.4	>4.5	0.6
Guy 1	1.0	2.4	0.2
Guy 2(1)	1.9	2.4	Not encountered
Guy 2(2)	1.8	2.1	0.9
Guy 3	2.0	>3.0	Surface

The encountered subsurface conditions are considered consistent with the geology map of the area that was described above.

The intertidal beach area surrounding the Estevan Point Light Station had frequent and extensive exposures of near horizontally bedded shale bedrock. The shale bedrock was weathered and easily broken with a geologic hammer indicative of weak Grade R2 rock. Discontinuities were predominantly near horizontal, closely spaced and frequently gapped where exposed on the surface. Surface scan Rock Quality Designation (RQD) ranged from 65 to 80%.

LABORATORY TESTING

Soil samples from the boreholes considered representative of the subsurface conditions were returned to our laboratory for index property tests. Those tests indicated the moisture content of the gravel and sand to range from 21.8 to 24.2% of dry weight, while the glacial till-like material had moisture content that ranged from 13.5 to 15.8%. The moisture contents and sample locations are shown on the borehole logs.

Laboratory gradation analysis was conducted on samples of the gravel and sand and glacial till-like materials. Those tests indicated the gravel and sand to be 54.8% gravel, 40.5% sand and 4.6% fines (passing the 0.075mm screen) and well graded. The glacial till-like material was 21.3% gravel, 48.1% sand and 30.6% fines and poorly graded.

DISCUSSION AND RECOMMENDATIONS

General

The subject site is considered to be geotechnically suitable for the proposed guyed communications tower provided the following recommendations are implemented. We anticipate that the most geotechnically practical support system for the proposed tower will be reinforced concrete footing for support of the tower base and rock anchors and/or deadman anchors for the guy anchors.

The materials encountered in the site assessment are not considered to be susceptible to strength loss from seismic liquefaction due to the coarse-grained gradation and/or compactness of the soil.

Excavation

We anticipate that the foundation excavation to the bedrock surface could be conducted with hydraulic excavation equipment. Although not encountered in the test holes, large boulders may be encountered in glacial outwash materials and glacial till that may require breaking for removal. All excavations should be conducted in accordance with the BC Occupational Health and Safety Regulation.

Groundwater seepage is likely to be encountered in excavations, especially during periods of wet weather. Groundwater control with sumps and pumps or cut-off ditches may be required. Seepage rates in the gravelly sand are anticipated to be relatively high, while seepage rates from the glacial till-like material is anticipated to be relatively low. Seepage from excavation side-slopes will reduce the stability of the excavation sides and may require flatter side-slopes to reduce sloughing.

Excavations should not encroach within a plane projected down and out at 1.5 horizontal to 1 vertical from the ground surface of adjacent structures without specific geotechnical advice.

Foundations and Anchors

The tower foundation and guy anchors may bear directly on an approved subgrade of undisturbed, inorganic, compact gravel and sand, or dense, undisturbed glacial till-like silty, gravelly sand, or intact bedrock. The foundation and guy anchors may be designed based on the geotechnical parameters tabled below.

Recommended Geotechnical Foundation Parameters for Foundations and Deadman Anchors in SOIL (In accordance with CSA S37-13)

Parameter	Value
Ultimate (un-factored) bearing resistance on gravelly sand	150 kPa
Serviceability bearing resistance on gravelly sand	75 kPa
Ultimate (un-factored) bearing resistance on glacial till	250 kPa
Serviceability bearing resistance on glacial till	125 kPa
Dry density of gravelly sand (γ_{dry})	19.5 kN/m^3
Submerged density of gravelly sand (γ_{sat})	9.7 kN/m^3
Dry density of glacial till (γ_{dry})	17.6 kN/m^3
Submerged density of glacial till (γ_{sat})	7.8 kN/m^3
Angle of internal friction of gravelly sand (saturated) ϕ	28°
Angle of internal friction of glacial till (saturated) ϕ	25°
Soil cohesion of gravelly sand (c)	0
Soil cohesion of glacial till (c)	5 kPa
Active Earth Pressure Coefficient for gravelly sand (K_a)	0.36
Passive Earth Pressure Coefficient for gravelly sand (K_p)	2.77
At Rest Earth Pressure Coefficient for gravelly sand (K_o)	0.53
Active Earth Pressure Coefficient for glacial till (K_a)	0.40
Passive Earth Pressure Coefficient for glacial till (K_p)	2.46
At Rest Earth Pressure Coefficient for glacial till (K_o)	0.57
Depth to groundwater	0m
Depth of frost	0.6m
Seismic Site Class (NBCC 4.1.8.4)	C

Recommended Geotechnical Foundation Parameters for Foundations and Anchors in BEDROCK (In accordance with CSA S37-13)

Parameter	Value
Bedrock type	Shale
Design depth to sound bedrock (including weathered rock)	2.1 to >4.5m
Ultimate, un-factored, bearing resistance (bearing on approved, undisturbed, intact shale bedrock)	1000 kPa
Serviceability bearing resistance	500 kPa
Ultimate, un-factored compressive strength of intact shale bedrock	25 MPa
Ultimate un-factored tensile strength of shale rock mass	3 kPa
Unit weight of intact, undisturbed shale bedrock	21 kN/m^3
Ultimate, un-factored, grout to shale rock bond stress	0.75 MPa
Recommended design depth to groundwater	0m
Rock Quality Designation (RQD)	65%
Design cone apex angle	maximum 90 degrees
Seismic site class (NBCC 4.1.8.4)	C

The ultimate and serviceability bearing resistances tabled above are based on submerged and saturated subgrade with no foundation drainage provided. The serviceability bearing resistance is intended to limit total and differential settlement to less than 15mm.

We note that the sandy subgrade materials will be easily disturbed during excavation and by both machine and foot traffic. Any loosened or disturbed subgrade material should be removed prior to foundation or anchor concrete placement.

Approved subgrade could be raised and levelled with engineered fill, if desired. Engineered fill should consist of well graded, free draining, nominal 75mm minus particle diameter sand and gravel, placed and uniformly compacted in lifts not exceeding 200mm in loose thickness. Each lift should be compacted to a minimum 100% of the laboratory

Standard Proctor maximum dry density for the material. Engineered fill should extend laterally beyond the edges of supported elements a distance at least equal to the fill thickness beneath the footing. Engineered fill compaction should be verified by field density testing.

The cobbly, bouldery sand with trace silt free of roots and organics that was encountered in the test holes may be suitable for re-use as engineered fill, following removal of cobbles and boulders larger than 75mm in diameter, subject to field approval. The glacial till material is not considered suitable for re-use.

All foundation bearing surfaces should be reviewed by SGL prior to the placement of formwork, concrete or engineered fill. Following approval of subgrade surfaces concrete or engineered fill should be placed as quickly as possible to avoid disturbance of the foundation subgrade. If soils in the areas of foundation support become disturbed from construction traffic (including foot traffic), the disturbed material should be removed or suitably re-compacted and the subgrade re-evaluated by SGL prior to concrete placement.

The un-factored lateral earth pressures on deadman guy anchors should be based on the diagram shown on Figure 2 and the parameters tabled above. Those earth pressures are based on undrained conditions and the concrete being formed directly against the undisturbed excavation face, or backfilled with thoroughly compacted engineered fill material as described above.

We envision that rock anchors could be installed from the glacial till surface. The portion of rock anchors in glacial till should not be included in the uplift resistance of the anchor. The uplift resistance should be based on the inverted cone approach for the portion of the anchor in bedrock using the parameters in this report, based on a maximum cone apex angle of 90 degrees (45 degrees each side of the long axis of the anchor). The apex of the inverted cone should be located no deeper than the midpoint of the anchor bond length. Anchors located laterally closer than 1.2 x D (where D is the anchor depth) should be considered to as act as a group.

Rock anchors should be installed in accordance with the tendon and grout manufacturers' recommendations and be proof loaded to 110% of the factored load under the review of

Simpson Geotechnical Ltd. Groundwater is anticipated to be encountered during rock anchor installation and wet conditions in the rock anchor drill holes should be anticipated.

CLOSURE

This report was prepared for the exclusive use of the Canadian Coast Guard and their appointed agents for design of the proposed guyed communications tower described herein. Any use or reliance made on this report by an unauthorized third party is the responsibility of that third party. Contractors should make their own assessment of the property for the purposes of bidding on and performing work on the site.

Geological and hydrological conditions can vary significantly over short distances and may also change with time. Actual conditions remote from the test locations may vary across the site. Any encountered variation from the subsurface conditions described in this report should be brought to the attention of Simpson Geotechnical Ltd. to consider potential significance to the recommendations provided in this report.

This report has been prepared in accordance with standard geotechnical engineering practice. No other warranty is provided, either expressed or implied.

We appreciate the opportunity to provide our services on this project. Should you have any questions, please do not hesitate to contact us.

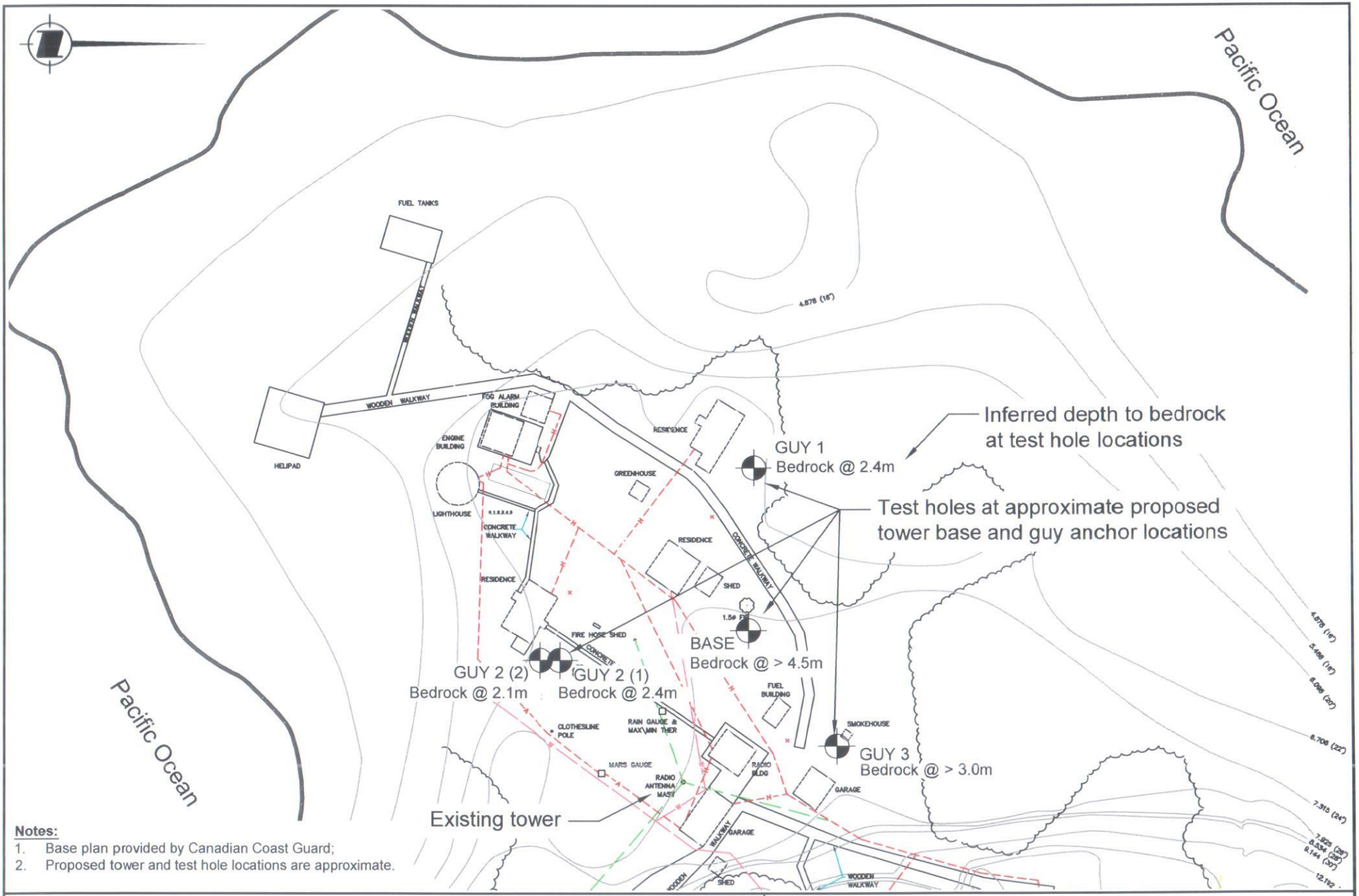
Yours truly,
Simpson Geotechnical Ltd.

Per: Richard Simpson, P.Eng.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA R.R. SIMPSON 2016

Attachments:

Figure 1 – Site Plan
Borehole Logs (5)
Gradation analyses (2 pages)
Seismic Hazard Calculation



Notes:

1. Base plan provided by Canadian Coast Guard;
2. Proposed tower and test hole locations are approximate.

Project:	Estevan Point Light Station Communications Tower				
Title:	Geotechnical Site Plan				
Client:	Canadian Coast Guard				
File:	SGL16-045	**Drawn by:** RRS	**Scale:** 1 : 1200 ±	**Date:** December 15, 2016	**Dwg. No.:** Figure 1

SIMPSON Geotechnical Ltd

BOREHOLE # Base

Date Drilled: December 1, 2016
Rig: Atlas Mole Rat
Contractor: Drillwell
Hammer Type:

Location:
Elevation: 0
Co-ord:

Project No. SGL16-045
Project: Estevan Point Comm.Tower
Client: Canadian Coast Guard

Depth (m)	Sample Type	Number	Symbols	SOIL DESCRIPTION	Elev. (m)
				Ground Surface	0.0
0				***Gravel and sand*** trace of silt, some rounded cobbles, loose to compact, wet becomming saturated at 0.65m depth, brown, rough cobbly drilling	
1					
2				Grain size anaysis Sample No. 1	
					-2.4
				Silty, gravelly sand damp, grey, smooth hard drilling (glacial till-like)	
3				Grain size analysis Sample No. 2	
4					
					-4.5
				End of Borehole	
5					

Water level

Water Content %
10 20 30 40

24.2

14.3

DCPT blows/0.3m
10 20 30 40

Pocket Penetrometer (kPa)
100 200 300 400

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

SIMPSON GEOTECHNICAL LTD.
SimpsonGeotech.com

BOREHOLE # Guy 1

Date Drilled: December 1, 2016
Rig: Atlas Mole Rat
Contractor: Drillwell
Hammer Type:

Location:
Elevation: 0
Co-ord:

Project No. SGL16-045
Project: Estevan Point Comm.Tower
Client: Canadian Coast Guard

Depth (m)	Sample Type	Number	Symbols	SOIL DESCRIPTION	Elev. (m)
				Ground Surface	0.0
0				***Gravel and sand*** trace of silt, occasional cobbles and small boulders, loose, wet becomming saturated at 0.25m depth, brown	-1.0
1				***Sand and silt/clay*** trace of gravel, damp, grey, hard smooth drilling (glacial till-like)	-1.8
2				***Silty, gravelly sand*** dense,, damp, grey (glacial till-like)	-2.4
				Bedrock Augers spinning with little torque resistance and no progress, shale dust on bit	
3				End of Borehole	
4					
5					

Water level

Water Content % (10, 20, 30, 40)

13.5

DCPT blows/0.3m (10, 20, 30, 40)

Pocket Penetrometer (kPa) (100, 200, 300, 400)

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

SIMPSON GEOTECHNICAL LTD.
SimpsonGeotech.com

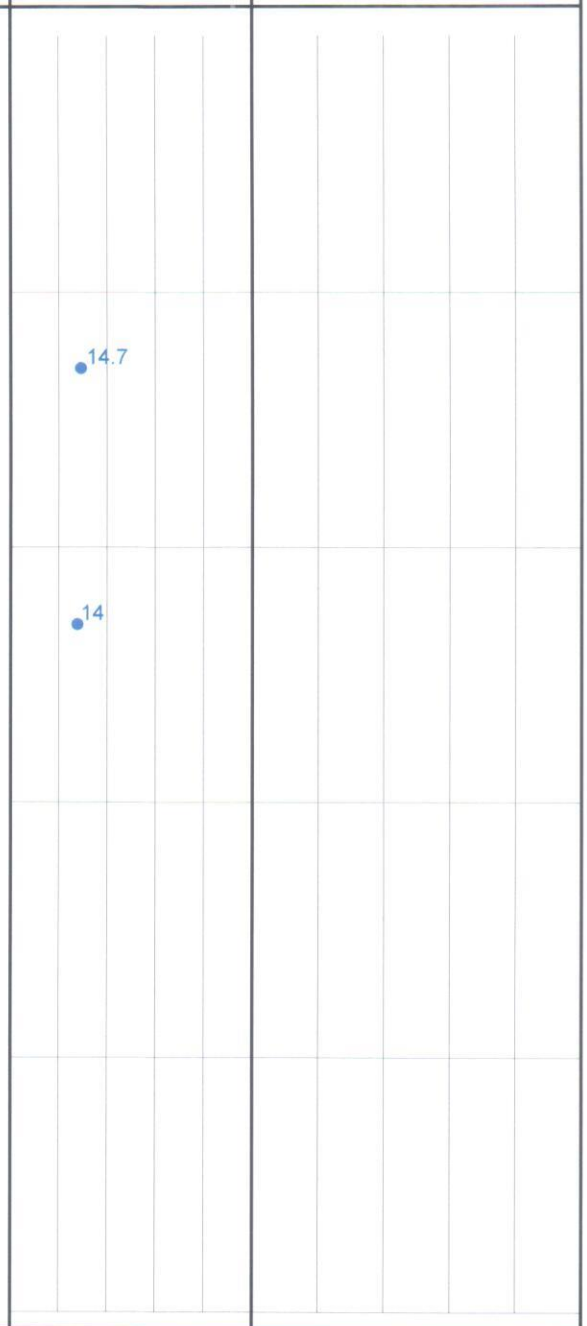
BOREHOLE # Guy 2 (1)

Date Drilled: December 1, 2016
Rig: Atlas Mole Rat
Contractor: Drillwell
Hammer Type:

Location:
Elevation: 0
Co-ord:

Project No. SGL16-045
Project: Estevan Point Comm.Tower
Client: Canadian Coast Guard

Depth (m)	Sample Type	Number	Symbols	SOIL DESCRIPTION	Elev. (m)	Water level
				Ground Surface	0.0	
0				***Silty sand*** some gravel, trace of organics, loose, damp, dark brown (possible fill)	-0.8	
1				***Sand and Gravel*** some silt, trace of cobbles, compact, damp, grey becomming wet with depth	-1.9	
2				***Silty, gravelly sand*** dense/hard, damp, grey (glacial till-like)	-2.4	
3				***Shale bedrock*** Auger spinning with no progress, little torque resistance, shale dust on bit End of Borehole		
4						
5						



Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

SIMPSON GEOTECHNICAL LTD.
SimpsonGeotech.com

BOREHOLE # Guy 2 (2)

Date Drilled: December 1, 2016
Rig: Atlas Mole Rat
Contractor: Drillwell
Hammer Type:

Location:
Elevation: 0
Co-ord:

Project No. SGL16-045
Project: Estevan Point Comm.Tower
Client: Canadian Coast Guard

Depth (m)	Sample Type	Number	Symbols	SOIL DESCRIPTION	Elev. (m)
				Ground Surface	0.0
0				***Gravel and sand*** trace of silt, trace of cobbles, compact, damp, brown grading to grey with depth, becomming saturated with depth	
					-1.8
2				***Silty, gravelly sand*** dense, damp, grey (glacial till-like)	-2.1
				Shale bedrock Auger spinning with no progress, little torque resistance, shale dust on bit	
				End of Borehole	

Water level

Water Content (%) 10 20 30 40

21.8

DCPT blows/0.3m 10 20 30 40

Pocket Penetrometer (kPa) 100 200 300 400

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

SIMPSON GEOTECHNICAL LTD.
SimpsonGeotech.com

BOREHOLE # Guy 3

Date Drilled: December 1, 2016
Rig: Atlas Mole Rat
Contractor: Drillwell
Hammer Type:

Location:
Elevation: 0
Co-ord:

Project No. SGL16-045
Project: Estevan Point Comm.Tower
Client: Canadian Coast Guard

Depth (m)	Sample Type	Number	Symbols	SOIL DESCRIPTION	Elev. (m)	Water level
				Ground Surface	0.0	
0				***Peaty organics*** soft, black to dark brown, occasioanl boulder to 400mm diameter, saturated		
					-2.0	
2				***Silty, gravelly sand*** dense, damp, grey (glacial till-like)		
					-3.0	
3				End of Borehole		
4						
5						

Water Content (%): 10, 20, 30, 40 — 15.8

DCPT (blows/0.3m): 10, 20, 30, 40

Pocket Penetrometer (kPa): 100, 200, 300, 400

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

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Report of: _____

Grain Size Analysis

Client:	**Canadian Coast Guard**
CC:	

Project No:	SGL16-045
Project:	Estevan Point
Sample Date:	01-Dec-16
Sample By:	RRS
Test Date:	06-Dec-16
Tested By:	0

SAMPLE INFORMATION:

Material Type: Gravel and sand, trace of silt

Source: Site
Specification: N/A
Sample Location: Base at 2.0m depth
Sample No: 1

Moisture Content: 24.2%
Fracture: N/A
Washed Sieve: X
Dry Sieve:

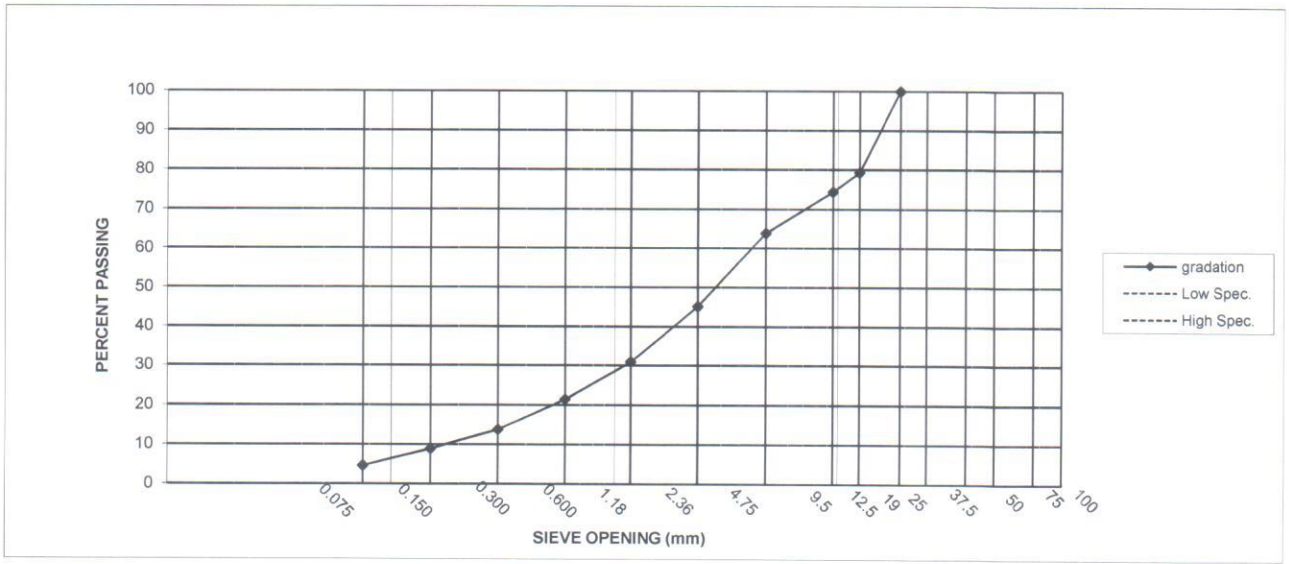
Sieve Analysis			
Sieve (mm)	**% Passing**	**Low Spec.**	**High Spec.**
100.0			
75.0			
50.0			
37.5			
25.0			
19.0	100.0		
12.5	79.2		
9.50	74.4		
4.75	63.8		
2.36	45.2		
1.18	30.9		
0.600	21.4		
0.300	13.7		
0.150	8.8		
0.075	4.6		

Sample Properties

Gravel (+2.36 mm):	54.8	%
Sand (+0.075 to -2.36 mm):	40.5	%
Silt and / or Clay (-0.075 mm):	4.6	%

d10=	0.180
d30=	1.117
d60=	4.073
Cu=	22.58
Cc=	1.70

AGGREGATE GRADATION:



Comments: _____

per: _____
Richard Simpson, P.Eng.

SIMPSON Geotechnical Ltd

Report of:

Grain Size Analysis

Client: Canadian Coast Guard
CC:

Project No: SGL16-045
Project: Estevan Point
Sample Date: 01-Dec-16
Sample By: RRS
Test Date: 06-Dec-16
Tested By: 0

SAMPLE INFORMATION:

Material Type: Glacial till-like
Source: Site
Specification: N/A
Sample Location: Base at 2.8m depth
Sample No: 1

Moisture Content: 14.3%
Fracture: N/A
Washed Sieve:
Dry Sieve: X

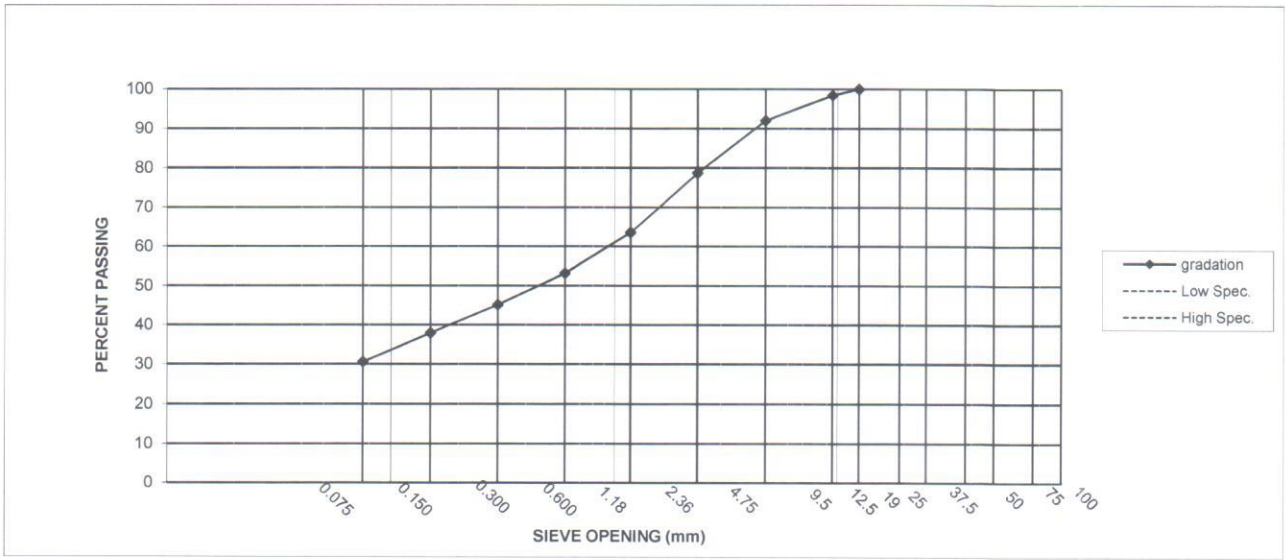
Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0			
37.5			
25.0			
19.0			
12.5	100.0		
9.50	98.4		
4.75	92.0		
2.36	78.7		
1.18	63.6		
0.600	53.2		
0.300	45.1		
0.150	38.0		
0.075	30.6		

Sample Properties

Gravel (+2.36 mm):	21.3 %
Sand (+0.075 to -2.36 mm):	48.1 %
Silt and / or Clay (-0.075 mm):	30.6 %

d10=	0.010
d30=	0.073
d60=	0.956
Cu=	94.50
Cc=	0.55

AGGREGATE GRADATION:



Comments:

per:
Richard Simpson, P.Eng.

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (613) 363-6565

September 15, 2016

Site: 49.3833 N, 126.543 W User File Reference: Estevan Point

Requested by: , Simpson Geotechnical Ltd.

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.869	1.411	**1.622**	1.663	**1.501**	**0.973**	**0.580**	**0.180**	**0.063**	**0.766**	**1.042**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.123	0.384	0.592
Sa(0.1)	0.183	0.616	0.956
Sa(0.2)	0.230	0.720	1.101
Sa(0.3)	0.217	0.709	1.112
Sa(0.5)	0.167	0.601	0.980
Sa(1.0)	0.093	0.359	0.615
Sa(2.0)	0.045	0.201	0.357
Sa(5.0)	0.013	0.058	0.108
Sa(10.0)	0.0049	0.020	0.037
PGA	0.102	0.330	0.511
PGV	0.095	0.393	0.663

References

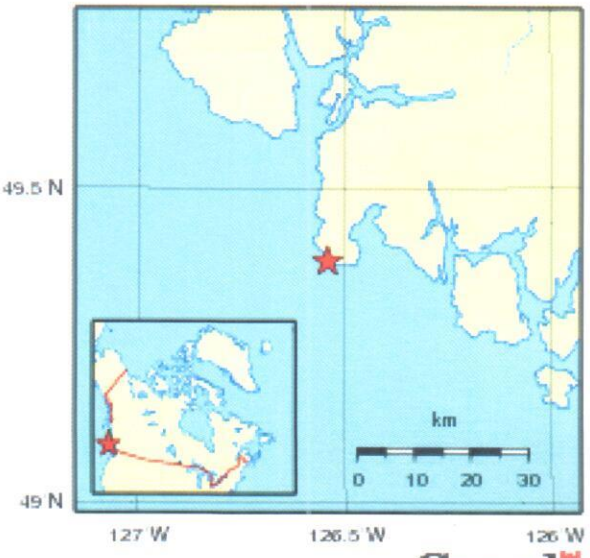
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



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