

EGG ISLAND LIGHTSTATION – TOWER REPLACEMENT

FISHERIES, OCEANS AND THE CANADIAN COAST GUARD
REAL PROPERTY SAFETY AND SECURITY – PACIFIC REGION

200 – 401 Burrard Street
Vancouver, British Columbia
V6C 3S4

Project Location

Egg Island Light Station
Lat : 51° 15' 0" N
Long : 127° 50' 3" E



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Section 01 11 00 – Summary of Work

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 14 00 – WORK RESTRICTIONS
- .2 Section 01 31 19 – PROJECT MEETINGS
- .3 Section 01 32 16.07 – CONSTRUCTION PROGRESS SCHEDULE BAR (GANTT) CHART
- .4 Section 01 33 00 – SUBMITTAL PROCEDURES
- .5 Section 01 35 29.06 – HEALTH AND SAFETY REQUIREMENTS
- .6 Section 01 35 43 – ENVIRONMENTAL PROCEDURES
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- .11 Section 01 78 00 – CLOSEOUT SUBMITTALS
- .12 Section 03 30 00 – CAST-IN-PLACE CONCRETE
- .13 Section 13 36 13.13 – STEEL TOWERS
- .14 Section 26 05 27 – GROUNDING

1.2 DEFINITIONS

- .1 Throughout contract documents, the words “Owner,” “Contracting Authority,” “Contractor,” “Engineer,” or “Department,” shall be defined as follows:
 - .1 Owner and Contracting Authority
Real Property, Safety and Security of the Department of Fisheries and Oceans,
200-401 Burrard Street Vancouver B.C. V6C 3S4
 - .2 Engineer/Departmental Representative
An employee of the Owner or Engineer assigned by the Owner as the
Engineer for this project, or the Engineer’s representative assigned by the
Engineer as his representative for the project.
 - .3 Contractor
The party accepted by the Owner with whom a formal contract is entered to
complete the work of this project.
 - .4 Department
Fisheries and Oceans, and the Canadian Coast Guard.

1.3 MINIMUM STANDARDS



- .1 Perform Work in accordance with National Building Code of Canada (NBCC) and any other code of provincial, federal, or local application. In the case of any conflict or discrepancy, the more stringent requirements shall apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents
 - .2 Specified standards, codes and referenced documents

1.4 DRAWINGS

- .1 15450 – ANTENNA LAYOUT AND SPECIFICATIONS

1.5 WORK LOCATION

- .1 The Egg Island Light Station is a staffed site located just north of Port Hardy near the entrance to Fitzhugh Sound from Queen Charlotte Sound. Egg Island is at Latitude: 51.2499°, Longitude: -127.8342°. Appendix A: Site Location/Photos gives site location details and includes some photos of the existing site.
 - .1 The site is accessed via helicopter. The Contractor is responsible for providing all transportation services of materials, equipment and crew to and from the site before and during construction. This also includes any trips required during tendering.
 - .2 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.
 - .3 The Contractor will be responsible for the demobilization, removal and transportation of all construction equipment and associated waste material from site.

1.6 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Schedule of Quantities
 - .1 Work of this Contract comprises design, supply and installation of an 80ft tall self-supported light tower at the DFO site on Egg Island. Work includes but is not limited to:
 - .1 Mobilization and Demobilization
 - .2 Demolition



- .3 Design, supply and installation of a new tower foundation
 - .4 Design, supply and installation of a new 80ft self-supported tower
 - .5 Design, supply and installation of antennas and lighting system
 - .6 Design, supply and installation of new grounding system
- .2 Technical Proposal
- .1 Provide an adequate technical proposal to allow for a compliant bid
 - .2 See Section 01 33 00 – Submittal Procedures
- .3 Schedule
- .1 Provide an adequate schedule to allow for a compliant bid
 - .2 See Section 01 33 00 – Submittal Procedures
- .4 Qualification
- .1 Provide adequate qualifications to allow for a compliant bid
 - .2 See Section 01 33 00 – Submittal Procedures
- .5 The work shall be completed no later than March 31, 2018.
- .6 An optional pre-tender meeting will be held on October 23, 2017 at 1:00pm at the Institute of Ocean Sciences where a large scale aerial photograph will be available.

1.7 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.

1.8 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work to allow:
 - .1 Work by other contractors
 - .2 Light keepers/CCG Crew
- .2 Co-ordinate use of premises under direction of Owner.

1.9 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.
 - .1 Technical Bid Proposal
 - .1 Deadline: Submit with Bid
 - .2 Submission to include:
 - .1 Design profile drawing of the proposed tower that includes tower section type, section splice detail, section weight, and foundation loads.
 - .2 Contractor qualifications: proof of 1 previous tower design build contract in the past 10 years of at least the height and width of the outlined proposed drawing
 - .2 Design Package
 - .1 Deadline: 28 days following contract award
 - .2 Submission to include:
 - .1 Tower design drawings stamped and sealed by a qualified Professional Engineer registered in the Province of British Columbia as outlined in Section 13 36 13.13.
 - .2 Foundation design drawings stamped and sealed by a qualified Professional Engineer registered in the Province of British Columbia as outlined in Section 03 30 00.
 - .3 Grounding design drawings as outlined in Section 26 05 27.
 - .4 Drawings to conform to all requirements outlined in relevant sections.
 - .3 Tower Fabrication Plan
 - .1 Deadline: 28 days following contract award
 - .2 Submission to include:



- .1 Tower supply company qualifications to include:
 - .1 Canadian Welding Bureau (CWB) Certification
 - .2 Proof of 5 previous tower design/fabricate contracts of a similar construction and remote site/helicopter use complexity or approved equivalent structure.
- .2 Tower fabrication shop drawings
- .3 Schedule indicating:
 - .1 Start and completion dates of fabrication
 - .2 Delivery of tower to site
- .4 Construction Plan
 - .1 Deadline: 28 days following contract award
 - .2 Construction Plan to be of sufficient detail to demonstrate that the Contractor has considered all the challenges of the project and it prepared to undertake the Work in a competent and professional manner in accordance with all legislation
 - .3 Submission to include:
 - .1 Contractor qualifications including:
 - .1 Core Project member contact information (Site Foreman and Project Manager)
 - .2 Complete listing of all Subcontractors
 - .2 Project Health and Safety Program as outlined in Section 01 35 29.06
 - .3 Environmental Protection Plan as outlined in Section 01 35 43
 - .4 Concrete Construction Plan as outlined in Section 03 30 00
 - .5 Tower Erection Plan as outlined in Section 13 36 13
 - .6 Tower Grounding Plan as outlined in Section 26 05 27
- .5 Supplemental Material



- .1 Deadline: 21 days following acceptance of Works
- .2 Submission to include:
 - .1 Project as-built drawings as outlined in Section 01 33 00

1.10 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings which conflict with scope of work.
- .3 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .4 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .5 Record locations of maintained, re-routed and abandoned services.

1.11 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy of each document as follows:
 - .1 Contract Drawings, Specifications and any Addenda.
 - .2 Change Orders and other Modifications to Contract.
 - .3 Health and Safety Plan and Other Safety Related Documents.
 - .4 All regulatory permits required for the work
 - .5 Associated Best Management Practices documentation.

1.12 FEES, PERMITS AND CERTIFICATES

- .1 Contractor to pay fees, obtain certificates and permits, and provide information to authorities having jurisdiction where required.
 - .1 Contractor to provide copies to Departmental Representative of any documentation submitted to other authorities related to the Work
- .2 Contractor to furnish certificates and permits when requested.

1.13 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 Departmental Representative, and debris shall be removed from the site.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 DEADLINE

- .1 Tower fabrication design must be completed prior to September 1, 2017
- .2 All construction materials to be mobilized to site by DFO including tower and associated equipment, to be supplied by Contractor by September 11, 2017
 - .1 Alternate material transport requests or drop off locations will be reviewed by Departmental Representative, but are not guaranteed
- .3 All other aspects of the project must be completed before October 1, 2017

END OF SECTION



Section 01 14 00 – Work Restrictions

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 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.

1.3 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.

1.4 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 Ensure any radio equipment and/or service is maintained and operational throughout construction and access is available to DFO/CCG staff to make repairs, complete maintenance or replacement if required mid-construction.



- .3 Where Work involves connecting to existing services, give Departmental Representative 5 working days of notice for necessary interruption of mechanical or electrical services throughout the course of Work. Keep duration of interruptions to a minimum.
- .4 Where security is reduced by work provide temporary means to maintain security.
- .5 Owner 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 two (2) bedrooms (each with two beds), 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 through 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 Departmental Representative. This cost does not include meals.
 - .5 The cost is \$20.00 per person per night payable to the Light Station staff if residing in the principal dwelling. This cost does include meals.
 - .5 Use of the crew house shall be scheduled in advance with the Departmental Representative.
- .6 Closures: protect work temporarily until tower and antenna installation contract work is completed.

1.5 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, Owner or Canadian Coast Guard. Arrange with Departmental Representative to facilitate execution of work.

1.6 EXISTING SERVICES

- .1 Notify Departmental Representative of intended interruption of services and obtain required permission.

1.7 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 Departmental Representative 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, Owner or Canadian Coast Guard.
 - .6 Work hours can be extended with written approval from Departmental Representative.

1.8 SECURITY

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

1.9 BUILDING SMOKING ENVIRONMENT

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION



Section 01 31 19 – Project Meetings

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 32 16.07 – CONSTRUCTION PROGRESS SCHEDULES – BAR (GANTT CHART)
- .2 Section 01 33 00 – SUBMITTAL PROCEDURES.
- .3 Section 01 56 00 – TEMPORARY BARRIERS AND ENCLOSURES.
- .4 Section 01 78 00 – CLOSEOUT SUBMITTALS.

1.2 ADMINISTRATIVE

- .1 Schedule and administer project meetings at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to all stakeholders.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, and major Subcontractors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.



- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.07 – Construction Progress Schedules - Bar (GANTT) Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Delivery schedule of specified equipment.
 - .5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .7 Owner provided products.
 - .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .11 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .12 Appointment of inspection and testing agencies or firms.
 - .13 Insurances, transcript of policies.

1.4 PROGRESS MEETINGS

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings at regular intervals.
- .2 Departmental Representative, Contractor and major Subcontractors involved in Work are to be in attendance.
- .3 Notify parties minimum 5 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.



- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for effect on construction schedule and on completion date.
 - .12 Other business.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION



Section 01 32 16.07 – Construction Progress Schedule Bar (Gantt) Chart

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – SUBMITTAL PROCEDURES

1.2 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Owner to enable monitoring of project work in relation to established milestones.



1.3 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Owner within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.5 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
 - .1 Interim Certificate (Substantial Completion) within 45 working days of Award of Contract date.

1.6 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.7 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.



- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Preconstruction
 - .3 Material Transport
 - .4 Mobilization and Demobilization
 - .5 Demolition
 - .6 Foundation
 - .7 Tower
 - .8 Antennas
 - .9 Grounding System
 - .10 Testing and Commissioning
 - .11 Supplied equipment long delivery items

1.8 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.9 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED



.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION



Section 01 33 00 – Submittal Procedures

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not used.

1.2 REFERENCES

- .1 Not used.

1.3 ADMINISTRATIVE

- .1 Submit to Owner submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Owner, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by any party's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by any party review.
- .10 Keep one reviewed copy of each submission on site.



1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by Professional Engineer registered or licensed in British Columbia, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 5 days for review of each submission.
- .5 Adjustments made on shop drawings by Contractor are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Owner prior to proceeding with Work.
- .6 Make changes in shop drawings as Owner may require, consistent with Contract Documents. When resubmitting, notify Owner in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:



- .1 Subcontractor.
- .2 Supplier.
- .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Owner may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Owner where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit 6 electronic copies of test reports for requirements requested in specification Sections and as requested by Owner.



- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Owner.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit 6 electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Owner.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Owner.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Owner.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.



- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.5 DESIGN DRAWINGS AND PLANS

- .1 Submit drawings stamped and signed by a Professional Engineer registered or licensed in British Columbia, Canada. The Tower Design Engineer and the Foundation Design Engineer are to have at least 5 years of experience in tower design to CSA S37.
- .2 Allow three working days, or as otherwise stipulated in the specifications, for Departmental Representative to review each submission.
- .3 Any changes to engineering plans must be approved by Owner. Changes are to be highlighted on engineering plans and an As-Built set of engineering plans are to be submitted at the conclusion of the project.
- .4 Indicate materials, connections, explanatory notes and other information necessary for completion of Work.
- .5 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Other pertinent data.
- .6 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:



- .1 Subcontractor.
- .2 Supplier.
- .3 Manufacturer.
- .4 Details of appropriate portions of Work as applicable:
 - .1 All details required by specifications and information specified in CSA S37-13.
 - .2 Reference design standards.
 - .3 All design loads for specified load conditions.
 - .4 All analysis, calculations, and reactions for foundations and tower. A capacity profile of tower giving designed % load capacity for tower legs, diagonals, and foundations.
 - .5 Leg diameters for each section, types of connections, and typical details.
 - .6 Details of ice guards, attachments of antennas, anti-climb devices, and transmission line placement.
 - .7 Details of the grounding system and cable requirements.
 - .8 Any other information deemed relevant by the Engineer of Record.
- .7 Submit electronic and 2 printed copies of drawings for each requirement requested in specification Sections and as Owner may reasonably request.

1.6 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in standard resolution monthly with progress statement and as directed by Owner.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Frequency of photographic documentation: weekly.
 - .1 Upon completion of: project milestones and services before concealment, of Work, and as directed by Owner.

1.7 AS-BUILT DRAWINGS

- .1 Submit As-builts, including digital photographs and scanned redline drawings, within 21 days following completion of Work to Owner in CD format.



- .2 As-built CD to be labelled for easy identification including:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name.
 - .4 Other pertinent data.
- .3 Submissions include:
 - .1 1 page report summarizing Work completed or not completed.
 - .2 Redlined drawings containing:
 - .1 Any changes or variations from the original design drawings clearly identified in red markings.
 - .2 Antenna type and model specified when there is a change in the scope of work.
 - .3 Construction photographs clearly showing completion of Work and any changes of variations from the original design documents corresponding to redlined drawings.
 - .4 Drawings of new hardware (if applicable).
 - .5 1 page signed and stamped letter from the Tower Design Engineer stating that Work relevant to their design has been completed to their satisfaction and in accordance with their design.
 - .6 1 page signed and stamped letter from the Foundation Design Engineer stating that Work relevant to their design has been completed to their satisfaction and in accordance with their design.
 - .7 Any other information deemed relevant by the Engineer of Record.

1.8 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED



.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION



Section 01 35 29.06 – Health and Safety Requirements

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 00 – SUMMARY OF WORK
- .2 Section 01 35 43 – ENVIRONMENTAL PROCEDURES
- .3 Section 02 41 16 – STRUCTURE DEMOLITION

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of British Columbia
 - .1 Workers Compensation Act, RSBC 1996 - Updated 2012.
 - .2 WorkSafeBC Occupational Health and Safety Regulation

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Listing of all activities specific to the project and their Health and Safety risks or hazards
 - .3 Detailed descriptions of how the activities are to be carried out as well as methods for mitigating hazards and risks
 - .4 Listing or personnel responsible for Health and Safety measures, and Emergency procedures
 - .5 Proof of training for all employees working at heights and proof of rescue training for at least one employee working on site.



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- .3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative 5 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility within 3 weeks of contract award. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.
- .3 Work zone locations include:
 - .1 Egg Island Light Station.
- .4 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS



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- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 CCG Crew
 - .2 Light keeper
 - .3 Marine and Civil Infrastructure (MCI)

1.8 GENERAL REQUIREMENTS

- .1 Develop written 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 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 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.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Workers Compensation Act, B.C. Reg.
- .2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.
- .3 Comply with Occupational Health and Safety Regulations, 1996.
- .4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN 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 the Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise the Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of the Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province having jurisdiction, and in consultation with Departmental Representative.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE



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- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION



Section 01 35 43 – Environmental Procedures

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – SUBMITTAL PROCEDURES
- .2 Section 02 41 16 – STRUCTURE DEMOLITION

1.2 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)
- .2 Canadian Environmental Assessment Act, 2012 (CEAA)

1.3 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Environmental Protection Plan: Within 28 days following contract award and before commencing construction activities or delivery of materials to site.
- .3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Include in Environmental Protection Plan:
 - .1 Name of person responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name and qualifications of person responsible for manifesting hazardous waste to be removed from site.



- .3 Name and qualifications of person responsible for training site personnel.
- .4 Drawings indicating locations of proposed temporary excavations or embankments for material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .5 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas. Plan to indicate staging, refueling, and cleaning areas.
- .6 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .7 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .8 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .9 Waste Water Management Plan identifying methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .10 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
- .11 Equipment to be used on site identifying age and spill containment procedures.

1.5 FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.6 DRAINAGE



- .1 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .2 Ensure pumped water into waterways is free of suspended materials.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- .4 Complete working near water best management practices.

1.7 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Only clear vegetation that interferes with construction.
- .3 Minimize stripping of topsoil and vegetation.
- .4 Restrict tree removal to areas designated by Owner.

1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Provide methods, means, and facilities to prevent the contamination of soil, water, and atmosphere from the discharge of pollutants produced by construction operations.
- .3 Vehicles, machinery, and equipment shall be in good repair, equipped with emission controls as applicable and operated within regulatory requirements.
- .4 Avoid unnecessary idling of vehicles or heavy machinery.
- .5 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.9 NOTIFICATION

- .1 Engineer will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, Engineer of proposed corrective action and take such action for approval by Engineer.
 - .1 Take action only after receipt of written approval by Engineer.
- .3 Engineer will issue stop order of work until satisfactory corrective action has been taken.



- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Do not bury rubbish and waste materials on site.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .4 Waste Management: separate waste materials for recycling or reuse from materials for disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION



Section 01 45 00 – Quality Control

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 13 36 13 – STEEL TOWERS

1.2 REFERENCES

- .1 Construction General Conditions

1.3 INSPECTION

- .1 Refer to Construction General Conditions for stipulated interpretation.
- .2 Allow Owner access to Work.
- .3 Place of Work; allow access to such Work whenever it is in progress.
- .4 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals.
- .5 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .6 Owner will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.
- .7 The below list identifies key milestones where the Owner will require an opportunity to take samples/inspect:
 - .1 Tower fabrication: Owner will inspect the tower and associated components after the fabrication work is complete and prior to site installation.
 - .2 Rock anchor installation: Owner will be on site while Contractor performs rock anchor pull-tests and verify size and quantity of anchors prior to concrete or surrounding grout installation.
 - .3 Reinforcing steel installation: Owner will inspect rebar for concrete foundations prior to placing concrete, or, at Owner's discretion, request photographic documentation to be reviewed prior to concrete pour.



- .4 Concrete formwork: Owner will inspect formwork prior to placing concrete.
- .5 Concrete testing: Owner will employ an independent testing agency to test concrete for air content, slump, and compressive strength during the concrete pour. The Contractor is to arrange, coordinate, and supply transport to and from the work site for the testing agency representative on the day of the pour. The testing to include at minimum 6 cylinders (one 7 day, two 28 day, and three extras).
- .6 Final completion: Owner will conduct a final inspection upon completion.

1.4 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

- .1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- .4 Provide access to site if the site is of remote nature whereby the Contractor is responsible for providing access to the site.
- .5 All work to 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.

1.6 REJECTED WORK

- .1 Refer to Construction General Conditions for stipulated interpretation.
- .2 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.



- .3 Make good other Contractor's work damaged by such removals or replacements promptly.
- .4 If in opinion of Owner it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by the Engineer.

1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested

1.8 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections or as otherwise requested by Owner.

1.7 REPORTS

- .1 Submit 4 copies of inspection and test reports to Owner.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION



Section 01 56 00 – Temporary Barriers and Enclosures

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not used.

1.2 REFERENCES

- .1 CGSB
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 CSA International
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and
- .4 Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.4 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.5 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.6 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.



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1.7 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION



Section 01 73 00 – Execution Requirements

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – SUBMITTAL PROCEDURES
- .2 Section 02 41 16 – STRUCTURE DEMOLITION

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.3 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request to Departmental Representative



1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Restore work with new products in accordance with requirements of Contract Documents.
- .8 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 See Section 02 41 16 – Structure Demolition.

Part 2 Products

2.1 NOT USED

- .1 Not Used.



Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION



Section 01 77 00 – Closeout Procedures

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 REFERENCES

- .1 Refer to Construction General Conditions for stipulated interpretation.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Owner in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Consultant's inspection.
 - .2 Consultant's Inspection:
 - .1 Consultant and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, and fully operational.
 - .4 Certificates required submitted.
 - .5 Operation of systems: demonstrated to Owner's personnel.
 - .6 Work: complete and ready for final inspection.



- .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Consultant, and Contractor.
 - .2 When Work incomplete according to Consultant, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .7 Final Payment:
 - .1 When Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
 - .2 Refer to CONSTRUCTION GENERAL CONDITIONS 2: when Work deemed incomplete by Consultant, complete outstanding items and request re-inspection.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.4 FINAL CLEANING

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.



END OF SECTION



Section 01 78 00 – Closeout Submittals

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 31 19 – PROJECT MEETINGS
- .2 Section 01 33 00 – SUBMITTAL PROCEDURES
- .3 Section 01 45 00 – QUALITY CONTROL

1.2 REFERENCES

- .1 Not Used

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with contractor's representative, Departmental Representative and the Engineer, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Owner to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Owner, four final copies of operating and maintenance manuals in English.



- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.5 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.6 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses and telephone numbers of the Engineer and with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.



- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.7 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Owner.

1.8 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of black line opaque drawings.



- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.
 - .4 References to related shop drawings and modifications.
 - .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
 - .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
 - .7 Provide digital photos, if requested, for site records.

1.9 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.



- .1 Include regulation, control, stopping, shut-down, and emergency instructions.
- .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Additional requirements: as specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Not used.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Owner.

1.12 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Owner approval.
- .3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Owner for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:



- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.



- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
- .1 Failure to respond will be cause for the Owner to proceed with action against Contractor.

1.13 WARRANTY TAGS

- .1 Not used.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.



END OF SECTION



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Section 02 41 16 – Structure Demolition

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 SCOPE OF WORK

- .1 This section refers to all demolition and removal of existing structures and hardware and any other items identified for removal in the course of completing the work.
- .2 All demolition and removal of existing structures and hardware must only occur once the new structures and hardware are in place and are in service.

Part 2 Products

2.1 EQUIPMENT

- .1 Furnish all labour, materials, tools, plant and services required incidental to the completion to the full extent of the drawings and specifications for execution of all demolition salvage and protection work specified herein.

Part 3 Execution

3.1 REMOVAL OF DEMOLISHED MATERIAL

- .1 All materials, which are not to be salvaged for the Owner, shall become the Contractor's property and the Contractor must remove it from the site. Remove and dispose of all demolition rubble offsite in accordance with all municipal, provincial, and federal requirements.
- .2 If not specifically identified, the Engineer shall decide as to which material shall be salvaged and which materials shall be disposed of.

3.2 PROTECTION OF STRUCTURES TO REMAIN

- .1 Take all necessary precautions to contain the demolitions within the limits designated. Protect remaining structural elements, services and equipment against damage from demolition works.
- .2 Contractor is liable for any damage caused to structures not specified for removal as a result of completing work. Any damage incurred during execution of the work to any part of the property or structure not specifically designated for demolition shall be



repaired, replaced, and reconstructed to its original condition at no expense to the Owner.

3.3 SERVICES

- .1 All services that must be removed from existing structures in order to perform work must be removed so as not to damage them.
- .2 All service materials including miscellaneous hangers, fasteners and supplies required to reinstall the services shall be supplied by the Contractor and will be of equivalent quality to the new conditions of such materials being replaced.
- .3 All materials that are not reusable shall be disposed of by the Contractor.
- .4 The Contractor shall be responsible for the handling and storage of services lines, lamps standards and other equipment during construction. All materials damaged by the Contractor shall be replaced at the Contractor's expense.

3.4 CLEANING AND RESTORATION

- .1 Keep site clean and organized throughout demolition procedure.
- .2 Upon completion of project or as appropriate, reinstate light standards, electrical and water services and items affected by Work to condition which existed prior to beginning of Work.

END OF SECTION



Section 03 10 00 – Concrete Forming and Accessories

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 20 00 – CONCRETE REINFORCING
- .2 Section 03 30 00 – CAST-IN-PLACE CONCRETE

1.2 REFERENCES

- .1 CSA International
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121, Douglas Fir Plywood.
 - .3 CAN/CSA-S269.3, Concrete Formwork, National Standard of Canada

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets
- .3 Co-ordinate submittal requirements and provide submittals

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Divert wood materials from landfill to a recycling facility as approved by Departmental Representative.
 - .4 Divert plastic materials from landfill to a recycling facility as approved by Departmental Representative.
 - .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

Part 2 Products



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2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .3 Form liner:
 - .1 Plywood: Douglas Fir to CSA O121 square edge,
- .4 Form release agent: biodegradable, low VOC, non-toxic.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm²/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .6 Align form joints.
 - .1 Keep form joints to minimum.



- .7 Use 20 mm chamfer strips on external corners, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .10 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

END OF SECTION



Section 03 20 00 – Concrete Reinforcing

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 45 00 – QUALITY CONTROL
- .2 Section 03 10 00 – CONCRETE FORMING AND ACCESSORIES
- .3 Section 03 30 00 – CAST-IN-PLACE CONCRETE

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
 - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .3 CSA International
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-14, Design of Concrete Structures.
 - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.
- .5 National Building Code of Canada

1.3 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.



- .1 Mill Test Report: upon request, provide Consultant with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.
- .2 Upon request, submit in writing to Consultant proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in a manner which prevents contamination or damage.
- .2 Clean all loose scaly rust, dirt, oil, paint, or other coatings that may be detrimental from reinforcement prior to being placed.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean area.
 - .2 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan/Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 All reinforced steel to be of size and grade as per the engineered design drawings.
- .2 Substitute different size bars only if permitted in writing by Departmental Representative.
- .3 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices: subject to approval of Departmental Representative.



- .8 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Departmental Representative written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Departmental Representative to review and approve reinforcing detail.
- .2 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.
- .3 Upon request, inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on engineered design drawings in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.



3.3 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment
- .3 Waste Management: separate waste materials for recycling

END OF SECTION



Section 03 30 00 – Cast-In-Place Concrete

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 32 16.07 – CONSTRUCTION PROGRESS SCHEDULE BAR (GANTT) CHART
- .2 Section 01 33 00 – SUBMITTAL PROCEDURES
- .3 Section 01 35 29.06 – HEALTH AND SAFETY REQUIREMENTS
- .4 Section 01 35 43 – ENVIRONMENTAL PROCEDURES
- .5 Section 01 45 00 – QUALITY CONTROL
- .6 Section 03 10 00 – CONCRETE FORMING AND ACCESSORIES
- .7 Section 03 20 00 – CONCRETE REINFORCING

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment (Additional Concrete Only):
 - .1 Measure cast-in-place concrete in cubic metres calculated from neat dimensions authorized in writing by Departmental Representative.
 - .2 No deductions will be made for volume of concrete displaced by reinforcing steel or structural steel.

1.3 REFERENCES

- .1 All concrete work shall conform to the requirements of the latest edition of the standards listed below
 - .1 ASTM International
 - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete
 - .3 ASTM C1017/C1017M-10a, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .2 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.



- .2 CSA A23.3, Design of Concrete Structures
 - .3 CSA S269.3 Concrete Formwork
 - .3 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction
 - .4 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .5 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .3 National Building Code of Canada
 - .4 ACI Specification 306 Cold Weather Concreting (if applicable)

1.4 ADMINISTRATIVE AND PERFORMANCE REQUIREMENTS

- .1 Pre-installation Meetings: in accordance with Section 01 32 16.07- Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure Departmental Representative attend.
 - .1 Verify project requirements.
- .2 The Work shall be designed to perform as reasonably expected for a life of 50 years.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit Foundation Design Drawings: Within 28 days following contract award and before commencing construction activities or delivery of materials to site. Submission to include:
 - .1 Drawings showing locations, plans and section views of the foundations
 - .2 Drawings showing reinforcement steel, anchorage steel and bonding the bedrock and required anchorage pull-test results
 - .3 Other information listed in Section 01 33 00 – Submittal Procedures
- .3 Submit Concrete Construction Plan: Within 28 days following contract award and as part of the Construction Plan in accordance with Section 01 11 00 – Summary of Work, and



before commencing construction activities or delivery of materials to site. Submission to include:

- .1 High level summary of mix properties and admixtures to demonstrate compliance with Owner criteria and Foundation Design Drawings
 - .2 Concrete placing plan identifying the location of the course of ready mix concrete, the transport and placement plan and any other relevant information required to demonstrate a plan for placing the concrete in the required amount of time
 - .3 Finishing procedures
 - .4 Curing methods and schedule
 - .5 Clean-up procedures
 - .6 Procedures to place and cure concrete in hot or cold temperatures where reasonably anticipated during the construction period
- .4 Submit concrete mix designs for review by consultant minimum 4 weeks prior to starting concrete work.
 - .5 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
 - .6 Provide testing reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
 - .7 Concrete to be placed in forms within 120 minutes after batching.
 - .8 Provide two copies of WHIMIS MSDS Material Safety Data Sheets.
 - .9 Concrete hauling time: provide for review by Foundation Engineer

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00- Quality Control.
- .2 Concrete cylinders to be broken to determine foundation strength prior to tower erection
- .3 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with concrete mix designs and methodology for preparing concrete on site



- .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .4 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Hot weather concrete.
 - .2 Cold weather concrete.
 - .3 Curing.
 - .4 Finishes.
 - .5 Joints.
- .5 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .6 Sustainability Standards Certification:
 - .1 Construction Waste Management: provide copy of plan

1.7 DESIGN REQUIREMENTS

- .1 Foundation Engineer: design a suitable foundation for the tower in consideration as per:
 - .1 The loading provided by the Tower Engineer and in the Specifications
 - .2 Any other loads that could be reasonably anticipated to affect the foundation
 - .3 The specific site soil conditions provided in Appendix E – Geotechnical Assessment Report
- .2 Foundation to be designed by a qualified Professional Engineer registered in British Columbia with a minimum of 5 years' experience in tower foundation design.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA



- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MIXES

- .1 50MPa concrete to be used unless otherwise directed.
- .2 The use of calcium chloride as an admixture is not permitted.

2.4 SOURCE QUALITY CONTROL

- .1 Mix design to be submitted to and approved by Departmental Representative

Part 3 Execution

3.1 PREPARATION

- .1 Allow for Departmental Representative to review rock anchors, reinforcing steel and formwork prior to placing concrete.
- .2 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 72 hours minimum notice prior to placing of concrete.
- .3 Place, finish and cure concrete in accordance with the Contractor's submitted Concrete Construction Plan and Foundation Design Drawings.
- .4 Place concrete reinforcing in accordance with Section 03 20 00- Concrete Reinforcing.
- .5 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .6 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .7 Pumping of concrete is permitted only after approval of equipment and mix.
- .8 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .9 Protect previous Work from staining.
- .10 Clean and remove stains prior to application for concrete finishes.



- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Testing of concrete shall be performed, with cylinder and mix design only, in accordance with CAN/CSA A23.1 by an independent agency.
- .3 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2 making all adjustments necessary to account for climatic conditions anticipated during the curing period
 - .2 Provide a lightly brushed non-skid surface on exposed concrete surfaces, unless otherwise specified in the submitted design.
 - .3 Finish concrete so as to slope gently away from the center of the slab. No water shall pond on the finished surface.
 - .2 Use procedures as reviewed by Departmental Representative to remove excess bleed water. Ensure surface is not damaged.
 - .3 Finish concrete floor to CSA A23.1/A23.2. Class A
 - .4 Provide steel-trowelled finish unless otherwise indicated.
 - .5 All concrete shall be properly cured by means of moisture and/or application of an approved curing membrane
 - .6 All exposed concrete surfaces shall be kept moist for minimum of 7 days after placing concrete or until concrete attains 70% of specified compressive strength
 - .7 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated. All exposed edges of concrete shall have 25mm chamfers, unless noted otherwise.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1 Straightedge Method FF = 20 : FL = 15 Index Method to tolerance schedule as indicated.

3.4 FIELD QUALITY CONTROL



- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00- Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Contractor will pay for costs of tests as specified in Section 01 45 00 – Quality Control.
- .4 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- .5 Allow for Departmental Representative to monitor any concrete pour and provide minimum 3 working days' notice prior to placement of any concrete

3.5 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Clean in accordance with Section 01 35 43 – Environmental Procedures
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment
- .3 Waste Management: separate waste materials for recycling
 - .1 Provide appropriate area on job site where concrete trucks can be safely washed.
 - .4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.



- .5 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- .6 Prevent admixtures and additive materials from entering drinking water supplies or streams.
- .7 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
- .8 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION



Section 13 36 13.13 – Steel Towers

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 00 – SUMMARY OF WORK
- .2 Section 01 33 00 – SUBMITTAL PROCEDURES

1.2 REFERENCES

- .1 Work under this section to be in compliance will all listed references. In the case of conflict or discrepancy, the more stringent shall apply:
 - .1 CSA International
 - .1 CSA S37-13, Antenna, Towers, and Antenna Supporting Structures
 - .2 CSA G40.20, General Requirements for Rolled or Welded Structural Quality Steel
 - .3 CSA G40.21, Structural Quality Steel
 - .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures
 - .5 CSA W59, Welded Steel Construction (Metal-Arc Welding)
 - .2 ASTM International
 - .1 ASTM A123 / A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .3 Canada Labour Code Part II
 - .4 Health and Welfare Canada Limits of Exposure to Radio-Frequency Fields Frequencies from 3kHz – 300GHz, Safety Code 6
 - .5 WorkSafeBC Occupational Health and Safety Regulation
 - .6 National Building Code of Canada
 - .7 TC CAR Standard 621.19, Standards Obstruction Markings
 - .8 Society for Protective Coatings – Surface Preparation
 - .1 SSPC-SP 1, Solvent Cleaning



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

1.3 SCOPE OF WORK

- .1 Work in this section includes the supply of all labour, material, and equipment necessary to complete the following activities:
 - .1 Design, supply, and installation of a new 80ft tall self-supported tower.
 - .2 Supply and install of a fall arrest system specification as outlined in Appendix C – Tower Specifications or an approved equivalent.
 - .3 Design, supply and install of a wave guide bridge (steel bridge for cable transition from tower to shelter).
 - .4 Design, supply and installation of antennas and antenna mounts identified in drawing 15450 – ANTENNA LAYOUT AND SPECIFICATIONS excluding antennas noted as “future.”

1.4 PERFORMANCE REQUIREMENTS

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

1.5 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 the 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 Owner.
- .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.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Tower Design Drawings: Within 28 days following contract award and before commencing construction activities or delivery of materials to site. Submission to include:



- .1 Drawings indicating:
 - .1 Plan and section views of the tower; and
 - .2 Other requirements identified in this section.
- .2 Other information listed in Section 01 33 00 – Submittal Procedures.
- .3 Submit Tower Fabrication Plan: Within 28 days following contract award and in accordance with Section 01 11 00 - Summary of Work. Contractor to obtain written approval from Departmental Representative prior to beginning fabrication.
- .4 Submit Tower Erection Plan: Within 28 days following contract award and as part of the Construction Plan in accordance with Section 01 11 00 – Summary of Work, and before commencing construction activities or delivery of materials to site. Submission to include:
 - .1 Procedures and methods to be employed to:
 - .1 Place new tower on new foundation;
 - .2 Monitor that turn of nut has been completed;
 - .3 Remedy any damage to the coating system incurred during erection.
 - .2 Departmental Representative reserves the right to request additional documentation verifying the suitability
- .5 Provide testing results reports for review by Departmental Representative and Foundation Engineer and do not proceed without written approval when deviations from mix design or parameters are found.

1.7 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

1.8 DESIGN REQUIREMENTS

- .1 Design a tower in accordance with CSA S37-13 to support all equipment and antennas indicated in Appendix C – Tower Specifications. The tower must be capable of supporting all initial and future antenna loading requirements.
- .2 Design all tower accessories including: new mounts for all equipment, antennas and climbing facility with a fall arrest assembly.
- .3 All antennas, lines and mounts should be incorporated in the tower design.



- .3 Tower to be designed by a qualified Professional Engineer registered in British Columbia with a minimum of 5 years' experience in tower design to CSA S37.
- .4 Tower to be designed to resist: all loads specified in CSA S37-13, maximum loads caused by all immediate and future equipment installed on the tower, and site specific wind pressure supplied in Appendix D – Site Specific Wind Pressure Report.
- .5 Unless otherwise specified, determine loading in accordance with CSA S37-13, latest edition, reliability Class I.
- .6 Tower to be designed for a minimum radial ice load of +25mm (Class II).
- .7 The operational requirement for maximum twist is 0.05 degrees and for maximum tilt is 0.5 degrees.
- .8 Each tower section must be in 3.05m lengths.
- .9 Anchorage steel below grade that is not encased in concrete shall be galvanized and further corrosion protection shall be provided.

Part 2 Products

2.1 GENERAL

- .1 Structural steel to be painted or galvanized.
- .2 All mounts, mount hardware, and line hangers shall be heavy-duty hot-dip galvanized.
- .3 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.
- .4 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 FABRICATION

- .1 Provide to Departmental Representative a copy of Canadian Welding Bureau (CWB) certification for the tower fabricating company and for each worker assigned to the project.



- .2 Designate each tower segment with a number that is easily read after galvanizing. Stamp the mark 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 on each piece shall correspond with the shown on the erection drawings.
- .3 Fabricate all members in accordance with the engineered drawings and the referenced codes and standards.
- .4 All like parts to be interchangeable. All like parts to 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 Provide electrical continuity between all tower sections.

3.2 CLIMBING APPARATUS

- .1 The tower shall be equipped with a climbing apparatus complete with a fall arrest rail, in compliance with CSA S37-13.
- .2 Provide an unobstructed and continuous 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 the Canada Labour Code. Rungs are to be horizontal, have adequate clearance, and line up vertically.

3.3 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.



- .7 Trylon Cougar Rail.

3.4 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.

3.5 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 Departmental Representative. 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 paint.
- .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 3 years.

3.6 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.

3.7 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. Departmental Representative will designate site storage and construction layout areas after Contractor has submitted their Construction Plan.

3.8 TOWER INSTALLATION

- .1 Obtain written authorization from Departmental Representative prior to site mobilization.
- .2 The precise tower location and orientation will be laid out by Departmental Representative.
- .3 The contractor shall give Departmental Representative a written notice TWO WEEKS prior to the commencement of the standing of the tower.
- .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 Departmental Representative.
- .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 overstressed 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.

3.9 TRANSMISSION LINES

- .1 All transmission lines shall be as indicated in Appendix C: Tower Specifications.
- .2 All waveguide shall be 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 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 and the waveguide bridge is adequately protected against potential damage.
- .9 The following are the mandatory connection and weatherproofing procedures:
 - .1 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. 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 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 2ft from the cable entry ports.
- .14 Cable types are specified in Appendix C: Tower Specifications.
- .15 Antennas should be mounted to the tower leg at the azimuth indicated in Appendix C: Tower Specifications.

3.10 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 Markets set to values at either end of frequency range for return loss or at VSWR peaks for distance to fault

3.11 FIELD QUALITY CONTROL

- .1 Allow for Departmental Representative to monitor any tower field erection to confirm submitted plans are being followed.

END OF SECTION



Section 26 05 27 – Grounding

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 00 – SUMMARY OF WORK
- .2 Section 01 33 00 – SUBMITTAL PROCEDURES
- .3 Section 01 45 00 – QUALITY CONTROL
- .4 Section 13 36 13.13 – STEEL TOWERS
- .5 Section 32 30 00 – SITE IMPROVEMENTS

1.2 REFERENCES

- .1 Work under this section to be in compliance with all listed references. In the case of conflict or discrepancy, the more stringent shall apply:
 - .1 American National Standards Institute/Institute of Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding
 - .2 CSA International
 - .1 CSA C22.1, Canadian Electrical Code.
 - .2 CSA S37-13, Antennas, Towers, and Antenna-Supporting Structures.
 - .3 National Building Code of Canada.
 - .4 Canada Labour Code Part II.
 - .5 WorkSafeBC Occupational Health and Safety Act and Regulation.

1.3 SCOPE OF WORK

- .1 Work in this section includes the supply of all design, labour, material, and equipment necessary to provide a grounding system comprising: copper-clad steel ground rods and tinned copper ground cable complete with exothermic ground rod connections.
- .2 The grounding system is to be provided for all applicable Sections.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.



- .2 Submit Grounding Design Drawings: Within 28 days following contract award and before commencing construction activities or delivery of materials to site. Submission to include:
 - .1 Drawings indicating plan and section views of the grounding system, as well as all other requirements identified in this Section.
 - .2 Other information listed in Section 01 33 00 – Submittal Procedures.
- .3 Submit Grounding Plan: Within 28 days following contract award and as part of the Construction Plan in accordance with Section 0 11 00 – Summary of Work, and before commencing construction activities or delivery of materials to site. Submission to include procedures and methods to be used during construction.
- .4 Submit As-Built Drawings: Within 21 days following acceptance of Works.

1.5 QUALITY ASSURANCE

- .1 Quality assurance: in accordance with Section 01 45 00 – Quality Control.

1.6 DESIGN REQUIREMENTS

- .1 Provide grounding work in accordance with the Canadian Coast Guard (CCG) Standard: Lightning and Grounding Protection for MCTS Sites 67-013-000-ES-EQ-001. Any deviation from this standard shall be made known to Departmental Representative.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 GENERAL

- .1 Ensure other site infrastructure and grounding systems are not disturbed by excavation and backfill activities.
- .2 Obtain Departmental Representative's written approval before installing grounding system.
- .3 In areas where topsoil is present, strip 152mm topsoil and stockpile. Upon completion of backfilling, spread topsoil evenly over affected areas.

3.2 FIELD QUALITY CONTROL



- .1 Allow for Departmental Representative to monitor any grounding construction to confirm submitted plans are being followed.

END OF SECTION



Section 31 23 10 – Excavation and Backfill

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 REFERENCES

- .1 Canada Labour Code Part II – January 2008
- .2 CSA International
 - .1 CSA-S37-13 - Antenna Towers and Antenna Supporting Structures
- .3 Worksafe British Columbia Occupational Health and Safety Act and Regulation

1.3 GENERAL

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

Part 2 Materials

2.1 NOT USED

- .1 Not Used

Part 3 Execution

3.1 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.

3.2 BACKFILL

- .1 Backfill for tower foundations and anchors shall be undertaken as per engineering plans submitted by Contractor.

END OF SECTION



Section 32 30 00 – Site Improvements

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not Used.

1.2 REFERENCES

.1 CSA International

.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)

.2 Canada Labour Code Part II – January 2008

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

.4 National Building Code of Canada – 2015

1.3 SCOPE OF WORK

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

Part 2 Materials

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION





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DRAWING LIST					
DRAWING NO.	DRAWING TITLE	REVISION			
		A	B	C	D
EL-001	KEY PLAN				
EL-002	PROPOSED LIGHT TOWER LOCATION				
EL-003	AERIAL PHOTOGRAPH				
15450	ANTENNA LAYOUT AND SPECIFICATIONS				

5	
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0	Design Completion
Revision/Description	Date/Date

**Fisheries and Oceans and
the Canadian Coast Guard**

401-200 Burrard St
Vancouver, BC

Project title/Titre de projet

**Egg Island Light Station
Tower Replacement**

Consultant Signature Only

Designed by/Conçu par

Drawn by/Dessiné par

ES

PMSC Project Manager/Administrateur de Projets PMSC

PMSC, Regional Manager, Architecture and Engineering Services,
Secteur régional, Services d'architecture et de génie, PMSC

Drawing title/Titre de dessin

**EGG ISLAND LIGHT STATION
DRAWING LIST**

Project No./No. de projet	Sheet/Feuille	Revision no./ La Révision no.
	A1 OF 01	0

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Revizyon/Version	Description/Description	Date/Date
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1		
0	Design Completion	

**Fisheries and Oceans and
the Canadian Coast Guard**

401-200 Burrard St
Vancouver, BC

Project title/Titre de projet

Consultant Signature Only

Designed by/Conçu par
ES

Drawn by/Dessiné par
ES

PWSC Project Manager/Administrateur de Projets PWSC

PWSC, Regional Manager, Architectural and Engineering Services/
Génie et Architecture, Services d'architectural et de génie, PWSC

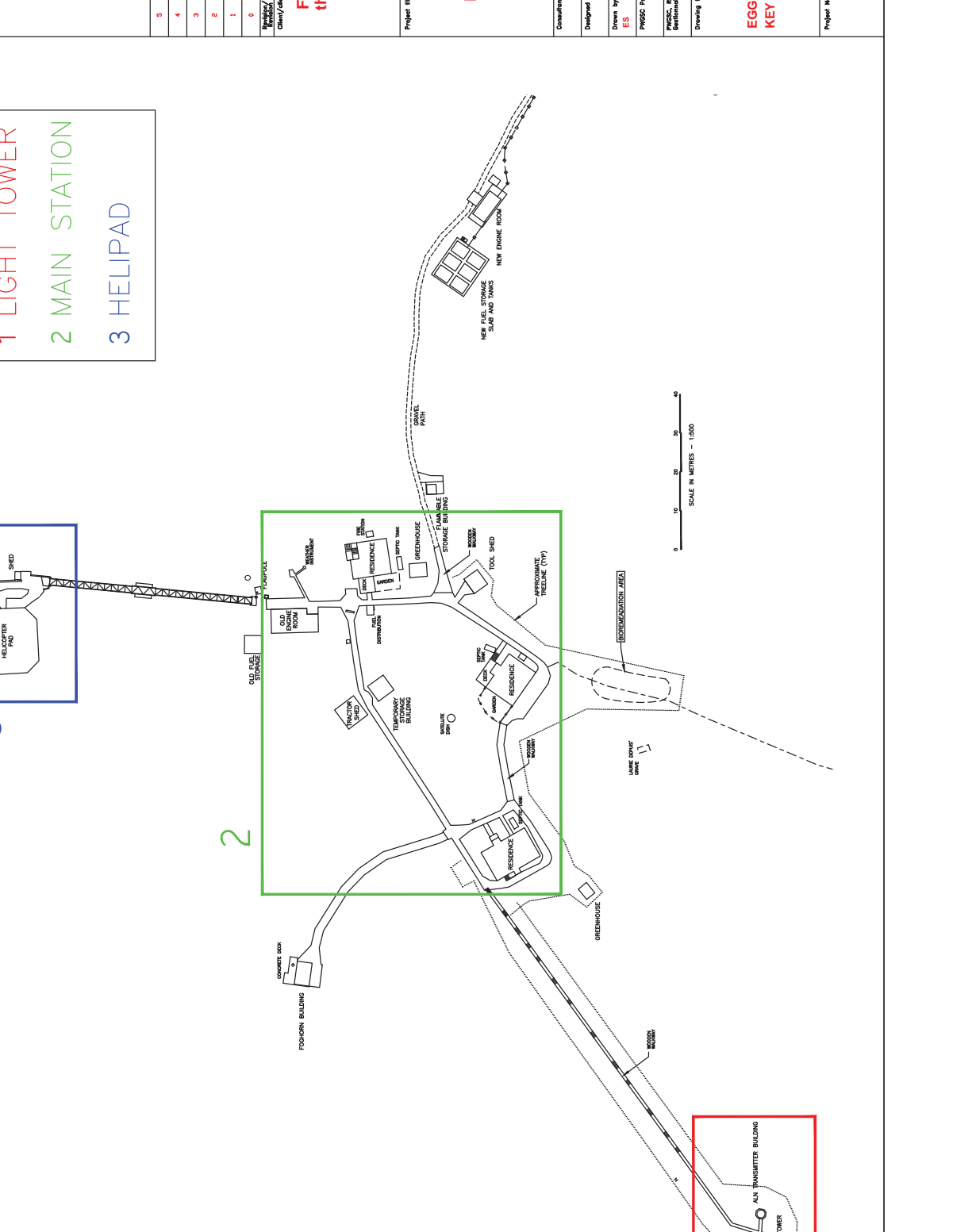
Drawing title/Titre de dessin

**EGG ISLAND LIGHT STATION
Tower Replacement**

**EGG ISLAND LIGHT STATION
KEY PLAN**

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Revisión/Revision	Description/Description	Date/Date
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Fisheries and Oceans and the Canadian Coast Guard
 401-200 Burrard St
 Vancouver, BC

Project title/Titre de projet

Egg Island Light Station Tower Replacement

Consultant Signature Only

Designed by/Conçu par

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ES

PMSC Project Manager/Administrateur de Projets PMSC

PMSC, Regional Manager, Architecture and Engineering Services, Gensimare régionaux, Services d'architecture et de génie, PMSC

Drawing title/Titre de dessin

EGG ISLAND LIGHT STATION LIGHT TOWER LOCATION

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OF 01

Revision no./La Révision no.

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Existing Walkway

Tower Location

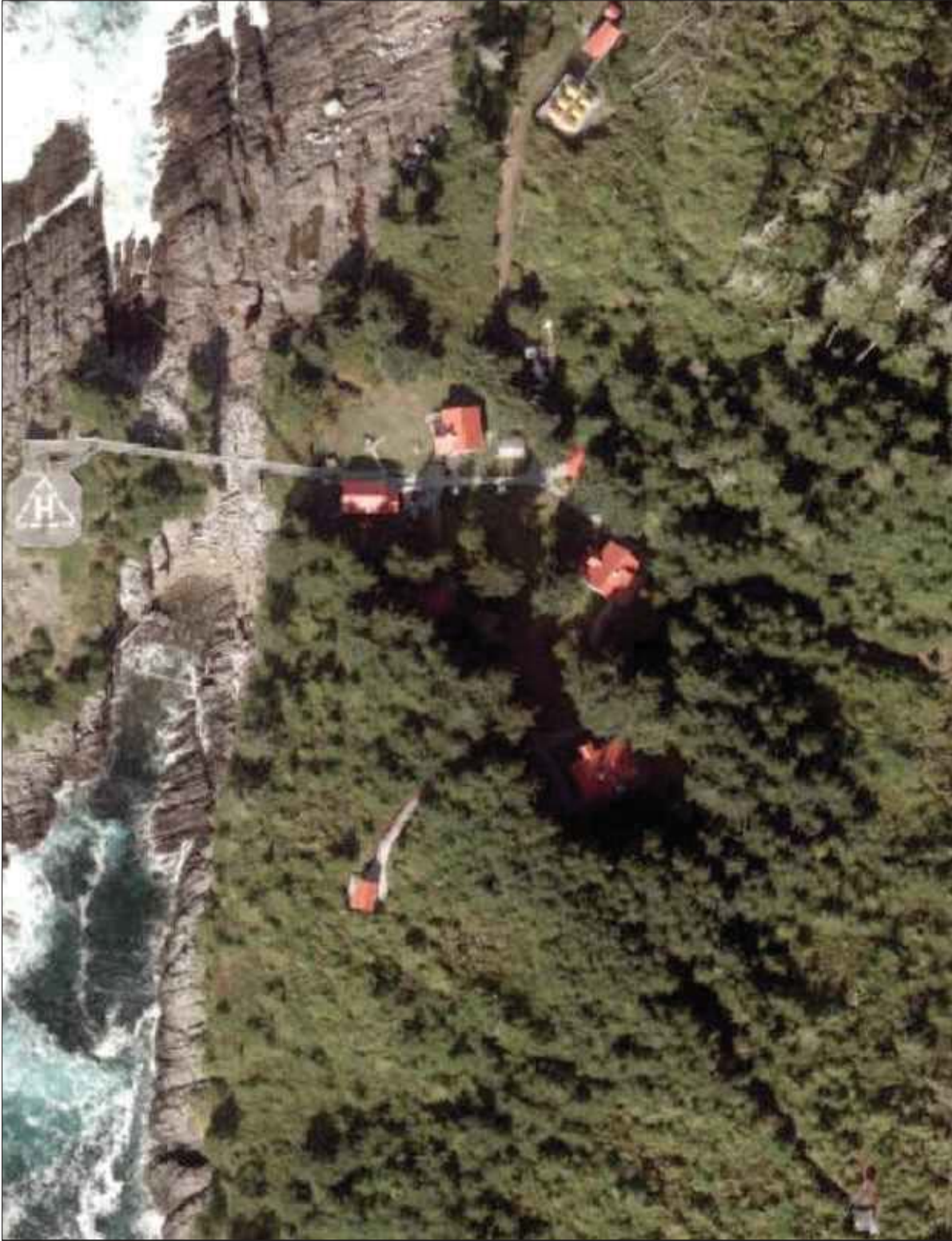
Proposed Tower Location

Existing Tower Location



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Project/Client	Description/Description	Date/Date

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401-200 Burrard St
Vancouver, BC

Project title/Titre de projet

**Egg Island Light Station
Tower Replacement**

Consultant Signature Only

Designed by/Conçu par

Drawn by/Dessiné par

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PMSC Project Manager/Administrateur de Projets PMSC

PMSC, Regional Manager, Architecture and Engineering Services/
Généraliste régionale, Services d'architecture et de génie, PMSC

Drawing title/Titre de dessin

**EGG ISLAND LIGHT STATION
AERIAL PHOTOGRAPH**

Project No./No. de projet	Sheet/Feuille	Revised no./ La révision no.
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APPENDIX A
SITE LOCATION AND PHOTOS

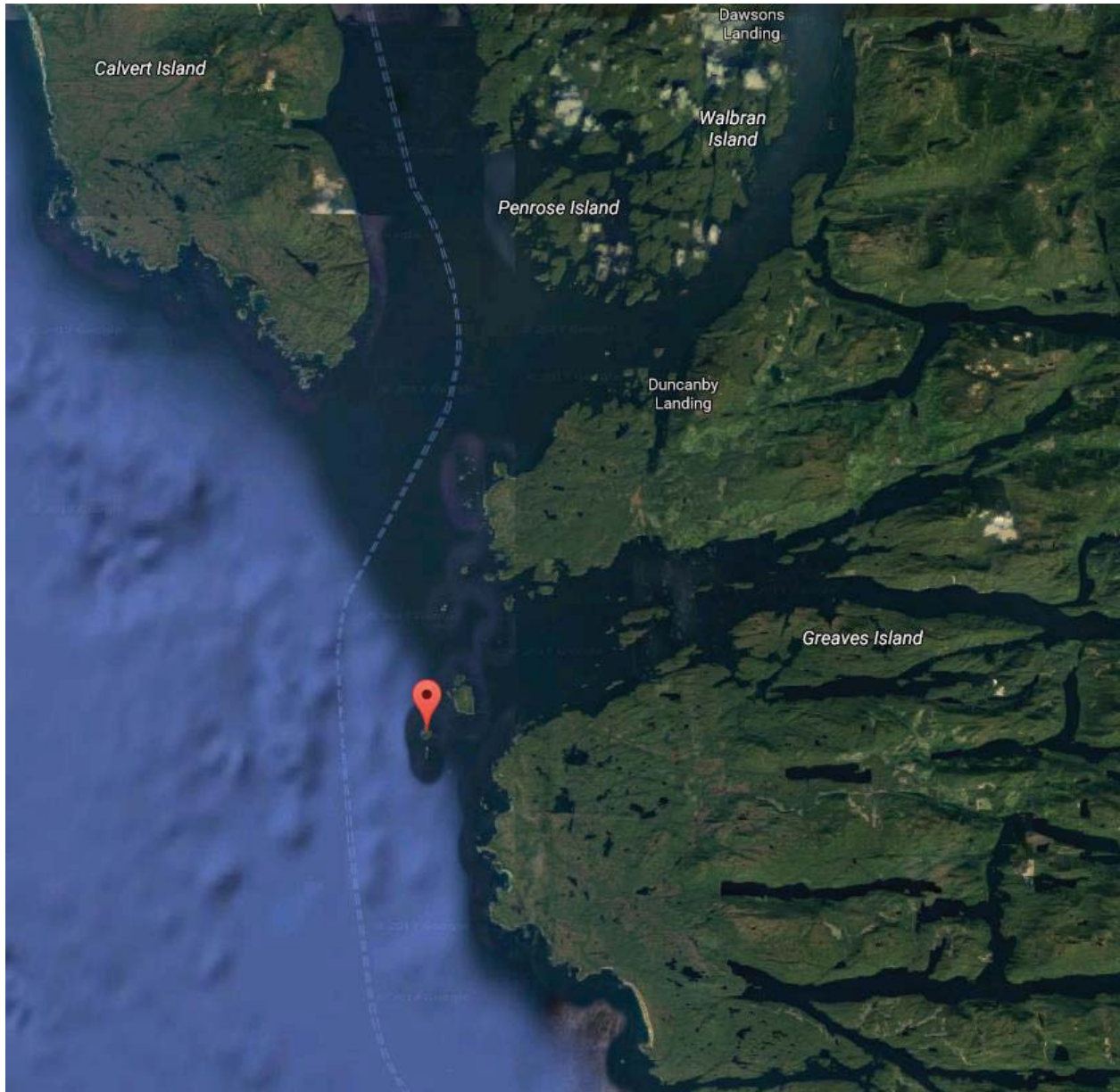


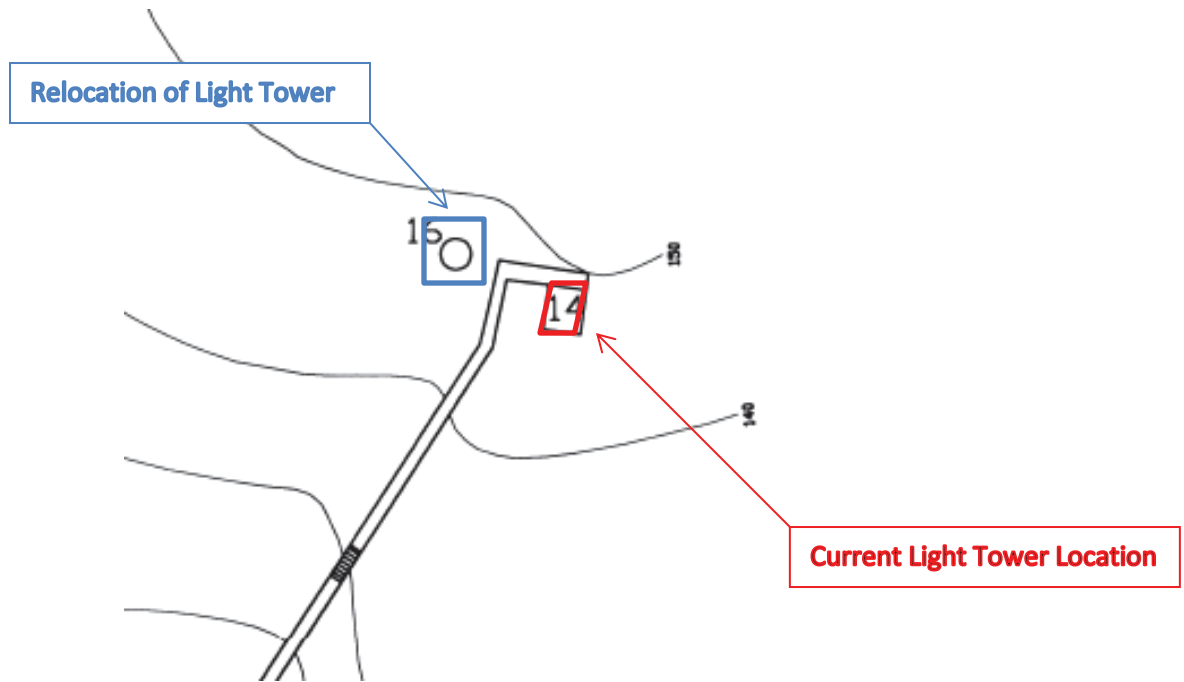
Figure 1: Site Location



Figure 2: Site Overview



Figure 3: Relocation of Light Tower



APPENDIX B
SUMMARY OF SUBMITTALS

	SUBMISSION DESCRIPTION	SECTION(S)	REQUIRED DATE
BID	Technical Bid Proposal	01 11 00 – 1.9.1.1	With bid
	Design profile drawing of proposed tower		
	Contractor qualifications		
	Schedule	01 11 00 – 1.9.1.2	With bid
DESIGN	Design Package	01 11 00 – 1.9.1.3	28 days after award
	Tower Design Drawings		
	Foundation Design Drawings		
	Grounding Design Drawings		
	Tower Fabrication Plan	01 11 00 – 1.9.1.4	28 days after award
	Tower company qualifications		
	Tower shop drawings		
	Tower fabrication schedule		
	Construction Plan	01 11 00 – 1.9.1.5	28 days after award
	Contractor qualifications		
	Health and Safety Program		
	Environmental Protection Plan		
	Concrete Construction Plan		
	Tower Erection Plan		
	Tower Grounding Plan		
	Supplemental Material	01 11 00 – 1.9.1.6	21 days after acceptance of Work
	As-built package		

APPENDIX C
TOWER SPECIFICATIONS

Latitude	51.2482083 N				
Longitude	-127.83371 W				
Design Standard	CSA S37-13				
Design Wind	Refer to Environment Canada Wind Analysis – July 4,2016				
Design Ice	25mm (Class II)				
Reliability	1				
Serviceability	1				
Tower Twist	0.05 DEG				
Tower Tilt	0.5 DEG				
Tower Type	Self-Support – 3 leg				
Tower Height	80 ft				
Paint	See Transport Canada and Nav Canada Evaluation Forms				
Lights	See Transport Canada and Nav Canada Evaluation Forms				
	See CCG Nav-aid requirement				
Ice Guard	N/A				
Safety Climb	Climb ladder c/w Trylon Cougar Rail or approved equivalent				
Anticlimb	No				
Lightning Protection	Lightning rod to provide 45deg protection top antennas				
Tx Brackets	Tx Brackets supplied to both non-climbing faces – 6 line capacity ea. OR Tx Brackets supplied on either side of ladder – 6 line capacity ea.				
Antenna List	Model	Height	Azimuth	Cable	Comments
Yagi	SY206-SF2SNM	70'	356	LDF4-50A	To Addenbroke (ALN)
Yagi	SY206-SF2SNM	70'	165	LDF4-50A	To Pine (ALN)
Yagi	SY206-SF2SNM	70'	0	LDF4-50A	
Yagi	SY206-SF2SNM	70'	0	LDF4-50A	
Dual Sinclair Dipole	SD212-HF2P2SNM	70'	90	LDF4-50A	Local VHF
Dual Sinclair Dipole	SD212-HF2P2SNM	50'	90	LDF4-50A	
4' SAT Dish		20'	100	LMR400 (4)	
Foundation Design	Refer to Simpson Geotechnical Report – SGL16-001 Egg Island Light Tower March 10 2016				
Tower Design	Refer to Assembly drawings				
Tower Orientation	Refer to Site Plan				
See Plan and Profile Drawing 15450 – ANTENNA LAYOUT AND SPECIFICATIONS					

APPENDIX D
SITE SPECIFIC WIND PRESURE REPORT

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

Site Information:

Name: Egg Island, BC
 Latitude: 51° 14' 53.7" N
 Longitude: 127° 50' 1.5" W
 Tower Height (m): 24.4
 Elevation MSL (m): 40

Results:

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

Q_{nbc} (Pa): 440	$Q_{nbc} = 440(Z/10)^{0.2}$	$V_{nbc} = 58.36$ 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):

$$Q_h = 0.12919 \{ [0.0000 e^{(-0.0000 z)} + 1.7439 \ln(z/0.5000) / \ln(z/0.0250)] 60.20 \}^2 (z/10)^{0.200}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{ [a_1 e^{(-a_2 z)} + a_3 \ln(z/z_h) / \ln(z/z_{01})] v_{01} \}^2 (z/10)^{0.200}$$

Site Values of Coefficients:

$$a_1 = 0.0000, a_2 = 0.0000, a_3 = 1.7439, z_h = 0.5000, z_{01} = 0.0250, v_{01} = 60.20 \text{ mph}$$

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 $z/10$ 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 $z/10$ 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)

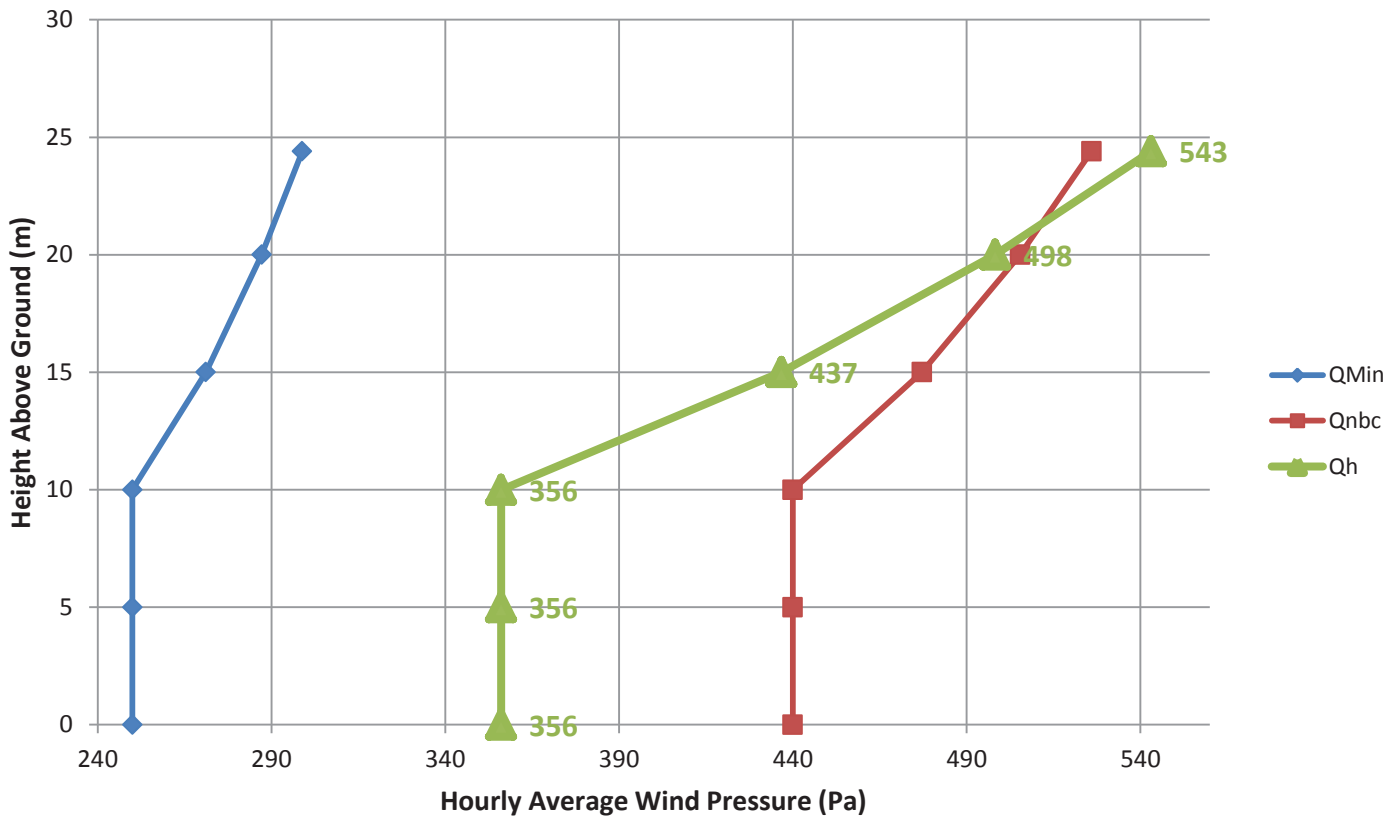
Height (Z): the vertical distance (m) above ground level at the base of the tower.

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%].

Environment Canada has not made and does not make any representations or warranties, either expressed or implied, arising by law or otherwise, respecting the accuracy of recommended climatic information. In no event will Environment Canada be responsible for any prejudice, loss or damages which may occur as a result of the use of design wind pressure recommendations.

10-yr. Wind Pressure Profile Graph for Egg Island, BC 24.4m Tower



Q_{nbc} Profile: Regionally representative reference wind profiled with the $z^{2/10}$ 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 $z^{2/10}$ 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 $z^{2/10}$ 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.

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

Site Information:

Name: Egg Island, BC
 Latitude: 51° 14' 53.7" N
 Longitude: 127° 50' 1.5" W
 Tower Height (m): 24.4
 Elevation MSL (m): 40

Results:

Note: Following direction from the S37 Committee, Q_e 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) 300	$Q_{Min} = 300(Z/10)^{0.2}$	$V_{Min} = 48.19$ mph

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

$$Q_h = 0.12919 \{ [0.0000 e^{(-0.0000 z)} + 1.7439 \ln(z/0.5000) / \ln(z/0.0250)] 65.89 \}^2 (z/10)^{0.200}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{ [a_1 e^{(-a_2 z)} + a_3 \ln(z/z_h) / \ln(z/z_{01})] v_{01} \}^2 (z/10)^{0.200}$$

Site Values of Coefficients:

$$a_1 = 0.0000, a_2 = 0.0000, a_3 = 1.7439, z_h = 0.5000, z_{01} = 0.0250, v_{01} = 65.89 \text{ mph}$$

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 $z/10$ 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 $z/10$ 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)

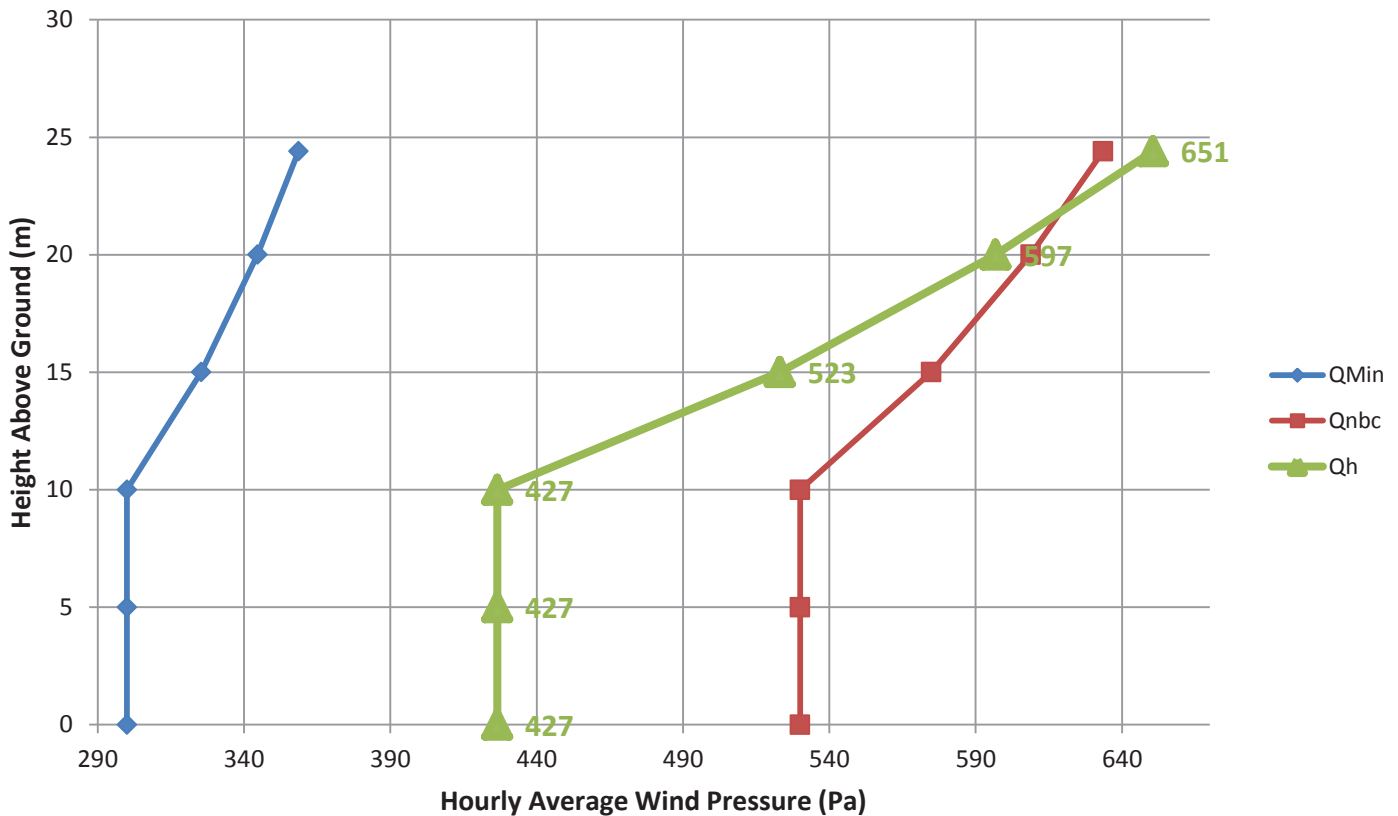
Height (Z): the vertical distance (m) above ground level at the base of the tower.

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%].

Environment Canada has not made and does not make any representations or warranties, either expressed or implied, arising by law or otherwise, respecting the accuracy of recommended climatic information. In no event will Environment Canada be responsible for any prejudice, loss or damages which may occur as a result of the use of design wind pressure recommendations.

30-yr. Wind Pressure Profile Graph for Egg Island, BC 24.4m Tower



Q_{nbc} Profile: Regionally representative reference wind profiled with the $z/10$ 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 $z/10$ 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 $z/10$ 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.

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

Site Information:

Name: Egg Island, BC
 Latitude: 51° 14' 53.7" N
 Longitude: 127° 50' 1.5" W
 Tower Height (m): 24.4
 Elevation MSL (m): 40

Results:

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

Q_{nbc} (Pa): 570	$Q_{nbc} = 570(Z/10)^{0.2}$	$V_{nbc} = 66.42$ 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):

$$Q_h = 0.12919 \{ [0.0000 e^{(-0.0000 z)} + 1.7439 \ln(z/0.5000) / \ln(z/0.0250)] 68.49 \}^2 (z/10)^{0.200}$$

Profile Formula General Form:

$$Q_h = 0.12919 \{ [a_1 e^{(-a_2 z)} + a_3 \ln(z/z_h) / \ln(z/z_{01})] v_{01} \}^2 (z/10)^{0.200}$$

Site Values of Coefficients:

$$a_1 = 0.0000, a_2 = 0.0000, a_3 = 1.7439, z_h = 0.5000, z_{01} = 0.0250, v_{01} = 68.49 \text{ mph}$$

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 $z/10$ 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 $z/10$ 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)

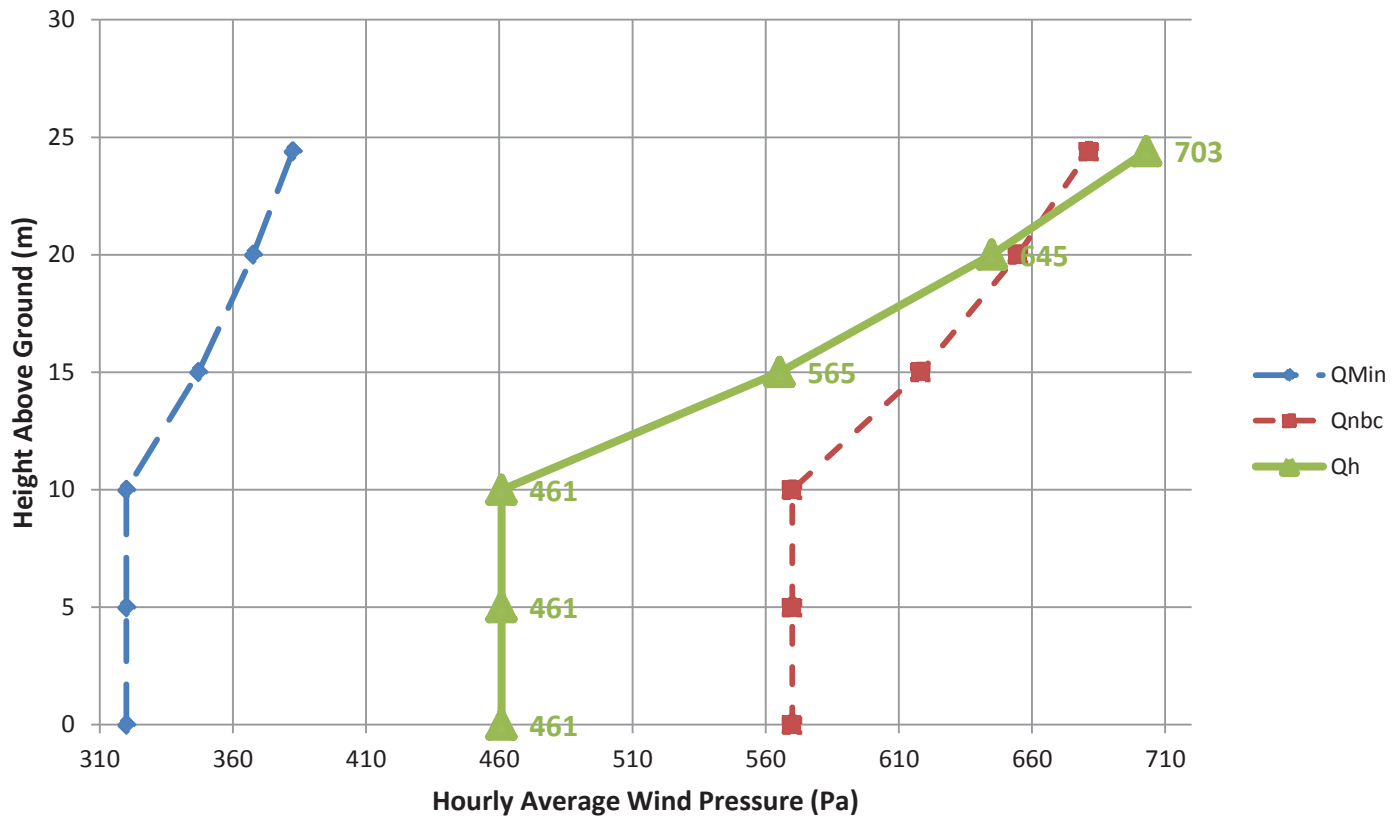
Height (Z): the vertical distance (m) above ground level at the base of the tower.

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%].

Environment Canada has not made and does not make any representations or warranties, either expressed or implied, arising by law or otherwise, respecting the accuracy of recommended climatic information. In no event will Environment Canada be responsible for any prejudice, loss or damages which may occur as a result of the use of design wind pressure recommendations.

50-yr. Wind Pressure Profile Graph for Egg Island, BC 24.4m Tower



Q_{nbc} Profile: Regionally representative reference wind profiled with the $z^{2/10}$ 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 $z^{2/10}$ 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 $z^{2/10}$ 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.

APPENDIX E
GEOTECHNICAL ASSESSMENT REPORT

March 10, 2016
File: SGL16-001

Fisheries and Oceans Canada, Pacific Region
Real Property, Safety & Security
9860 West Saanich Road
Sidney, British Columbia V8L 4B2

Attention: Mr. Shaun Zealand

**Re: Proposed Egg Island Light Tower Replacement
Report of Geotechnical Assessment**

INTRODUCTION

As requested, Simpson Geotechnical Ltd. has conducted a geotechnical assessment for the proposed light tower replacement at the Egg Island Light Station located north of Port Hardy and west of Smith's Inlet at approximately 51° 14' 53.93" N and 127° 50' 05.77" W.

We understand that the new tower would be a self supported steel skeleton tower in the order of 24.4m (80 feet) high and would be located adjacent to the existing 24.4m high steel skeleton light tower. It was not known at the time of our assessment on what side of the existing light tower the new light tower would be located. Figure 1 is a plan of the vicinity of the existing light tower.

This assessment has been conducted in general accordance with CSA S37-13 Antennas, Towers, and Antenna-Supporting Structures and the Canadian Foundation Engineering Manual, 4th Edition.

SITE ASSESSMENT

The site assessment was conducted on February 26, 2016 and consisted of observations of the general setting and ground surface geometry of the site,

dynamic cone penetration tests in the vicinity of the proposed tower with a Trigg's Wildcat Penetrometer, as well as mapping of bedrock condition and discontinuities at available bedrock exposures in the area.

The existing and proposed tower site was located on a relatively flat and level area at approximately the topographic high point of Egg Island. The immediate area of the tower site was cleared and vegetated with grasses and low brush, with occasional large tree stumps. The area surrounding the clearing was vegetated with dense brush and conifer trees with trunk diameters up to approximately 600mm.

The ground surface in the area generally sloped gently down in all directions from the existing tower, at approximately 3 to 5 degrees from horizontal to the north, south and east, and up to approximately 10 degrees from horizontal to the west. Photographs of our site observations are appended.

Five dynamic adhesion cone penetration tests were conducted around the existing light tower with a Trigg's Wildcat Penetrometer. Those tests indicated the subsurface to comprise primarily soft organic clay with sudden refusal encountered on what we interpret as the underlying bedrock surface at depths of 0.6 to 0.8m below the ground surface. The approximate dynamic cone test locations are shown on Figure 1 and the test logs are appended.

Hand excavation was conducted at the DC-1 dynamic cone test location. That excavation encountered black organic clayey topsoil and roots to 0.8m depth. A smooth fine grained basaltic rock surface was encountered at 0.8m depth.

Extensive exposures of fine grained basaltic bedrock were observed at lower elevations on Egg Island. The rock surface was commonly heavily weathered near surface and quickly became hard with depth. The rock exposures typically required several blows of a geologic hammer to break, indicative of Grade R3 (Medium Strong) rock in accordance with the Canadian Foundation Engineering Manual rock classification system.

Predominant bedrock discontinuities were measured at the observed bedrock exposures, as tabled below. The joints were moderately closely spaced, closed and without filler or evidence of water seepage.

Egg Island Light Station Predominant Bedrock Discontinuities			
Joint Set No.	Dip Direction	Dip	Joint Spacing
1	N82°E	80°	0.2 to 0.4m
2	N3°E	55°	0.16 to 0.34m
3	N25°E	63°	0.1 to 0.4m
4	N82°E	85°	0.25 to 0.6m

The rock quality designation (RQD) was measured by surface scanline at several locations of bedrock exposures below the existing light tower site. The scanline measurements resulted in an RQD of approximately 70 to 80% indicative of fair to good quality rock.

A specific gravity test in accordance with ASTM C127 was conducted on a rock sample retained from the site. That test indicated a specific gravity of 2.55 g/cm³ with absorption of 1.84%. That test report is appended.

The existing tower site is illustrated on Figure 1 and a photolog of our site observations is appended.

DISCUSSION AND RECOMMENDATIONS

General

Based on the site assessment described above, a self supported light tower foundation in the immediate vicinity of the existing Egg Island Light Tower may consist of a combination of concrete footings bearing on approved undisturbed intact basaltic bedrock with uplift resistance provided by resin or cementitious bonded rock anchors. The foundation design should be based on the geotechnical parameters tabled below in accordance with CSA S37-13 Antennas, Towers, and Antenna-Supporting Structures.

A Seismic Hazard Calculation for the site was obtained from Natural Resources Canada. That calculation indicated a Peak Ground Acceleration (PGA) of 0.103g for the 10% in 50 year (1 in 475 year) probability seismic event. The Seismic Hazard Calculation is appended.

**Recommended Geotechnical Foundation Design Parameters
(In accordance with CSA S37-13)**

Parameter	Value
Bedrock type	Basaltic
Design depth to sound bedrock (including weathered rock)	0.6 to 0.8m
Ultimate, unfactored, bearing resistance (bearing on approved, undisturbed, intact basaltic bedrock)	1500 kPa
Serviceability bearing resistance	500 kPa
Ultimate, unfactored compressive strength of intact basaltic bedrock free of joints and discontinuities	20 MPa
Unit weight of intact, undisturbed basaltic bedrock	25.0 kN/m ³
Ultimate, unfactored, grout to rock bond stress	1.5 MPa
Recommended design depth to groundwater	>6m
Rock Quality Designation (RQD)	70%
Design cone apex angle	maximum 90 degrees
Seismic site class (NBCC 4.1.8.4)	A

Footings should bear on essentially level and intact basaltic bedrock bearing surfaces. The uplift resistance should be based on the inverted cone approach 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 $1.2 \times D$ (where D is the anchor depth) should be considered to act as a group.

Sloped ground surface may truncate the uplift cone and reduce the cone volume and uplift capacity. Consequently, the more steeply sloped ground westward of the existing light tower is less geotechnically favorable than the flatter slopes observed on the other sides of the tower.

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 not anticipated to be

encountered due to the local topography of the site. However, perched water may be encountered during periods of wet weather.

CLOSURE

This report was prepared for the exclusive use of Fisheries and Oceans Canada, Real Property Safety and Security and their appointed agents for design of the proposed light tower foundation 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,

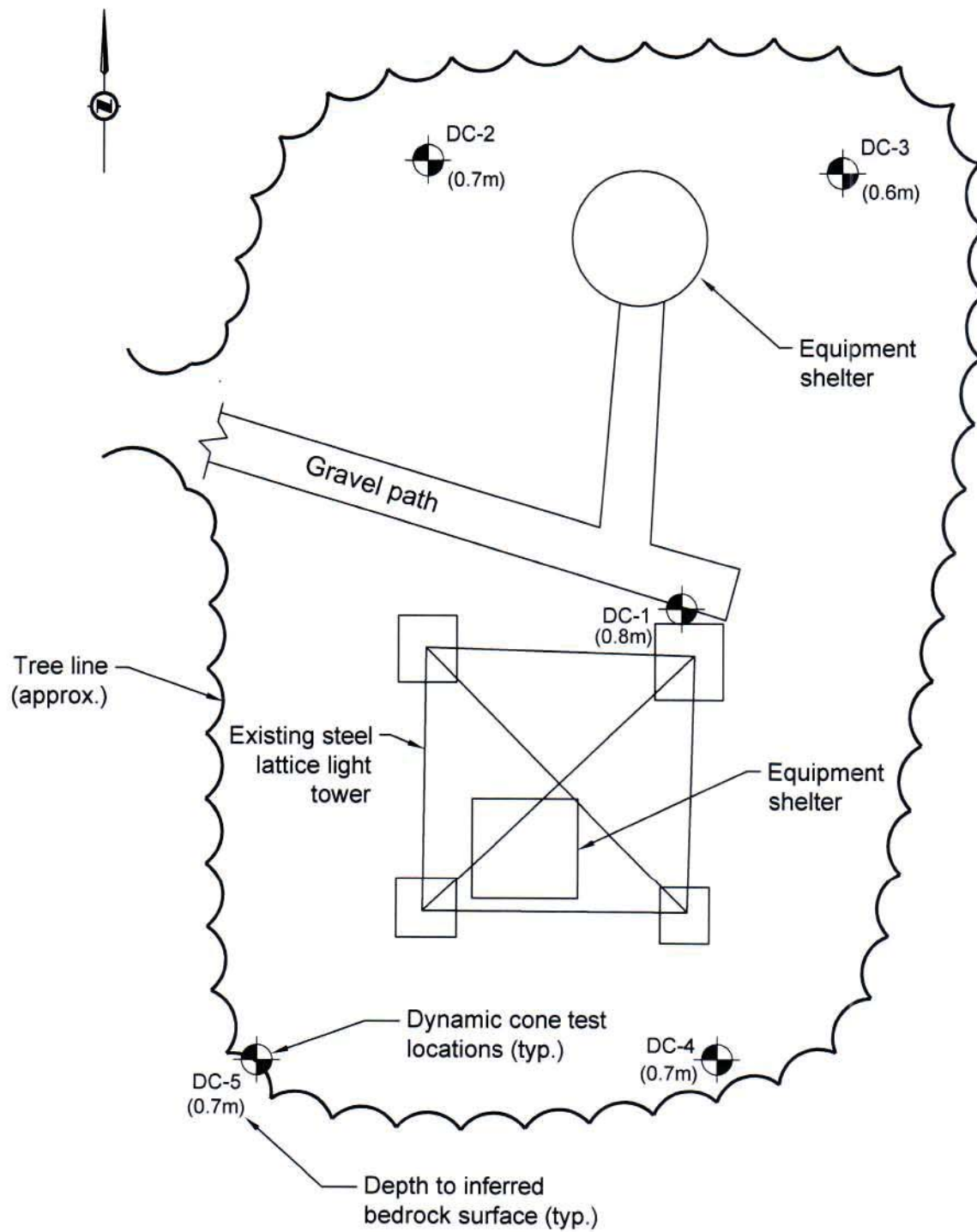
Simpson Geotechnical Ltd.

Per:


Richard Simpson, P. Eng.



Attachments: Figure 1 – Site Plan
Photo log
Dynamic Adhesion Cone Test Logs (5 pages)
Relative Density Test Report
Seismic Hazard Calculation



Project: Egg Island Light Tower				
Title: Geotechnical Site Plan				
Client: Fisheries and Oceans Canada, Pacific Region, RPSS				
File: SGL16-001	Drawn by: RRS	Scale: 1 : 100	Date: March 10, 2016	Dwg. No.: Figure 1

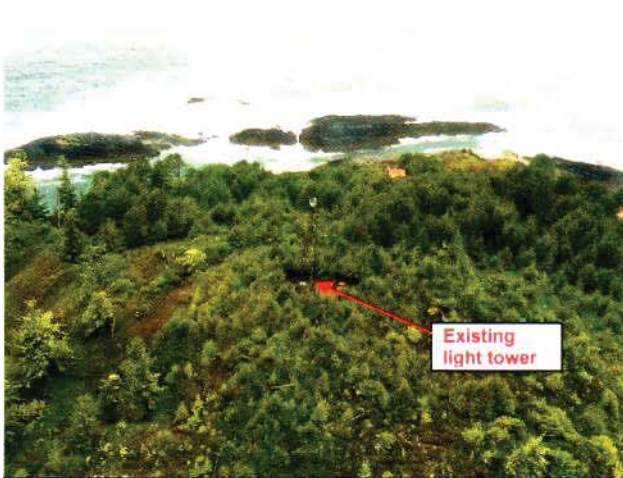


Photo 1 – Existing light tower looking westward



Photo 2 – Existing light tower looking southeastward



Photo 3 – Existing light tower area looking eastward from gravel path



Photo 5 – Basaltic bedrock exposure near tractor shed showing cubic jointing



Photo 6 – Bedrock at DC-1 location at 0.8m depth

WILDCAT ADHESION CONE LOG

Simpson Geotechnical Ltd.
 377 Milton Street
 Nanaimo, BC V9R 2K8

PROJECT NUMBER: SGL16-001
 DATE STARTED: 02-26-2016
 DATE COMPLETED: 02-26-2016

HOLE #: DC-1
 CREW: RS
 PROJECT: Light Tower Replacement
 ADDRESS: Egg Island Light Station
 LOCATION: Egg Island, BC

SURFACE ELEVATION: _____
 WATER ON COMPLETION: _____
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	SLEEVE TORQUE ft.-lbs.	ADHESION Kg/cm ²	CONE RESISTANCE Kg/cm ²	ADHESION RATIO %	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	INFERRED SOIL DESCRIPTION
	5	4	0.96	22.20	4.34	.....	4	SOFT CLAY
1 ft	1	2	0.48	4.44	10.86	•	0	VERY SOFT CLAY (ORG.)*
	6	5	1.21	26.64	4.52	.....	5	MEDIUM STIFF CLAY
	11	9	2.17	48.84	4.44	.....	9	LOOSE SILT
2 ft	18	7	1.69	79.92	2.11	.....	15	MEDIUM DENSE GRANULAR
	15	8	1.93	66.60	2.89	.....	12	MEDIUM DENSE SILT
	17	8	1.93	75.48	2.55	.....	14	MEDIUM DENSE SILT
3 ft								
1 m								
4 ft						Sudden refusal at 0.8m depth (inferred bedrock)		
5 ft								
6 ft								
2 m								
7 ft								
8 ft								
9 ft								
3 m	10 ft							
	11 ft							
	12 ft							
4 m	13 ft							

* SOFT CLAY, FAT CLAY, ORGANIC SOIL OR PEAT

WILDCAT ADHESION CONE LOG

Simpson Geotechnical Ltd.
 377 Milton Street
 Nanaimo, BC V9R 2K8

PROJECT NUMBER: SGL16-001
 DATE STARTED: 02-26-2016
 DATE COMPLETED: 02-26-2016

HOLE #: DC-2
 CREW: RS
 PROJECT: Light Tower Replacement
 ADDRESS: Egg Island Light Station
 LOCATION: Egg Island, BC

SURFACE ELEVATION: _____
 WATER ON COMPLETION: _____
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	SLEEVE TORQUE ft.-lbs.	ADHESION Kg/cm ²	CONE RESISTANCE Kg/cm ²	ADHESION RATIO %	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	INFERRED SOIL DESCRIPTION
1 ft	1	2	0.48	4.44	10.86		0	VERY SOFT CLAY (ORG.)*
2 ft	0	2	0.48	4.44	10.86		0	VERY SOFT CLAY (ORG.)*
3 ft	0	2	0.48	4.44	10.86		0	VERY SOFT CLAY (ORG.)*
4 ft	0					Sudden refusal at 0.7m depth (inferred bedrock)		
5 ft	1							
6 ft								
7 ft								
8 ft								
9 ft								
10 ft								
11 ft								
12 ft								
13 ft								

* SOFT CLAY, FAT CLAY, ORGANIC SOIL OR PEAT

WILDCAT ADHESION CONE LOG

Simpson Geotechnical Ltd.
 377 Milton Street
 Nanaimo, BC V9R 2K8

PROJECT NUMBER: SGL16-001
 DATE STARTED: 02-26-2016
 DATE COMPLETED: 02-26-2016

HOLE #: DC-3
 CREW: RS
 PROJECT: Light Tower Replacement
 ADDRESS: Egg Island Light Station
 LOCATION: Egg Island, BC

SURFACE ELEVATION: _____
 WATER ON COMPLETION: _____
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	SLEEVE TORQUE ft.-lbs.	ADHESION Kg/cm ²	CONE RESISTANCE Kg/cm ²	ADHESION RATIO %	GRAPH OF CONE RESISTANCE				N'	INFERRED SOIL DESCRIPTION	
						0	50	100	150			
	2											
	1	4	0.96	4.44	21.71	•				0	VERY SOFT CLAY (ORG.)*	
1 ft	1	2	0.48	4.44	10.86	•				0	VERY SOFT CLAY (ORG.)*	
	1	0	0.00	4.44	0.00	•				0	VERY LOOSE GRANULAR	
	1	4	0.96	4.44	21.71	•				0	VERY SOFT CLAY (ORG.)*	
2 ft	2	4	0.96	8.88	10.86	••				1	VERY SOFT CLAY (ORG.)*	
3 ft												
1 m												
4 ft												
							Sudden refusal at 0.6m depth (inferred bedrock)					
5 ft												
6 ft												
2 m												
7 ft												
8 ft												
9 ft												
3 m	10 ft											
	11 ft											
	12 ft											
4 m	13 ft											

* SOFT CLAY, FAT CLAY, ORGANIC SOIL OR PEAT

WILDCAT ADHESION CONE LOG

Simpson Geotechnical Ltd.
 377 Milton Street
 Nanaimo, BC V9R 2K8

PROJECT NUMBER: SGL16-001
 DATE STARTED: 02-26-2016
 DATE COMPLETED: 02-26-2016

HOLE #: DC-4
 CREW: RS
 PROJECT: Light Tower Replacement
 ADDRESS: Egg Island Light Station
 LOCATION: Egg Island, BC

SURFACE ELEVATION: _____
 WATER ON COMPLETION: _____
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	SLEEVE TORQUE ft.-lbs.	ADHESION Kg/cm ²	CONE RESISTANCE Kg/cm ²	ADHESION RATIO %	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	INFERRED SOIL DESCRIPTION
1 ft	1	2	0.48	4.44	10.86	•	0	VERY SOFT CLAY (ORG.)*
1 ft	1	2	0.48	4.44	10.86	•	0	VERY SOFT CLAY (ORG.)*
1 ft	1	3	0.72	8.88	8.14	**	1	VERY SOFT CLAY (ORG.)*
1 ft	1	3	0.72	4.44	16.28	•	0	VERY SOFT CLAY (ORG.)*
2 ft	2	7	1.69	8.88	19.00	**	1	VERY SOFT CLAY (ORG.)*
2 ft	10	10	2.41	44.40	5.43	*****	8	MEDIUM STIFF CLAY
3 ft								
1 m								
4 ft								
5 ft								
6 ft								
2 m								
7 ft								
8 ft								
9 ft								
3 m	10 ft							
11 ft								
12 ft								
4 m	13 ft							

Sudden refusal at 0.7m depth
(inferred bedrock)

* SOFT CLAY, FAT CLAY, ORGANIC SOIL OR PEAT

WILDCAT ADHESION CONE LOG

Simpson Geotechnical Ltd.
 377 Milton Street
 Nanaimo, BC V9R 2K8

PROJECT NUMBER: SGL16-001
 DATE STARTED: 02-26-2016
 DATE COMPLETED: 02-26-2016

HOLE #: DC-5
 CREW: RS
 PROJECT: Light Tower Replacement
 ADDRESS: Egg Island Light Station
 LOCATION: Egg Island, BC

SURFACE ELEVATION: _____
 WATER ON COMPLETION: _____
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	SLEEVE TORQUE ft.-lbs.	ADHESION Kg/cm ²	CONE RESISTANCE Kg/cm ²	ADHESION RATIO %	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	INFERRED SOIL DESCRIPTION
-	1	2	0.48	4.44	10.86	•	0	VERY SOFT CLAY (ORG.)*
- 1 ft	1	3	0.72	4.44	16.28	•	0	VERY SOFT CLAY (ORG.)*
-	1	2	0.48	4.44	10.86	•	0	VERY SOFT CLAY (ORG.)*
- 2 ft	1	4	0.96	4.44	21.71	•	0	VERY SOFT CLAY (ORG.)*
-	4	11	2.65	17.76	14.93	••••	3	SOFT CLAY (ORG.)*
- 3 ft								
- 1 m								
- 4 ft								
-								
- 5 ft								
- 6 ft								
- 2 m								
- 7 ft								
-								
- 8 ft								
-								
- 9 ft								
- 3 m	10 ft							
-								
- 11 ft								
-								
- 12 ft								
- 4 m	13 ft							

Sudden refusal at 0.7m depth
(inferred bedrock)

* SOFT CLAY, FAT CLAY, ORGANIC SOIL OR PEAT

Project Egg Island Light Tower **Project No.** SGL16-001
Client Fisheries and Oceans, RPSS **Date** 09-Mar-16
Sample Location Near Tractor Shed
Sample Description Fine grained basaltic
Pan No. H

Drying Start Time March 7, 2016 9am
Drying Stop Time March 8, 2016 12pm
Sample Dry, 110° for 24 hours (A) g 365 g
Soak Start Time March 8, 2016 2pm
Soak Stop Time March 9, 2016 11:30am
Saturated Surface Dry 24 hour soak (B) g 371.7 g
Water Temperature 23.2 ° C
Submerged Weight at 23° g (C) 228.4 g

Relative Density (specific gravity) = A/(B-C) 2.55 g/cm³
Absorption (%) = (B-A)/Ax100 1.84 %

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 (250) 363-6565

March 09, 2016

Site: 51.2483 N, 127.8349 W User File Reference: Egg Island Light Station

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)
0.183	0.294	0.383	0.410	0.399	0.289	0.186	0.066	0.023	0.177	0.393

Notes. Spectral ($S_a(T)$, 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)	0.055	0.107	0.138
Sa(0.1)	0.081	0.166	0.218
Sa(0.2)	0.117	0.226	0.291
Sa(0.3)	0.124	0.240	0.310
Sa(0.5)	0.109	0.224	0.296
Sa(1.0)	0.072	0.154	0.209
Sa(2.0)	0.040	0.092	0.130
Sa(5.0)	0.013	0.031	0.044
Sa(10.0)	0.0048	0.011	0.015
PGA	0.051	0.103	0.134
PGV	0.084	0.203	0.281

References

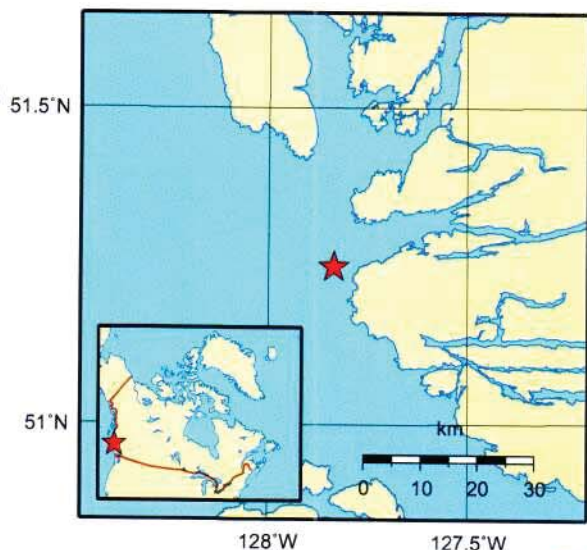
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

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

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Natural Resources
Canada

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Canada

Canada

APPENDIX F
STRUCTURAL REVIEW



Review by:
LTS Infrastructure Services
Limited Partnership
1500 1055 W. Hastings Street British Columbia,
Canada V6E 2E9

Customer: **Canadian Coast Guard**



STRUCTURAL REVIEW REPORT

SITE ID:
SITE NAME: *EGG ISLAND*
SITE LOCATION: *EGG ISLAND, B.C.*

LTS PROJECT No. :
DATE:

5080174 - 900006
September 27, 2016



Appendix A – Tower Profile.
Appendix B – Member Load and Capacity Charts.



1.0 Introduction.

As requested by Joseph Murray of Canadian Coast Guard a structural analysis was performed on the existing self support tower located at Egg Island, B.C. The tower is a 75 ft Prescott Agency 4 sided knock down structure. The objective of the analysis was to determine the tower structural adequacy for an existing loading.

The following information was used for the analysis:

Tower members: *The tower geometry and member sizes from site visit on July 14, 2015 and Prescott Agency drawing # 2458, dated September 16, 1959.*

Tower foundations: *Prescott Agency drawing # 2458, dated September 16, 1959.*

Antenna inventory: *From Canadian Coast Guard info and site visit info.*

Soils Report: *By Simpson Geotechnical Ltd file# SGL16-001, Dated March 10, 2016.*

Site verification: *August 24, 2016.*

2.0 Review.

The tower review was performed using a combination of hand calculations and "Guymaster" a computer program designed to calculate tower loading and member forces.

The following parameters were used for the analysis:

Standard: *CSA S37-13*

Wind: *Qh=461Pa @ 10m (Site specific 1/50)*

Ice: *1" Class II*

Combination factor: *$\psi=0.5$*

Importance Factor: *I = 1.0*

Serviceability Factor: *1.0*

3.0 Assumptions

The existing tower is assumed to have been properly maintained in accordance with the CSA-S37-13 Standard, to be in good condition and capable to support its original design load.

All prior structural modifications are assumed to be as per data supplied, and to have been properly installed and to be fully effective.

Some assumptions have been made regarding antennas and mounts. Their sizes and projected areas are based on the best interpretation of data supplied, the best knowledge of antenna type, and industry practice.

Maximum transmission line exposure to the wind as follows:

4- LDF4-50 or equal from 0 ft to 75 ft;

1- TECH90 or equal from 0 ft to 75 ft;

Tower leg and bracing material tensile strength $F_y=33$ ksi.

The ice loading used for this analysis is Class II ice (1") from the Ice Map in CSA S37-01.

Notify LTS Infrastructure Services if these assumptions do not reflect actual conditions.



4.0 Tower Loading.

Proposed load:

Elevation ⁽¹⁾	Antenna model	Q-ty	Azimuth	Transmission Lines	Q-ty	Carrier
30'-0"	SRL 206	1	TBD	LDF4-50	1	DFO
48'-0"	SRL206	1	TBD	LDF4-50	1	DFO
75'-0"	MaxLumina TRB-220 BEACON	1	NA	TECH90	1	DFO
75'-0"	Wind Sensor	1	NA	TECH90	1	DFO

(1) Elevations are antenna center above the tower base.

5.0 Review Results.

Tower member compressive forces

Elevation	Members					
	Legs		Diagonals		Horizontals	
	Force kip	Capacity %	Force kip	Capacity %	Force kip	Capacity %
0'-0" - 15'-0"	17.97	106*	5.65	62	3.61	37
15'-0" - 25'-0"	16.22	136*	3.16	22	2.26	19
25'-0" - 35'-0"	12.04	101*	3.1	20	2.37	17
45'-0" - 55'-0"	7.51	154*	3.56	33	2.12	18
55'-0" - 63'-0"	4.82	99	2.91	26	1.37	14
63'-0" - 70'-0"	3.25	45	1.81	20	0.65	5
70'-0" - 75'-0"	2.03	22	1.03	38	0.24	2

* Overstressed, reinforcing required

Tower foundation

	Foundation Loads (Factored)	Capacity %
Individual Shear	7.04 kip	
Individual Down	25.87 kip	61
Individual Uplift	21.33 kip	105*

* Overstressed, reinforcing required



6.0 Conclusions and Recommendations.

The existing tower and foundations with loading configuration outlined in section 4.0 is **structurally not adequate** to meet the requirements of CSA-S37-13 for a site specific wind $Q_h=461\text{Pa}$ @10.0m (*Site specific 1/50*) and (Class II) **1"** radial ice.

The existing tower, with loading configuration outlined in section 4.0 can be made structurally adequate to meet the requirements of CSA-S37-13 for a site specific wind $Q_h=461\text{Pa}$ @10.0m (*Site specific 1/50*) and (Class II), **1"** radial ice with the following recommendations:

- 1.0 Reinforce tower legs from 0'-0" to 55'-0" by installing mid panel horizontals;
- 2.0 Reinforce tower foundation.
- 3.0 Remove surface corrosion from tower members and paint with 2 liberal coats of zinc rich paint (ASTM A780)

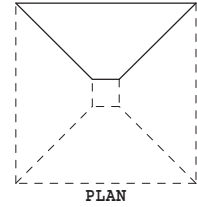
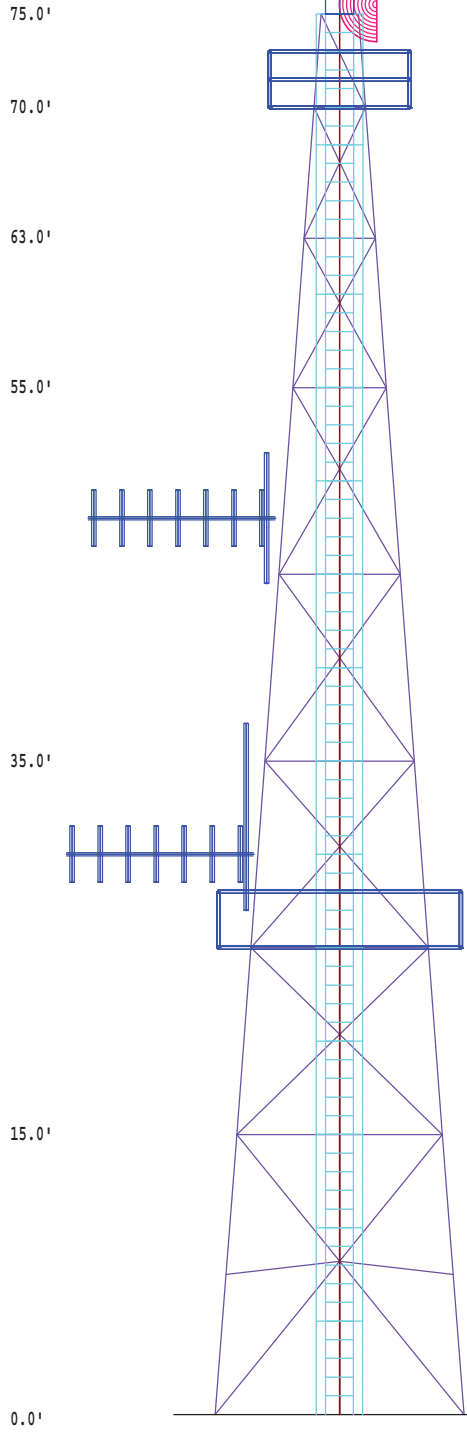
We recommend to replace service platform at 25 ft and beacon mount plate due to extensive corrosion.

We trust the analysis and recommendations presented in the report will meet your requirements. However, please do not hesitate to contact the undersigned if you have any questions, or require any further information regarding this analysis.

LTS Infrastructure Services Limited Partnership.

Review By: _____
Vladimir Tchirkov
Manager Engineering.

Leg	300W	L 3"x3"x3/8"	L 2-1/2"x2-1/2"x1/4"	1 @ 8.0'	3.8'	1 @ 7.0'	2.0'
Diagonal	300W	L 3"x3"x1/4"	L 2-1/2"x2-1/2"x1/4"	1 @ 8.0'	3.8'	1 @ 7.0'	1 @ 5.0'
Horizontal	300W	L 3"x3"x1/4"	L 2-1/2"x2-1/2"x1/4"	1 @ 8.0'	3.8'	1 @ 7.0'	1 @ 5.0'
Brace		L 2"x2"x1/4"					
Sub Horizontal		L 3"x3"x1/4"					
Face Width	13.3'	11.0'					
Panel Height # Panels		1 @ 15.0'	4 @ 10.0'				



NOTES:
1.0 FOUNDATION LOADS ARE FACTORED VALUES AS PER CSA S37-13

ANTENNA LIST

NO	ELEV	ANTENNA	TX-LINE
1	30'-0"	SRL206	LDF4
2	48'-0"	SRL206	LDF4
3	75'-0"	TRB-220 BEACON	TECH90
4	75'-0"	WIND SENSOR	

MATERIAL LIST

NO	TYPE
A	L 1-1/4"x1-1/4"x3/16"

TOTAL FOUNDATION LOADS

H=11.60 k
V=24.39 k
M=459.65 k-ft
T=14.34 k-ft

INDIVIDUAL FOOTING LOADS

H=7.04 k
V=25.87 k
U=-21.33 k

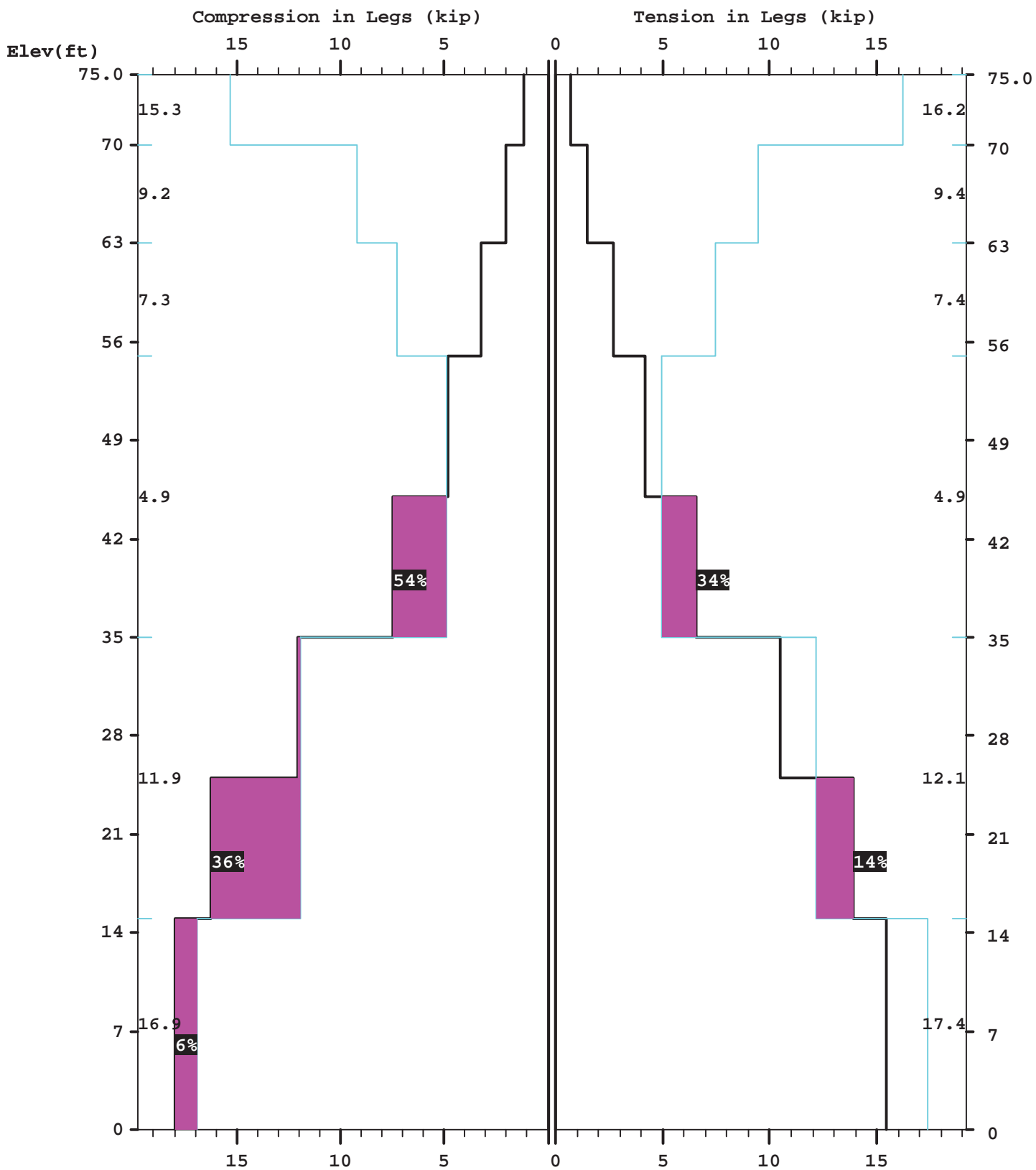


LTS Infrastructure Services

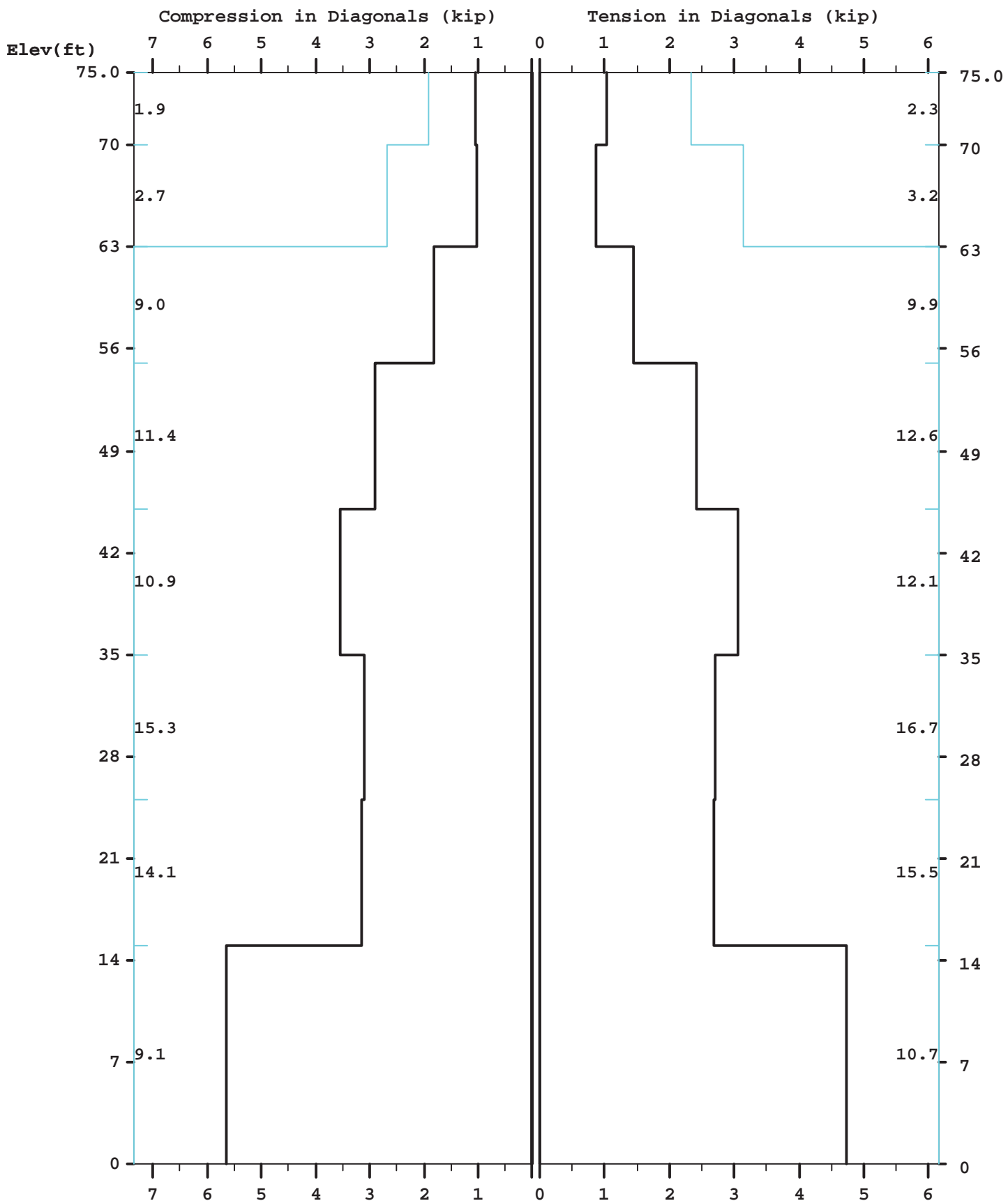
1500, 1055 W. Hastings Street, Vancouver, B.C.
Phone: (604) 999-5263

Client: CANADIAN COAST GUARD	Job No: 5080174	Date: 27 sep 2016
Location: EGG ISLAND, B.C.	Total Height: 76.50'	Tower Height: 75.00'
Standard: CSA S37-013	Design Wind & Ice: Qh=461 Pa @10m, ICE: 25mm	

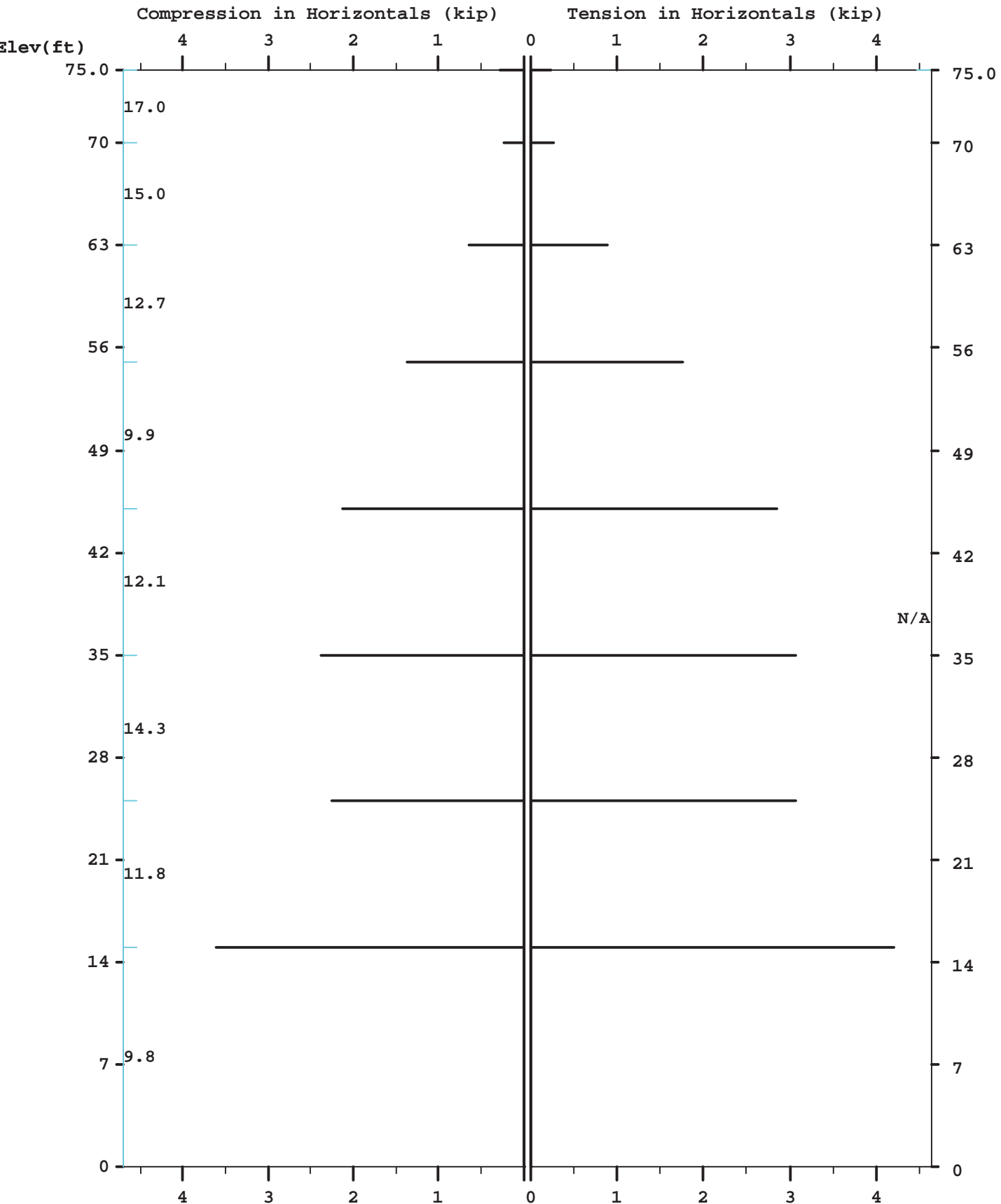
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Maximum



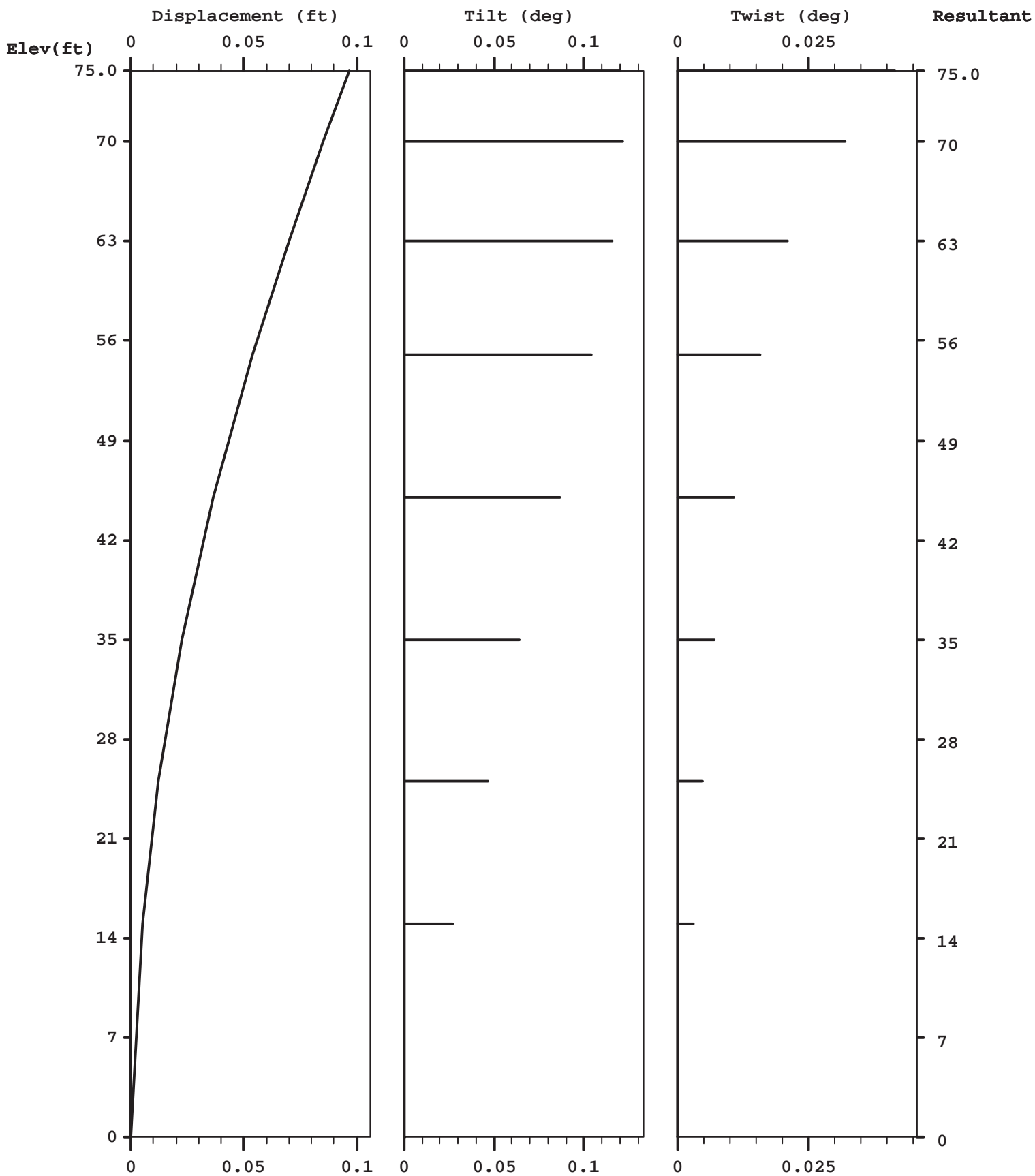
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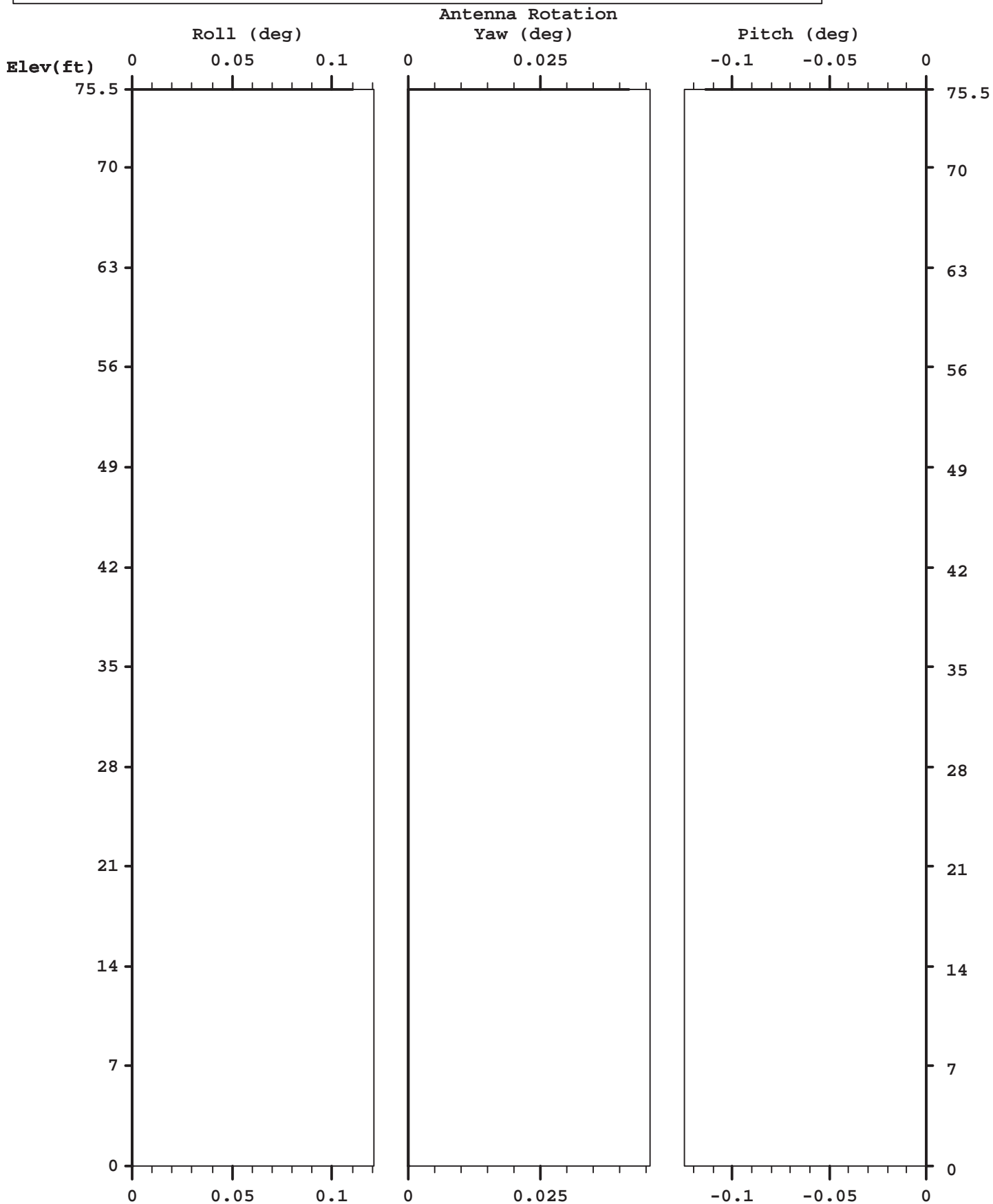
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Maximum



EXISTING EGG ISLAND
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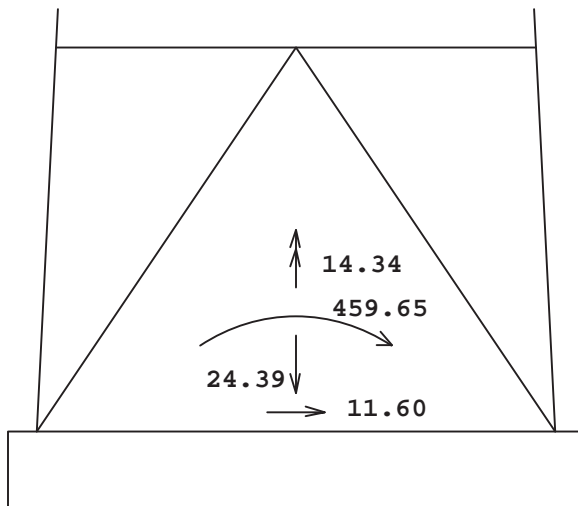


EXISTING EGG ISLAND
Maximum



EXISTING EGG ISLAND
Maximum

TOTAL FOUNDATION LOADS (kip, ft-kip)



INDIVIDUAL FOOTING LOADS (kip)

