



**TECHNICAL SPECIFICATION FOR:  
Design, Fabrication and Supply of two  
34.0m DGPS Towers  
&  
Installation of one Unit:  
Point Escuminac, NB**

**Canadian Coast Guard  
Maritime and Civil Infrastructure  
Prepared by: JS  
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## **Section 011100**

### **Summary of Work**

## Summary of Work

### Part 1 – General

#### 1.1 Description of work

The work covered under this specification consists of design, fabrication, supply of two new DGPS Tower Systems, and the installation of one system at Point Escuminac, NB. The work to be done under this Specification shall include all labor, materials and equipment necessary to complete the design, fabrication and installation to the full extent of the Specification and Drawings. The specification is for a 30-year performance life. Work shall include but not be limited to the following:

- Engineering design, supply and installation of a 34.0m guyed DGPS tower structure, guys, guy hardware, foundations and anchors, guy curtain, radial ground system, tuning unit and all other materials required to meet the terms of this contract.
- Supply and installation of auxiliary facilities such as ladders, safety rails, and platforms.
- Tower and anchor layout in accordance with approved engineering drawings. Actual layout shall be subject to the approval of Departmental Representative prior to commencement of any work.
- Contractor responsible for safe dismantling and disposal of existing DGPS tower at the Point Escuminac site, including antenna system, transmission lines, guys and guy anchor systems. Salvage items as directed by Departmental Representative.
- Contractor responsible for supply and installation of site fencing.
- Contractor responsible for design, supply and install of transformer.
- Contractor responsible for arranging all snow clearing requirements.
- Transportation of all materials and equipment to the sites. (the second tower is to be shipped to Dartmouth, NS.)
- All antenna orientation, optimization, testing, and system commissioning. Contractor shall coordinate all work with Departmental Representative and provide report.
- Contractor responsible for all site clean-up following completion of work.

#### 1.2 Definitions

“Departmental Representative” means: Fisheries and Oceans Canada, Canadian Coast Guard (CCG)

“(Tower) Design Engineer” means: Contractor’s Design Engineer of Record.

#### 1.3 Existing Site Conditions

1.3.1 The contractor should note that this work is to be performed on an existing site. The site is located adjacent to other towers. Refer to the site survey and location maps for the Point Escuminac site, appended to this specification for site details and new tower locations.

## Summary of Work

- 1.3.2 Before tendering it is recommended that the Contractor familiarize themselves with the remote location, scope of work, site restrictions, short construction season and temporary measures required to complete work as specified. **No after claim will be allowed** for any work or material necessary for proper execution and completion of the contract.
- 1.3.3 The site is located at 47°-04'-23.0" N (Latitude) and 64°-47'-53.3" W (Longitude) for Point Escuminac, NB. Refer to Appendix B for site survey
- 1.3.4 The Second tower and associated equipment is to be delivered to Dartmouth, NS. Contractor to transport, deliver and unpack onsite. Department Representative to coordinated delivery schedule and provide address.
- 1.3.5 Any dimensions given in this Specification or appended drawings are approximate and are for guidance only. Exact dimensions and layouts to be determined by the Contractor in the field.
- 1.3.6 The site is accessible by 2WD vehicle using an access road.
- 1.3.7 Contractors should note that there are restrictions at this location with regard to:
- the available space
  - location of cable trenches
  - location of buried power conductors
  - location of buildings
  - location of overhead power conductors
  - access to anchors (guy lanes to be cleared of trees and brush)

It shall be the Contractor's responsibility to locate and protect all buried cables and other underground or overhead structures. Any damage to such structures shall be the responsibility of Contractor. Where unknown services are encountered, Contractor to log location and advise Departmental Representative immediately.

### 1.4 Existing Soil Conditions

- 1.4.1 Geotechnical reports are attached in Appendix E of this specification. The Contractor is reminded that the intention of these reports is to provide data applicable to borehole and test pit locations. Any interpolation or assumptions made relative to any locations other than the borehole and test pit locations, is the responsibility of the Contractor. Contractor is to advise the Departmental Representative if any discrepancies exist between the Geotechnical report and actual excavations.

### 1.5 Schedule

- 1.5.1 All work on the project shall be completed within the time indicated in the tender document.

## Summary of Work

- 1.5.2 Design to be substantially completed within four weeks of award. Fabrication to be substantially completed within eight weeks of award. Installation to be completed within 20 weeks of award.
- 1.5.3 Contractor is to provide an updated detailed schedule and commence work immediately upon award of contract and after review and approval of all submittals.
- 1.5.4 The Contractor is to make every effort to ensure sufficient material and equipment is delivered to site at the earliest time possible upon award of the contract.
- 1.6 Site Operations**
- 1.6.1 Arrange for sufficient space adjacent to project site for conduct of operations storage of material etc. Exercise care so as not to obstruct or damage public or private property in area. Do not interfere with normal day-to-day operations at site. All arrangements made for space and access shall be made by the Contractor. All arrangements for security shall be made by the Contractor.
- 1.6.2 At completion of work restore area to its original condition. The Contractor must repair damage to ground and property. Remove all construction materials, residue, excess etc., and leave site in a condition acceptable to Departmental Representative.
- 1.7 Project Meetings**
- 1.7.1 Departmental Representative will arrange and give notice of all project meetings. Contractor is responsible for any expenses related to attending these meetings.
- 1.7.2 All project meetings will take place at site of work unless otherwise directed by the Departmental Representative.
- 1.7.3 Prior to commencement of work there will be a Project “Kick-Off” Meeting. The Contractor’s Project Manager, the Departmental Representative and the consultant will be in attendance. The meeting will via Teleconference.
- 1.7.4 Departmental Representative will be responsible for recording minutes and distribution.
- 1.7.5 Contractor to have a responsible representative present at all job meetings and to the maximum extent possible, this should be the same person.
- 1.8 Protection of Materials and Equipment**
- 1.8.1 Store all materials and equipment to prevent theft or damage. Repair or replace all material or equipment damaged in transit or storage to the satisfaction of and at no cost to the Departmental Representative.

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**Summary of Work**

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**1.9 Documents Required on Site**

1.9.1 Contractor to maintain on site one copy of the following:

- Health and Safety Plan
- First Aid Kit
- Contract drawings and specifications
- Addenda
- Reviewed shop drawings
- Change Orders
- Other modifications to Contract
- Field test reports
- Copy of approved work schedule
- Manufacturers Installation and Applications Instructions
- Contact information for Departmental Representative.
- Other items as requested

**1.10 Taxes and Permits**

1.10.1 Contractor to obtain all Federal, Provincial and Municipal permits and pay all applicable taxes.

**END OF SECTION**

**Section 013300**  
**Submittal Procedures**

## Submittal Procedures

### Part 1 – General

#### 1.1 General

- 1.1.1 The Contractor shall submit for review, design and detail drawings in PDF format to the Departmental Representative and consultant. The review period by the Departmental Representative shall be two weeks. After successful review, one copy of each submitted drawing will be returned to the Contractor either “Reviewed” or “Reviewed as Noted”. There after no change shall be made to the drawing without the permission of the Departmental Representative. The Professional Engineer, responsible for the design, shall seal all drawings submitted to the Departmental Representative and must be registered to practice by the Association of Professional Engineers and Geoscientists of New Brunswick.
- 1.1.2 The Contractor, at no additional cost to the Departmental Representative, shall make any changes in the drawings which may be required, consistent with this Specification and shall submit revised copies for review in the manner herein set out. The review does not relieve the Contractor from responsibility for ensuring that his complete work meets all the requirements for the drawings and Specifications contained herein. Items submitted are to be complete, in final form and ready “for construction”. Incomplete submissions will be returned. The Contractor shall ensure that the tower design, including guy location, does not interfere with the operation of the antenna systems.
- 1.1.3 Any work done prior to the return of the reviewed drawings shall be at the Contractor’s own risk. The Departmental Representative or his representative may issue a stop work order if any site work is started prior to approval of engineering drawings. Any costs associated with this shall be the Contractor’s responsibility.
- 1.1.4 Drawings of the work produced by the Contractor and all rights and privileges associated therewith shall become the exclusive property of the Departmental Representative who will be free to make any use or reuse of said drawings which in the opinion of the Departmental Representative is reasonable and/or required in the Departmental Representative’s interest.

#### 1.2 Mandatory Construction Plan Submittal

- 1.2.1 A construction plan of sufficient detail to demonstrate that the contractor has considered all the challenges of the project and is prepared to undertake the works in a competent and professional manor in accordance with all legislation including:
- List of subcontractors proposed for: steel fabrication, galvanizing, painting and tower erection.
  - Project specific safety program
  - Project environment protection plan
  - Detailed demolition plan for Point Escuminac tower
  - Tower Erection plan

## Submittal Procedures

- Detailed work schedule including all project milestones for design, fabrication, transport and installation.

### 1.3 **Mandatory Technical Submission**

1.3.1 Copies of all Quality Control and Quality Assurance programs in place relating to, governing and demonstrating the ability to complete the work in question, including but limited to, the tower painting process, steel fabrication process and the tower steel galvanizing process. Details of all material handling procedures are to be included.

1.3.2 Details with regard to the steel supplier and fabrication company and their CWB certification number.

1.3.3 Sealed Drawings which include:

- Structural profile drawing showing the sizes of legs, web members and bolts. The elevations at which the member sizes changes shall be clearly shown. Antenna orientation, size, type and center of radiation shall be clearly indicated. The drawing shall include all pertinent design information including design standard, ice loading, wind loading, bearing pressure, soil conditions, elevation difference from base and any special design factors. A copy of this drawing shall be submitted on a CD in AutoCAD format (unless other wise discussed with Departmental Representative).
- A detailed plan of the tower clearly showing the attachment position and size of all attachments including (but not limited to), TX lines, ladders, lifeguards, safety devices and anticlimb in relation to the leg and web members and antennas.
- Detailed drawings showing the following:
  - a) Details of tower sections.
  - b) Details of each different leg and web member and their connections.
  - c) Details of ground fault interrupters.
  - d) Details of the tuning unit installation
  - e) Details of anti-climb devices.
  - f) Details of grounding bars.
  - g) Description of materials, i.e. grades of steel, bolts, steel capacity, etc.
  - h) Shop drawings shall be provided with drawings.
- Details of tower and guy assemblies, including:
  - a) Make, type, diameter, breaking strength, cross sectional area, weight, etc.
  - b) Make, size and description of all guy assembly hardware, including ultimate capacity.
  - c) Preformed guy grips: Make, type, length, diameter, number and size of wires and a note indicating that grip lay shall be the same as the guy lay.
  - d) Mechanical or pressed sleeves: physical dimensions such as length and diameter.
  - e) Turnbuckles: Make, ultimate capacity, diameter, take up.
  - f) Bridge sockets: Make, size and take up.

## Submittal Procedures

- g) Initial design tensions and pulse charts over a range from  $-30^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$  in  $5^{\circ}\text{C}$  increments.
- h) Details of any special members.
- i) Details of the climbing ladder, safety fall arrest rail and trolley system.
- j) Details of the tower base insulator and guy wire insulators.
- k) Tower profile, anchor radius, anchor drop off, etc.
- l) Details of the tower base foundation and guy anchors, showing all dimensions and steel reinforcement or rock anchor details. Drawings shall show concrete strength. Where rock bolts are used, installation and testing procedures shall be clearly indicated on the drawings. Generic copies of typical foundations are not adequate.
- m) Manufactures detailed Bill of Materials showing quantities, part number, drawing reference number, weight, mark number, etc.
- n) Design details related to wind and ice loading, design standard, etc.
- o) Details with regard to any special design assumptions.
- p) Any other drawings or diagrams required in order to make clear the work intended or show its relation to adjacent work of others.
- q) All vendor data sheets for antennas, tx lines, ground kits and all other third party products proposed for use.

1.3.4 On acceptance of the Tender, the Contractor shall submit for review sealed design calculation report which includes:

- Reference design standard.
- All design loadings.
- All foundation analysis and calculations.
- All tower computer analysis input and output.
- All tower member capacity calculations.
- Any other information requested by Departmental Representative.

1.3.5 Contractor shall maintain and update the work schedule. Each revision shall be submitted to the Departmental Representative for review.

### 1.4 As Built Drawings

1.4.1 Upon completion of all work, and prior to release of contract holdback, the Contractor shall issue a full set of As Built drawings, which reflect any and all changes from the original contract drawings. These drawings shall be stamped AS BUILT DRAWINGS and shall be sealed by a Professional Engineer in accordance with the requirements of this specification. Submit a full set of drawings (with Tower Engineer's stamp) on CD in AutoCAD format and two (2) copies of the stamped paper versions in binders including **ALL** product data on the antennas, Tx lines, etc. Binder to have cover page with the Project Name and Location, Departmental Representatives Name (Canadian Coast Guard), design engineer, Manufacturer, Installer and date of completion. A tower profile photo should also be included.

1.4.2 As built drawings, shall show actual antenna arrangement including azimuths and elevations, anchor radius and drop, leg azimuth, etc.

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**Submittal Procedures**

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1.4.3 As part of the final submission, a set of tension and pulse charts will be submitted for temperature range of  $-30^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$  in  $5^{\circ}\text{C}$  increments based on actual guy lengths, radius and anchor elevations.

1.4.4 All As-built submissions to be bound in a binder format.

**1.5 Inspection Reports**

1.5.1 The Contractor is to submit two (2) PDF copies of all quality control test reports required by this specification immediately upon completion of testing.

**1.6 Safety Plan**

1.6.1 The Contractor is to submit two (2) copies of their project and site specific Safety Plan, including, climbing safety, rescue techniques, rigging procedures, equipment maintenance and inspections, general work site safety, hazardous material safety (WHMIS), site security, public safety etc. and emergency response plans, for review prior to commencement of work on site.

**END OF SECTION**

# **Health and Safety Requirements**

## **Section 013530**

## Health and Safety Requirements

### Part 1 - General

#### 1.1 Summary

- 1.1.1 This section describes specific safety requirements to be observed and enforced during the scope of this work.
- 1.1.2 Inclusion of these safety requirements shall not constitute a relief of the Contractors responsibility but is a precaution against oversight and errors.
- 1.1.3 The Contractor is solely responsible for safety procedures necessary to; meet the requirements of these specifications and to ensure the safety of workers and the general public.

#### 1.2 Construction Safety

- 1.2.1 Provide all workers, including sub-trades, with adequate and appropriate safety regulations prior to commencement of their duties. Ensure all workers comply with all safety regulations required by Federal and Provincial Regulations, Worker's Compensation Board and municipal statutes. Take all precautions and provide all required protection to ensure the safety of the general public and the workers in accordance with the current edition of the Occupational Health and Safety Act and Regulations applicable for construction projects and all applicable regulations such as but not limited to The Canada Labour Code, The Provincial Workers Compensation Regulations, Health and Welfare Canada Safety Code 6.
- 1.2.2 In the event of conflict between any provisions of the above authorities the most stringent shall govern.
- 1.2.3 Provide health and safety protection required by the manufacturer's printed literature and ensure that all workers are trained in the safe use of health and safety equipment and the handling of materials. Ensure that at least one-person remains on site at all times who is properly trained in the first aid aspects required to deal with emergency situations that may arise. The safety person should be trained in the proper use of climbing harnesses and equipment.
- 1.2.4 A first aid station must be maintained on site, available to workers at all times.
- 1.2.5 Protect all utilities and services against damage or interruption. Any claims resulting from damage will be the Contractor's responsibility. The possible location of any underground cables must be established and marked prior to any excavation.
- 1.2.6 Post "NO SMOKING" signage where flammable materials are being used. Do not allow use of spark producing equipment during application of flammable materials.

## Health and Safety Requirements

Ensure that at least one site person is trained to deal with emergency situations that may arise due to fire.

1.2.7 Take all required precautions, including those recommended by the manufacturers printed instructions, to protect persons and property, including vehicles from over-spray of materials.

1.2.8 Contractors' Site/Project specific Safety Plan shall incorporate the following;

- Continuous attachment at all times while on the tower. No unattached climbing will be permitted at any time
- Use of CSA approved; full body harness, belts, lanyards, trolleys, safety hats, safety boots, safety vest, and other equipment used to complete the job.
- Only experienced personnel with previous training and demonstrated experience working on similar structures and heights to work on the project.
- Not allowing personal to use equipment winches for transport of personnel.
- The ability for any worker to discuss issues that they feel affects worker's safety.
- Tailgate/job assessment forms to be completed daily and made available upon request.
- **Appropriate fall rescue plans and equipment.**

1.2.9 The Contractor shall prepare a written **Project/site specific Construction Safety Plan** outlining all procedures and safe work practices which must be followed by all personnel working on the construction site. This plan is to be developed in conjunction with all subcontractors who will be working on site. It is the Contractor's responsibility to become familiar with all safety laws and regulations applicable to the type of work to be undertaken. These safety laws and regulations shall be addressed in the safety plan as clear and specific safety rules, procedures and work practices. The Contractor shall ensure that all of his workers and his sub-contractors, as well as any other authorized persons working or circulating in the construction work area, have been briefed and are familiar with the safety rules and measures indicated in the Safety Plan and understand that these measures are mandatory at the construction site. Regular Site Safety Meetings and daily tailgate/job assessment meetings shall be held and minutes taken by the Contractor.

### 1.3 **Fire Safety**

1.3.1 Comply with the latest requirements of standard for Building Construction Operations FCC, No. 301, (Latest Edition) issued by the Fire Commissioner of Canada.

### 1.4 **Falsework and Scaffolding**

1.4.1 Design and construct all falsework as per CSA S269.1 (latest edition) and scaffolding as per SAS 269.2 (latest edition).

## Health and Safety Requirements

### 1.5 Overloading

1.5.1 Ensure no part of the work is subject to load(s) which endanger safety or will cause permanent deformations.

### 1.6 Signage and Barriers

1.6.1 The contractor is to maintain necessary signage to ensure workers, people accessing the site and the general public are aware of any hazards or potential hazards. Barriers are to be provided as required by regulation to ensure access to work by the general public is restricted.

1.6.2 The Safety Plan must be placed on the Construction Site in a common area visible to all workers and other persons accessing the site. All employees are to be advised of the Safety Plan. The Safety Plan shall also address the means to communicate the intent to all persons.

1.6.3 Submission of a Safety Plan to the Departmental Representative does not relieve the Contractor of any legal obligations for the provision of construction safety as specified by Federal and/or Provincial Safety Acts or Regulations.

1.6.4 Contractor shall ensure compliance with the Safety Plan. The Departmental Representative or authorized representative reserves the right to demand removal of any person(s) not complying. Any person removed shall not be permitted reentry to the site.

1.6.5 Provide Safety Plan immediately upon award of contract. The Safety Plan shall be submitted to the Departmental Representative for review prior to commencement of work. Work shall not be allowed to begin until safety plan has been submitted. Revise Safety Plan as required for changes in work procedures or when directed by Departmental Representative, Safety Officer or authority.

### 1.7 Hazardous Products

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

1.7.2 Deliver copies of WHMIS data sheets to Departmental Representative on delivery of materials.

1.7.3 All data sheets must be posted on site in a common area visible to all workers and subcontractors.

1.7.4 Make all efforts to select and use materials (ie. adhesives, solvents, cleaners etc.) for the type and nature of work being performed which are the least hazardous products available, of low VOC content or low toxicity type products and emitting low noxious

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**Health and Safety Requirements**

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odors. Select products known to be friendly to the environment and to human health. Communicate this intent to all subcontractors, suppliers and manufacturers.

- 1.7.5 Where the use of hazardous and toxic products cannot be avoided:
- Advise Departmental Representative beforehand of the product(s) intended for use. Submit WHMIS data sheets as per requirements above.
  - Schedule in conjunction with the Departmental Representative, to carry out the work during “Off Hours” where workers and employees have left the site.

**END OF SECTION**

# **Environmental Protection**

## **Section 013543**

**Environmental Protection****Part 1 – General****1.1 Summary**

1.1.1 This section describes environmental protection requirements to be observed and enforced during the progress of the Work.

1.1.2 Inclusion of these environmental requirements shall not constitute a relief of the Contractor's responsibility but is a precaution against oversight or errors.

1.1.3 The Contractor is solely responsible for all environmental protection procedures deemed necessary by the Contractor to meet the requirements of these Specifications. Contractor shall comply with all applicable Federal, Provincial and Municipal regulatory requirements.

1.1.4 Contractor is fully responsible for all costs associated with required remediation occurring from contractors work on site.

**Part 2 – Products**

2.1 Avoid the use of hazardous products. Use environmentally friendly products where practical.

**Part 3 - Execution****3.1 Fires**

3.1.1 Fires and burning of rubbish on site are not permitted.

**3.2 Disposal of Waste**

3.2.1 Do not bury rubbish or waste materials on site.

3.2.2 Do not dispose of waste or volatile materials such as mineral spirit, oil or paint thinner, into waterways, storm or sanitary sewers.

**3.3 Pollution Control**

3.3.1 Control emissions from equipment and plant to governing authorities' emission control requirements.

3.3.2 Prevent dust and debris from demolition operations and other extraneous materials from contaminating air beyond application area by providing temporary enclosures.

3.3.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

3.3.4 Contractor is to ensure all equipment is in good repair and no fuels or fluids are leaking from it. Equipment in disrepair will be removed from site. Basic petroleum spill clean-up equipment should be on site.

**Environmental Protection**

- 3.3.5 No maintenance, beyond that of a required daily routine nature shall be performed on equipment while on site. No refueling to be completed within 30 m of a water body.
- 3.3.6 No bulk storage of fuel or hazardous products will be permitted on site.
- 3.3.7 Work should be scheduled to avoid periods of heavy precipitation. Erosion control structures (temporary matting, geotextile filter fabric) are to be used, as appropriate, to prevent erosion and silt runoff during the construction phase.
- 3.3.8 Construction waste material such as pre-treated wood must be disposed of in an appropriate manner and shall not be incinerated onsite. Construction waste material such as aluminum, steel, iron, etc. should be recycled through a metal recycler.
- 3.3.9 All exposed soil should be minimized by limiting the area that is exposed at any one time and by limiting the time that any one area is exposed. Stockpiled soil must be covered and/or dyked to prevent erosion or silt runoff from leaving the site.
- 3.3.10 All spills or leaks should be promptly contained, cleaned up and reported to the CCG - Traffic Center at 709-772-2083 and notification given to the Project Officer handling the job.
- 3.3.11 Any and all stipulations of federal, provincial, or municipal authorities must be strictly followed.
- 3.3.12 During the constructional and operational phases of the project, limit or prohibit any activities on any of the surrounding wetland/bog (i.e. Heavy Equipment).
- 3.3.13 During Constructional phase of the project, target areas for excavation should be limited to areas that are not considered a wetland/bog.
- 3.4 Drainage**
- 3.4.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water at all times.
- 3.4.2 Do not pump water suspected of containing suspended materials into waterways, sewer or drainage systems.

**END OF SECTION**

# **Quality Control**

## **Section 014500**

## Quality Control

### Part 1 - General

#### 1.1 Shop Factory Inspection

- 1.1.1 Contractor's and all sub-contractor's facilities are subject to inspection at any time by the Departmental Representative. This can include, review and audit of Quality Control and Quality Assurance procedures, fabrication processes, materials handling processes, galvanization processes, painting processes, welding processes, workmanship and inspection of tools and equipment. Contractor will make associated documentation, procedures, drawings, specifications and mill test reports available to facilitate this work.
- 1.1.2 Co-operate in permitting access to all places where work is being done or stocked prior to shipment.
- 1.1.3 Inspection shall not relieve the Contractor of his responsibility but is a precaution against oversight or error. Defective material and workmanship wherever found at any time prior to final acceptance of the work will be rejected regardless of previous inspection.
- 1.1.4 As part of shop inspection, be prepared to assemble part (or complete) tower section(s).
- 1.1.5 Contractor shall ensure proper measures are taken to ensure the delivery of undamaged materials to site.

#### 1.2 Foundation Inspection

- 1.2.1 The foundation placement is subject to inspection during the following project stages:
- Testing of rock bolts
  - Pre-pour inspection of rebar prior to concrete placement for gravity anchors and tower base footing.
  - Concrete placement
  - Grouting
- 1.2.2 The Contractor shall advise the Departmental Representative **ONE WEEK** in advance of these activities. Every effort shall be made to allow completion of these activities within one full day on site. The Contractor shall organize and pay for an independent testing firm to obtain and test a minimum of three (3) concrete cylinders, per batch, as per the latest industry standards, for compressive strength for each structural anchor and base footing. An independent CSA certified testing firm shall conduct sampling and testing. This testing by the Departmental Representative does not relieve the Contractor of their responsibility for ensuring concrete quality assurance.

## Quality Control

1.2.3 No concrete shall be poured prior to the Departmental Representative's review of pre-pour conditions. At the discretion of the Departmental Representative, concrete poured prior to a pre-pour inspection shall be removed and replaced at the Contractors expense.

### 1.3 Grounding Inspection

1.3.1 All buried copper ground connections and runs shall be inspected before backfilling of the trenches. All costs to excavate grounding systems not inspected by the Departmental Representative shall be the responsibility of the Contractor.

1.3.2 All connections shall be completed prior to the Consultant / Owners arrival on site using suitable manufacturer recommended techniques and tools.

1.3.3 All ground connections that do not meet Canadian Coast Guard standards shall be replaced at the Contractors cost.

1.3.4 The Contractor shall advise the Consultant of these activities a minimum of ONE WEEK in advance for the purposes of scheduling a site visit to inspect the grounding elements

### 1.4 Completion Inspection

1.4.1 A completion inspection is to be carried out by the Departmental Representative. The purpose of this inspection is to ensure that the work is completed as per the project specifications and industry standards. The completion inspection does not relieve the Contractor of his responsibility to execute the work in a quality fashion as per the project specifications and industry standards. The Contractor must ensure that his quality control personnel perform a complete inspection of the works prior to their crew leaving the site. It is expected that the contractor has made a thorough check of all bolts, hardware, TX lines, tension and alignments as per requirements of CSA S37-13 standard or latest edition and reviewed the contract for full completion. The Contractor is to inform the Departmental Representative by letter that the installation is completed and is ready for inspection by the Departmental Representative. The Contractor shall have sufficient crew on site during the inspection to correct deficiencies noted by the Departmental Representative. Contractor to advise Departmental Representative ONE WEEK in advance to completion of the tower to permit scheduling of this inspection.

1.4.2 The completion inspection will be the Departmental Representative's expense. All costs incurred by the Contractor during the acceptance inspection shall be at the Contractor's expense.

1.4.3 All work must be completed and satisfactory prior to the Departmental Representative's completion inspection. Any deficiencies should be reported prior to the inspection teams' mobilization to site. **The Contractor will be responsible for the costs of all repeat completion inspections necessitated by work, which is considered by the Departmental Representative to be incomplete or deficient.**

## Quality Control

- 1.4.4 Any adjustments to the tension, twist or alignment shall be made by Contractor in consultation with the Departmental Representative to ensure effects on signal coverage can be reviewed and monitored.
- 1.4.5 After any adjustment measures are carried out to the tower, the Contractor shall, as required, under the direction of the Departmental Representative, re-orient any antennas.
- 1.4.6 An as-built tension pulse charts with actual measured guy lengths, radii and anchor elevations along with initial design guy tensions, must be provided prior to the inspection.

### **1.5 Post Erection Inspection**

- 1.5.1 Not less than six (6) months and not more than one (1) year after the completion inspection, the Departmental Representative shall re-inspect the tower. The purpose of this post erection inspection is to re-inspect the tower alignment and guy tensions, review satisfactory completion of any previously noted deficiencies and to conduct a general review of the tower condition. At this time the Contractor shall have a minimum crew of two present and carry out any adjustments necessary to ensure the structure meets the requirements of CSA S37-13 standard. The post-erection inspection will be at the Departmental Representative's expense. All costs incurred by the Contractor during the Post Erection Inspection shall be at the Contractor's expense.
- 1.5.2 Departmental Representative to advise Contractor at least **ONE WEEK** in advance of the post erection check in order to facilitate scheduling.
- 1.5.3 Any adjustments to the tension, twist or alignment shall be made by the Contractor in consultation with the Departmental Representative to ensure effects on signal coverage can be reviewed and monitored.
- 1.5.4 After any adjustment measures that are carried out on the tower, the Contractor shall, as required, under the direction of the Departmental Representative, re-orient any antennas.

### **1.6 Conformance Letter**

- 1.6.1 Upon completion of the installation stage of the project the Contractor is to provide the Departmental Representative with a Conformance Certification Letter stating that the tower has been designed, fabricated and installed as per the Project Specifications.

## **Part 2 – Products (N/A)**

## **Part 3 – Execution (N/A)**

**END OF SECTION**

# **Temporary Facilities**

## **Section 015100**

**Temporary Facilities****Part 1 – General (N/A)****Part 2 – Products (N/A)****Part 3 – Execution****3.1 Access**

3.1.1 Access to the tower site is available as described in section 011100. When appropriate, maintain this access during the construction period. Contractor is responsible for providing their own site office and accommodations.

3.1.2 The Departmental Representative must approve any temporary roads planned. A plan for remediation must be included.

3.1.3 If authorized to use existing roads for access to the project site, maintain such roads for the duration of the Contract and make good damage resulting from Contractor's use of roads.

3.1.4 Any damages as a result of Contractor's activities to existing roadways, property, and adjacent property shall be returned to original condition at Contractors expense.

**3.2 Sanitary Facilities**

3.2.1 Provide sanitary facilities for work force in accordance with regulations and ordinances.

3.2.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

**3.3 Power**

3.3.1 Power supply may not be available during the time of construction. The Contractor must provide and maintain power as required for the construction and temporary obstruction lighting.

3.3.2 Connect to power supply in accordance with Canadian Electrical Code once the building power is provided by Departmental Representative.

**3.4 Drainage**

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

3.4.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

## **Temporary Facilities**

- 3.4.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements and any other applicable Federal or provincial requirements.

**END OF SECTION**

# **Common Product Requirements**

## **Section 016100**

## Common Product Requirements

### Part 1 - General

#### 1.1 Summary

1.1.1 This Section describes requirements to be observed during the progress of the Work for materials and equipment.

#### 1.2 Submittals

1.2.1 Within five working days of written request by the Departmental Representative, submit following information for any and all materials and products proposed for use:

- name and address of the manufacturer and suppliers.
- trade name, model and catalogue number.
- performance, descriptive and test data.
- manufacturer's installation or application instructions.
- evidence of arrangements to procure.
- conformance to applicable standards.

#### 1.3 Supply and Use

1.3.1 Use new material and equipment unless otherwise specified.

1.3.2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.

1.3.3 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.

#### 1.4 Manufacturer's Instructions

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

1.4.2 Prior to use of a product or material, notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

#### 1.5 Conformance

1.5.1 When material or equipment is specified by standard or performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory report stating that materials or equipment meets or exceeds specified requirements. Trace-ability of all materials is to be performed.

#### 1.6 Substitution

1.6.1 Departmental Representative is not obligated to consider any substitutes or changes after contract award. Contractor is responsible for all costs associated with reviewing requested changes.

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**Common Product Requirements**

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- 1.6.2 Proposals for substitution after Contract Award must include all documentation and information required as part of this contract and statements of respective cost differences of items originally specified and proposed substitutions.
- 1.6.3 Should proposed substitution be accepted either in part or in whole, contractor will assume full responsibility and costs when substitution affects other work on project and pay for design or drawing changes required as result of substitution.
- 1.6.4 Amounts of credits arising from approval of substitutions will be determined by the Departmental Representative and the Contract Sum will be reduced accordingly. No substitutions will be permitted without prior written approval from Departmental Representative.

**Part 2 – Products (N/A)****Part 3 – Execution (N/A)**

**END OF SECTION**

**Clean Up**

**Section 017411**

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**Clean Up**

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**Part 1 - General****1.1 Clean Up**

1.1.1 Upon completion of the work, or sooner if ordered by the Departmental Representative, remove all temporary structures and clear away all rubbish, equipment, surplus and waste material remaining on or about the site, and attributable to this Contract, and place the site in a neat and tidy condition.

1.1.2 Under no circumstances will burning of construction refuse be allowed on the Departmental Representative's site. Remove all waste materials from the site to an approved dumping area as designated by local authority.

1.1.3 If the Contractor fails to clean up the site and restore to an acceptable condition, the Departmental Representative shall initiate completion of the work and deduct for same from monies due to the Contractor.

**END OF SECTION**

# **Structure Demolition**

## **Section 024116**

## Structure Demolition

### Part 1 – General

#### 1.2 Scope

- 1.1.1 The Contractor shall dismantle and dispose of the Point Escuminac site as directed by the Departmental Representative the existing tower and associated components. These components shall include, but not necessarily be limited to tower steel, guys, anchor assemblies and grounding radials to a minimum of 300 mm below grade, conduit, ladders, etc. All disposal shall be completed in a manner acceptable to the Federal, Provincial and Municipal authorities having jurisdiction.
- 1.1.2 The Contractor shall provide a detailed tower demolition plan to the Departmental Representative with regard to the proposed method of dismantling the tower. The detailed plan must be approved and stamped by a Professional Engineer licensed to practice in the Province of New Brunswick, prior to submission. Details should include measures to protect other property such as the new tower, guys and transmitter building. This method must be reviewed by the Departmental Representative prior to the start of any work. This review shall not relieve the Contractor of his responsibilities and liabilities with the regard to the dismantling process. The Contractor shall provide these details in writing to the Departmental Representative complete with sketches if required.
- 1.1.3 Contractor shall provide the Departmental Representative with a minimum notice of **ONE WEEK** prior to the proposed tower dismantling start.
- 1.1.4 Refer to Appendix K for tower details which require demolition and dismantling.

### Part 2 – Products (N/A)

### Part 3 – Execution

#### 3.1 General

- 3.1.1 Tower may not be felled.
- 3.1.2 Approval will be granted for a one (1) Month shutdown of the existing tower for removal of the structure and completion of the installation and optimization of the new service. The shutdown must be scheduled with the Departmental Representative. No deviation from this timeline will be allowed.
- 3.1.3 Coast guard shall disconnect cabling as necessary prior to Contractor commencing demolition activities.
- 3.1.4 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- 3.1.5 At end of each day's work, leave the site in safe and stable condition.

## Structure Demolition

### 3.2 Demolition

- 3.2.1 The tower shall be dismantled in such a manner so as to pose no threat to the new tower, antennas or transmitter buildings. Responsibility for any and all damage to property as a result of the dismantling and disposal of the existing tower shall be the sole responsibility of the Contractor.
- 3.2.2 Remove tower from its foundation ensuring the tower base plates remain intact.
- 3.2.3 Demolish all existing concrete foundations to a minimum depth of 300mm below grade level.
- 3.2.4 Existing anchors are to be cut off a minimum 300mm below grade.
- 3.2.5 Ensure that demolition does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- 3.2.6 Ensure demolition is undertaken safely. If at any period during demolition the safety of the Contractor's staff cannot be maintained, take preventative measures, stop work and immediately notify Coast Guard.

### 3.3 Salvage

- 3.3.1 Salvage the following:
- All tower steel
  - All guy systems
  - All anchor systems

### 3.4 Disposal

- 3.4.1 Dispose of:
- Old cables
  - Transmission lines
  - Existing Wave-guide Bridge
  - Foundations
- 3.4.2 Dispose of all materials in accordance with applicable provincial regulations. Contractor is responsible for transportation of demolished materials from site to appropriate waste handling facility.
- 3.4.3 Contractor shall provide written documentation with regard to where and how material was disposed of. On site disposal is strictly prohibited.

**END OF SECTION**

# **Concrete Work**

## **Section 033000**

## Concrete Work

### Part 1 - General

#### 1.1 Reference Standards

1.1.1 The design and installation of concrete shall be in accordance with the latest version of the referenced standards and codes.

- Design, install and reinforce foundations and anchors to CAN/CSA 3-A23.1-14 except where specified otherwise.
- Perform formwork and cast-in-place concrete work to CAN/CSA 3-A23.1-14, except where specified otherwise.
- Perform reinforcing work to CAN/CSA 3-A23.1-14 and welding of reinforcing to CSA W186-1990(R2016), except where specified otherwise.
- Cure and protect concrete work to CAN/CSA -A23.1-14, except where specified otherwise.

#### 1.2 Test Reports

1.2.1 Contractor to facilitate and pay for execution of testing and sampling procedures to be performed in accordance with CSA A23.2-14 and witnessed by Departmental Representative. Concrete cylinders shall be tested for each anchor and the tower base.

1.2.2 Confirmation of air content and slump shall be obtained for each load of concrete delivered to the project. The Contractor shall be responsible for the proper completion of the concrete. All costs associated with the testing of concrete supplied to the project shall be the responsibility of the Contractor.

1.2.3 If inspection or test results indicate that concrete materials do not meet the requirements of this specification, such materials shall be rejected and removed from the site. The Contractor shall be responsible for all costs, including testing and additional Engineering inspections associated with concrete removal and replacement.

1.2.4 The Contractor shall notify the Departmental Representative at least **ONE WEEK** prior to placing concrete. Notification shall be in writing with a copy to the Departmental Representative.

## Concrete Work

### Part 2 – Products

#### 2.1 Materials

- 2.1.1 Lumber: plywood and wood formwork materials to CSA CAN-086-14.
- 2.1.2 Reinforcing steel: Grade 400 MPa, deformed bars to CSA G30.12M unless indicated otherwise.
- 2.1.3 Cement: to CSA A5-03, normal (type 10), sulphate resistant (type 50).
- 2.1.4 Water, fine aggregates, normal weight coarse aggregates: CSA A23.1
- 2.1.5 Chemical admixtures: to CSA A266.2-M78.
- 2.1.6 Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing agents capable of developing minimum compressive strength of 50 MPa (7000 psi) at 28 days.

#### 2.2 Concrete Mixes

- 2.2.1 Except where indicated or specified otherwise use concrete mix designed to produce minimum compressive cylinder strength at 28 days of 30 MPa for tower foundation and 25 MPa for anchors.
- 2.2.2 Slump, unless noted otherwise, shall be 75mm +/-25mm.
- 2.2.3 All concrete exposed to exterior temperatures and weather in its final use shall contain an air-entraining agent. Total air content to be as specified in CSA Standard A23.2, for the particular size of aggregate being used. The air-entraining agent shall be compatible with the water reducing agent.
- 2.2.4 The maximum size of coarse aggregate shall be 40mm.
- 2.2.5 If the air temperature is 5 C° or less, the temperature of the concrete, at the time of placing, shall be between 15° C and 30° C.

### Part 3 – Execution

#### 3.1 Workmanship

- 3.1.1 Place all anchors against an undisturbed front face.
- 3.1.2 Ensure that reinforcement and inserts are not disturbed during concrete placement.
- 3.1.3 Do not place concrete against any surface which is less than 5° C. Remove all snow and ice before placing.

## Concrete Work

### 3.2 Formwork

- 3.2.1 Design all formwork in accordance with CSA Standard S269.1-16.
- 3.2.2 Withdraw all nails and thoroughly clean and repair all form materials before reusing.
- 3.2.3 Provide a 20mm chamfer on all exposed corners.
- 3.2.4 Take all precautions necessary to maintain the safety of the structure before and after forms are removed.
- 3.2.5 Take care that the concrete is not chipped or cracked while removing the forms. Pedestal forms to remain in place a minimum of 48 hours. **All formwork is to be completely removed.**

### 3.3 Reinforcement

- 3.3.1 Clean all reinforcement of any loose scale, dirt, or other coatings which would destroy or reduce the bond. Reject bars with kinks or bends not shown on the drawings. Thoroughly clean all forms before installing reinforcement. Fabricate, detail and install all reinforcing steel as per Reinforcing Institute of Canada “Manual of Standard Practice” latest edition.
- 3.3.2 Do not field cut, bend or displace any reinforcement to permit placing weldments or anchor bolts either before or after concrete is placed unless approval is given by the Departmental Representative.
- 3.3.3 All reinforcement shall have a minimum of 75mm concrete cover.

### 3.4 Joints

- 3.4.1 Construct all joints as detailed on the drawings.
- 3.4.2 Clean the face of the joints of dirt and then saturate with water before placing new concrete.

### 3.5 Grouting of Base Plates

- 3.5.1 Use In-Pact pre-blended non-shrink dry pack grout as manufactured by C.C. Chemicals Ltd. or approved equal. All grout should be installed according to the manufacturer’s instructions.
- 3.5.2 Edges of grout should be tapered off at 45° to give a neat transition between base plates and concrete pedestals.

### 3.6 Curing and Protection of Concrete

- 3.6.1 Provide effective means of maintaining the temperature of concrete in place at a minimum of 10° C and a maximum of 30° C for three days after placing. When the mean

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**Concrete Work**

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daily temperature is forecasted to be less than 5° C, provide protection for newly placed concrete by means of suitable enclosures or raised coverings, insulation and heat.

3.6.2 Insulation must be protected to prevent loss of effectiveness due to moisture.

3.6.3 The use of calcium chloride to accelerate curing is prohibited.

**3.7 Placement of Concrete**

3.5.1 Consolidation of concrete should be performed by internal or immersion type vibration. Consolidation of the concrete by rods or shovels will not be permitted.

**END OF SECTION**

**Steel Towers**

**Section 133613**

## Steel Towers

### Part 1 - General

#### 1.1 General

1.1.1 Work in this section relates to the design, supply and installation of the new guyed structure.

1.1.2 The design, supply and erection of the tower shall be in accordance with the latest version of the following codes and standards:

- CSA-S37-13	Antennas, Towers and Antenna Supporting Structures
- CSA B33.4	Galvanized Steel Tower Bolts and Nuts
- ASTM A325	High Strength Bolts for Structural Steel Joints
- CSA CAN3-A23.3	Design of Concrete Structures
- CSA W59	Welded Steel Construction
- CAN/CSA-G40.20	General Requirements for Rolled or Welded Structural Quality Steel
- CAN/CSA-G40.21	Structural Quality Steels
- CAN/CSA-G164	Hot Dip Galvanizing of Irregularly Shaped Articles
- CAN/CSA-S16.1	Limit States Design of Steel Structures
- CAN/CSA-B72	Installation of Lightning Rods
- CAN/CSA-C22.1	Canadian Electrical Code, Part 1
- CAN/CSA-G4	Steel Wire Rope for General Purpose and Mine Hoisting and Mine Haulage
- CSA-CAN3-G12	Zinc Coated Steel Wire Strand
- CSA W47.1	Certification of Companies for Fusion Welding of Steel Structures
- W47.1S1-M	Supplement No.1-M1989 to W47.1-1983
- W59	Welded Steel Construction (Metal-Arc Welding)
- Z259.2.-M	Fall Arresting Devices, Personnel Lowering Devices and Life Lines
- Z259.1	Fall Arresting Safety Belts and Lanyards for the Construction and Mining Industries

- Canada Labour Code
- Health and Welfare Canada Limits of Exposure to Radio-Frequency Fields at Frequencies from 10 kHz-300 kHz, Safety Code 6
- New Brunswick Occupational Health & Safety Act and Regulations
- National Building Code of Canada – 2005
- Transport Canada Standard TP382 – Standards Obstruction Markings
- Canadian Coast Guard Safety Requirements
- SSPC (The Society of Protective Coatings)
- Transport Canada CAR Standard 621 Obstruction Lighting

## Steel Towers

### Part 2 – Products

#### 2.1 General Requirements

2.1.1 All steel CSA G40.21M – 350W u/n. Preference shall be given to the use of structural steels with improved resistance to brittle fracture. A36 modified steel is not acceptable. All materials to be used in the tower shall be new and in accordance with the requirements of CSA Standard S37-13.

2.1.2 Use of material sections less than 5 mm in thickness will not be permitted on primary or secondary structural members. Sections used for attachment or support of auxiliary facilities may be permitted subject to review by the Departmental Representative

2.1.3 Hollow sections will not be permitted on primary or secondary structural members including tower legs, horizontals and diagonals.

2.1.4 Test Certificates: Two copies of mill test certificates for each lot of steel received from the mill by the Contractor shall be forwarded to the Departmental Representative. These certificates shall record results of tests indicating the following:

- Yield Strength
- Ultimate Tensile Strength
- Percent Elongation
- Chemical Composition.

2.1.5 Mill Certificates may be requested to be forwarded to the Departmental Representative by the Contractor, during the shop inspection prior to the commencement of fabrication of structures incorporating the related material.

2.1.6 All guys shall be one continuous length Bridge Strand or Guy Strand (Grade 180) and guy attachment assemblies unless otherwise approved by the Departmental Representative. Cut ends of strand shall be capped with a stainless-steel hose clamp or ear clips.

#### 2.2 Auxiliary Facilities

2.2.1 The following facilities shall be considered to be an integral part of the tower contract and shall be supplied and erected as such. In mounting any of these auxiliary facilities, care shall be taken that the structural members of the tower are not weakened by the drilling of holes or any other means.

## Steel Towers

2.2.2 Ladder – The tower shall be equipped with a climbing ladder (outside climb preferred) complete with a CSA approved fall arrest rail centered in the ladder. The ladder shall be a separate assembly bolted to the tower and shall conform to the latest version of CSA S37-13. Provide an unobstructed climbing path and maintain the required climbing radius as per CSA S37-13.

### 2.2.3 Turnbuckles and Shackles

- Turnbuckles and shackles shall be manufactured from AISI 1035 steel, heat treated, and shall be hot dip galvanized in accordance with the requirements of the latest version of CSA S37-13. The minimum turnbuckle length shall be 457 mm. Provide full articulation at anchor ends of each turnbuckle by means of shackles.
- Install all turnbuckles so as to provide a minimum of 250 mm of take-up for future adjustment. Provide a locking device for each turnbuckle. The locking device shall consist of vinyl coated cable or an approved equivalent.
- All guy hardware including turnbuckles and shackles to be Crosby (Heavy Duty Grade) or approved equivalent.

### 2.2.4 100% Terminations

- Bridge sockets shall be sized to provide a minimum of 1220 mm of adjustment. The sockets shall be installed so as to provide a minimum of 760 mm of take-up for future adjustment. The bridge sockets shall be made of heat treated steel. Contractor is to provide details of other 100% terminations.

### 2.2.5 Anti-climb Devices

- The tower is to be provided with a locked, Anti-climb device approved by the Departmental Representative. The Anti-climb should incorporate a framed, heavy gauge expanded wire mesh cage bolted flush to the tower face using round headed hardware that cannot be used as a step or hand hold. The panel should be approximately 2.5 m high with the lower edge positioned approximately 3 m above grade. Access should be prevented from both outside and inside the tower. Contractor is to submit drawings of the anti-climb system including specification sheets on the wire mesh and gauge thickness for approval by the Departmental Representative.
- The anti-climb shall be hinged on two faces, the climbing face and the transmission line face. Operable panels shall be framed, hinged on one vertical side, with a combined latching mechanism with a lock on the opposite vertical edge. A locking mechanism requiring removable hardware such as long steel rods to open access panels is not acceptable.
- The trap door in the horizontal anti-climb should easily open up to allow safe access to the tower.
- Barbed wire will not be permitted as part of the anti-climb.

## Steel Towers

### 2.2.6 Guy Markers

- Each guy shall be equipped with yellow vinyl guy markers located at the anchor end of each guy. Install such that markers extend to mark at a point 4 m above the ground.
- Guy markers shall be approximately 2 m in length and vandal resistant. Field drill 25 mm holes at 200 mm spacing to render these useless for other purposes.
- Contractor shall submit shop drawings for Departmental Representative approval.

### 2.2.7 Fall Arrest Safety Device

- The Contractor shall design, supply and install a CSA approved Fall Arrest Rail to meet CSA S37-13 and the latest version of CSA Z259.2.4-15 and CSA Z259.2.5-12(R2016). Rail system is to be Tylon type trolley compliant or approved equivalent.
- The fall arrest rail shall be free from obstructions for the complete height of the tower.
- The fall arrest rail shall be supported at spans not more than 1 m. Any extension beyond the top of the tower must be structurally supported for the entire height.
- 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.
- The fall arrest system shall be supplied complete with two new CSA approved trolleys that will be turned over directly to the Departmental Representative. Trolleys shall be supplied with permanently attached lock safe swivel clips for attachment to front D ring of CSA Approved full body harness.
- Cable fall arrest systems are not acceptable.

## Part 3 - Execution

### 3.1 Tower Design

- 3.1.1 The tower shall be designed in accordance with CSA S37-13 to support all antennas, attachments, etc as indicated.
- 3.1.2 The tower should have a maximum serviceability response (tilt and/or twist) of less than 2.0 degrees under working loads. Tower to be designed to require no torsion resistors.
- 3.1.3 Serviceability factor of 1.0 to be used for the design.
- 3.1.4 Design Ice Load: the tower shall be designed with loading consideration of 35mm of radial ice on all exposed surfaces, including members, guys and all attachments, and antenna components. 35 mm shall be the value considered as the reference ice thickness as per CSA S37-13

## Steel Towers

- 3.1.5 Design Wind Load: Use Site Specific Wind Data contained in Appendix D.
- 3.1.6 Recommended Antenna Specifications:
- Type = Guyed Tower
  - Height = 34 meters
  - Feed Height = 2 meters
  - Insulator Breakdown Voltage = 44 kV including safety factor
  - Finish = Hot-dip Galvanized
  - 6 Element Top Loading
  - Separation = 60°
  - Length = 24 meters
  - Insulator Breakdown Voltage = 44 kV including safety factor
- 3.1.7 Loading from auxiliary facilities and attachments such as ladders, fall arrest rails, feeder line supports, etc. must be considered in a similar fashion as that of the transmission lines and feeders outlined above.
- 3.1.8 The tower shall be of complete knock down, guyed, lattice design incorporating bolted angle sections. “All-welded” tower sections and welded round leg members are not acceptable.
- 3.1.9 The foundation designs shall be based on the conditions contained in the Geotechnical Report contained in Appendix ‘E’.
- 3.1.10 The Design Engineer accepting responsibility for the tower structure shall
- Have approved a minimum of five (5) towers of similar nature in the previous three (3) years.
  - Be registered or eligible for registration with the Association of Professional Engineers and Geoscientists of New Brunswick.
  - Seal all drawings issued that relate to the tower.
- 3.2 Connections**
- 3.2.1 Connections in the shop may be bolted or welded. All site connections shall be bolted.
- 3.2.2 Make all welded connections in conformance with CSA Standard W59.1. Use only low hydrogen electrodes or processes of equivalent rating. All weld designs shall be clearly indicated on the design drawings.
- 3.2.3 Make all bolted connections with high strength bolts clearly marked A325 conforming to A.S.T.M. Standard Specification A325. Place a hardened washer in under the bolt element (nut or bolt head) turned in tightening the bolt. Tighten all bolts by the turn of the nut method as specified in CSA Standard S16.

## Steel Towers

- 3.2.4 Power wrenches may be used in installing bolts, provided they are of the adjustable type capable of cutting-out at a pre-selected torque value.
- 3.2.5 After the tower, has been complete, check all bolted connections, including those on miscellaneous metal work, and retighten all loose bolts. Exercise care that bolts adequately tightened are not subjected to additional rotation of the turned element. All damaged nuts or bolts to be replaced.

### **3.3 Workmanship**

- 3.3.1 General: Workmanship and finish throughout shall be equal to the best modern practice for this class construction. All members shall be in accordance with the drawings and shall be straight and true as per CSA S37-13. All like parts shall be interchangeable. All punched holes must be accurately located so that the structure can be erected with a minimum of “drifting”. The ends of members shall be clipped as required to facilitate assembly. In any bending or reworking of any material, methods employed shall ensure that the physical properties of the material are not impaired.
- 3.3.2 Marking: Each separate member shall be distinctly identified by a number assigned to that member. Each member shall be clearly marked with its member number to facilitate erection and traceability. All like parts shall have the same number.
- 3.3.3 Punching: Punching shall be done by methods designed to ensure accuracy. The center of any hole shall, in no case, be displaced more than 1.5mm from its position shown on the drawings. Plugging or welding miss-punched holes will not be allowed. Punches and dies shall be sharp and true and all punch holes shall be round, true to size, and free from ragged edges and burrs. Where applicable, punching performed on bent members, shall be done after bending to avoid distortion of holes.
- 3.3.4 Welding: All welding shall be performed in accordance with CSA Standard W59 latest revision and shall be undertaken by a fabricator fully approved by the Canadian Welding Bureau to the requirements to CSA Standard W47, latest revision. Provide copy of CWB Certification to Departmental Representative.
- 3.3.5 Handling of Material: 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. Special care shall be taken to ensure that galvanizing, priming, or painting is not damaged during handling and erection of materials. Storage of materials on the site will be the responsibility of the Contractor.

### **3.4 Galvanizing**

- 3.4.1 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 the standards specified therein. Galvanizing applied to structural members is to have a minimum mass of Zinc coating of 610 g/m<sup>2</sup> (2 oz/ft<sup>2</sup>) equivalent to a thickness of 87 µm (3.40 mils). Galvanizing applied to bolts, nuts and threaded fasteners is to have a minimum mass of Zinc coating of 460 g/m<sup>2</sup> (1.5 oz/ft<sup>2</sup>) equivalent to a thickness of 65 µm (2.54 mils).

## Steel Towers

- 3.4.2 All materials shall be completely fabricated before galvanizing. No galvanizing shall be permitted on assemblies after being bolted. No machine or shop work shall be allowed after galvanizing (except the tapping of nuts).
- 3.4.3 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 as per the requirement of CSA S37-13 and the standards specified therein.
- 3.4.4 Test for thickness and uniformity of coating shall be made, on at least 10 members, throughout the galvanization process and from time to time on as many samples as may be considered necessary by the Departmental Representative. Such tests shall be conducted in full accordance with the requirements of CSA S37-13 and the standard recording results of the foregoing tests shall be forwarded to the Departmental Representative by the Contractor. The Contractor shall engage an independent testing firm to complete this work. All costs are to be included in the tender price.
- 3.4.5 The Contractor shall field paint all steel members of the tower where the galvanized finish has been scrapped or chipped during erection in the field. This shall be done using Zinkrich paint, as supplied by the Zinkrich Company, 42 Broadway, New York, New York, U.S.A. or Galvicon or an approved equal. Steel members that have a slightly damaged finish shall be given three coats of Zinkrich Paint applied according to the manufacturer's printed instructions.
- 3.4.6 Contractor shall warranty all galvanizing work for a period of not less than three (3) years.

### 3.5 Erection

- 3.5.1 The tower shall be erected in a manner that will not bend, scrape, distort, or injure the component parts of the galvanizing. **Upon award of contract, Contractor is to provide a detailed Erection Plan to include the use of gin poles, winches, cranes and erection equipment.**
- 3.5.2 The use of iron sledges for hammering or driving any members will not be tolerated. All hammering is to be done with wooden mauls or hammers of plastic, lead or other soft material.
- 3.5.3 Every failure of the material to join together properly shall be reported to the Departmental Representative.
- 3.5.4 Upon completion of erection, the tower shall be inspected by the Contractor for member damage. Any damaged or missing items, including nuts, bolts, etc., shall be replaced.

**Steel Towers**

- 3.5.5 The Contractor shall be responsible to ensure that no members of the tower are overstressed during erection. Any members damaged during erection shall be replaced. The Contractor shall be responsible for any damages done to the work of others, or to adjoining structures and property during erection.
- 3.5.6 The guy tensions shall be adjusted to within + 15% and -5% of the stipulated design tensions noted in the design drawings and as per the requirements of CSA S37-13. The tension calculations shall consider the ambient temperature at the time of adjustment. Full consideration of anchor location with respect to the tower base must be incorporated into the calculation of correct guy tensions. It shall be the Contractor's responsibility to obtain accurate measurements pertaining to elevation differences between the tower base and guy anchors.
- 3.5.7 The Contractor shall use a three-transit set up to complete final adjustment of vertical alignment and twist and to ensure it meets the requirements of CSA S37-13 for vertical alignment and twist.
- 3.6 Cathodic Protection of Anchor Shafts**
- 3.6.1 All anchor shafts are to be protected from deterioration and/or corrosion by a properly installed cathodic protection system designed by the Contractor. Anodes to be zinc or magnesium and to last the performance life of the tower.

**END OF SECTION**

## **Electrical - Antenna**

### **Section 260185**

**Electrical – Antenna****Part 1 - General****1.1 General**

- 1.1.1 Supply and installation of grounding radials screen systems as detailed in the drawings. Hand excavate the radials to a minimum depth of 150mm. All connections of the system are the responsibility of the contractor.
- 1.1.2 Supply and installation of Antenna Tuning Unit (ATU) and Vector Series Transmitters (VST) as detailed in the drawings and specifications.
- 1.1.3 Supply and installation of tower grounding system as detailed in the drawings and specification.
- 1.1.4 Supply and installation of grounding for chain link fence around tower as detailed in the drawing and specification.
- 1.1.5 See Appendix K for sample Tylon tower drawings.
- 1.1.6 All antenna optimization, testing, and system commissioning. Contractor shall coordinate all work with Owner. RF Engineer to provide antenna test report including VSWR network analyzer results for the transmitter frequencies utilized between 2-3 MHz. Report to be stamped by a RF Engineer.

**1.2 Codes and Specifications**

- 1.2.1 Ground system to conform to CSA S37-13 and CSA C22.1-2015 standards.

**Part 2 – Products****2.1 Materials (all cabling to be Contractor supplied)**

- Control cable: AVA5-50 Heliac.
- Grounding screen: as provided for DGPS tower.
- Grounding rods: copper clad, length as shown.
- Connections: Silver-Solder or cadwelded where specified by manufacturer.
- Conduit: as specified.
- Grounding equipment to: CSA C22.2-10 (R2015)
- Copper grounding cables to: CSA G7.1
- Guy guards: plastic, colors yellow, 2.1m long.
- ATU-LP / ATU-HP 250W/2000W Vector Series NDB
- 375W/3000W DGPS Antenna Tuning Unit

**Electrical - Antenna****2.2 Shop Drawings**

2.3.1 The Contractor shall submit shop drawings clearly indicating all elements of electrical - antenna system.

**Part 3 – Execution****3.1 Electrical Bonding**

3.1.1 Special care shall be taken to ensure continuity of required electrical connections and proper bonding of electrical conduits, etc., upon initial assembly and throughout antenna structure life when subjected to salt spray conditions in coastal installation.

**3.2 Required Acceptance Test Procedures**

3.2.1 The contractor shall provide all necessary test equipment and technical personnel to carry out this test under the supervision of the Project Engineer from the Department Representative.

3.2.2 All test results must be co-signed by both contractor's personnel and the Department Representative.

3.2.3 Contractor shall propose acceptance test procedures and the proposed procedures must first be approved by the Department Representative before any tests can be carried out.

3.2.4 All terms of this specification must be met for final acceptance.

**3.3 Vector Series Transmitters and Antenna Tuning Units**

3.3.1 Contractor to install Vector Series Transmitters and Antenna Tuning Units under the supervision of the Department Representative.

3.3.2 All testing, tuning and diagnostic procedures to be completed under the supervision of the Department Representative.

3.3.3 Contractor to install buried cable to Tuning Unit mounted on DGPS tower location to be approved by the Department Representative.

3.3.4 Contractor to supply and install all ATU enclosures, platforms, and mounts as detailed in the drawings and specifications.

**END OF SECTION**

# **Grounding**

## **Section 260527**

## Grounding

### Part 1 - General

#### 1.1 General

1.1.1 The Contractor shall be responsible for the design, supply and installation of a complete permanent continuous grounding system for the new DGPS tower systems. The design shall consider existing site topography and soil/rock conditions and is subject to approval by the Departmental Representative. See Appendix H for typical DGPS grounding details

1.1.2 The DGPS grounding system shall be independent of any existing on site grounding

1.1.3 Contractor to connect TX Cable through floor of equipment building where a polyphaser will be connected and grounded to internal bus bar.

1.1.4 Main External Buried Ground Grid impedance to true earth shall be less than 10 ohms.

1.1.5 Install tower grounding system and ground screen as per details provided. Contractor is responsible for all Caldwell's, Radials to be hand buried a minimum of 150mm. Supply and installation of fence grounding material as detailed.

1.1.6 Ground Radials Specifications:

- Number = 120
- Separation = 3°
- Length = 34 meters
- Wire Type = #8AWG Solid Copper
- Depth = minimum 150mm

1.1.7 Codes and Standards:

- Do complete installation in accordance with CSA C22.2-10(R2015) except where specified otherwise.
- Do underground systems in accordance with CSA C22.3 No.1-15 except where specified otherwise.
- As per Provincial Electrical Inspection Codes.

1.1.8 Permits, Fees and Inspections:

- Submit to Provincial Electrical Inspection Department and supply necessary number of drawings and specifications for examination and approval prior to commencement of work.
- Pay associated fees.
- Engineer will provide drawings and specifications required by Electrical Inspection Department at no cost.

## Grounding

- Notify Engineer of changes required by Electrical Inspection Department prior to making changes.
- Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Engineer.

### Part 2 - Products

#### 2.1 Equipment Specifications

The following sub-sections specify the equipment to be installed to meet the requirements of this standard. Equipment and material to be CSA certified. Where there is no alternative to supply equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

##### 2.1.1 Ground Radials and Connecting Conductors:

- Use bare copper for all below grade applications tinned copper for all above grade applications.
- The external buried ground grid shall consist of #8AWG Solid Copper.
- The 3.0m diameter main ground ring shall consist of 4/0 bare stranded copper.
- The grounding straps from the tower base to the main ground ring shall be 19Ga. x 300mm wide.
- The combined resistance of the conductors and associated connectors shall not exceed 0.5 ohms.

2.1.1 Ground Rods: Ground rods shall be copper-coated steel rods measuring 19 mm in diameter and 3 m in length.

2.1.2 Thermite Connectors: All thermite connectors shall be of the exothermic type requiring a mold unless otherwise noted on the drawings.

##### 2.1.3 Compression Connectors:

- All compression connectors specified in this standard shall be of the type requiring a linesman's type Y35 hand operated hydraulic compression tool.
- Low-force compression connectors as may be acceptable for the interconnections within an equipment cabinet shall not be covered by this standard.
- A compression connection shall be installed as per the manufacturer's instructions and shall not be used to connect to more than one conductor per compression operation unless specified by the manufacturer.
- External ground bus bar.

## Grounding

### 2.1.4 Bolted Connectors

- The use of bolted connectors shall not normally be acceptable for the connections covered by this standard.
- A notable exception shall be where a bolted connector forms an integral part of a compression connector. For example, compression connectors used to connect equipment cabinet ground conductors to flat bus bars incorporate an integral bolted connector.

2.1.5 Earth Enhancing Compounds: Earth enhancing compounds shall be considered for use at sites where the main external buried ground grid impedance to true earth cannot be reduced.

### 2.1.6 Additions to the Standard Buried Grid

- The addition of counterpoises or earth enhancing compounds shall be considered for those sites where the ground impedance cannot be achieved by other means. All such additions shall be approved by the design engineer prior to construction.
- Counterpoises shall consist of buried conductors installed radially outward from the site to a maximum length of 30 m and a minimum burial depth of 1.5 m.

2.1.7 Buried Ground Grid Conductor: All buried ground grid conductors shall be installed at 400 mm below finished grade and shall not be routed in or through cable trough. If this depth is not practical, consideration should be given to encasing the ground grid conductors in concrete.

### 2.1.8 Buried Ground Connectors

- All buried ground connectors shall be of the thermite type and shall be installed at 400 mm below finished grade.
- Buried ground connectors shall not be incased in concrete unless required as part of a building foundation or if the depth requirement cannot be achieved.

### 2.1.9 Ground Conductor Installation Details

- All ground conductors shall be installed to avoid sharp bends, excess loops, and shall be routed to minimize the distance to ground.
- Since lightning surges are composed of a wide spectrum of frequencies, copper braid should be considered for applications requiring short connections to irregular surfaces and because of its superior high frequency characteristics. Copper braid should also be considered for use to connect ground across mechanical hinges and movable joints.

## Grounding

2.1.10 Triax Cable Grounding: The outer and inner shields of triax cables, used for power line carrier (PLC), entering a C.C.G. facility shall not be connected to an external ground immediately before entering the building. The outer and inner shields shall both be grounded at either the entrance to a screen room if used, or the PLC cabinet if a screen room is not used. If a screen room is used, the triax cable shall be terminated at the screen room wall and coaxial cable shall be used internal to the screen room. In either case, the outer shield for triax cables shall only be grounded at one place as detailed above. This assumes that lightning protection is provided in both the CVT and LMU box and that the triax is routed entirely underground.

### 2.1.11 Insulator Ground

- An Austin base insulator shall be placed on the Austin insulator base plate at the tower base. It shall be equipped with lightning surge protection rings and its base bonded to the ground straps.

## Part 3 - Execution

### 3.1 Standards of Acceptance

#### 3.1.1 Ground Rods and Lightning Rods:

- C.L.M. DN6CC10
- L.C.A. 7510
- Slater 9450

#### 3.1.2 Thermite Connectors:

- Cadweld connectors manufactured by ERICO Products Inc.
- Compression Connectors: Burndy Hyground Compression System

### 3.2 Tower Ground Ring

3.2.1 Grounding for tower base to be 19Ga x 12" wide copper ground straps which connects between tower base and 4/0 AWG bare stranded copper wire ground ring which circles base of tower. See Appendix H and I for details.

### 3.3 Ground Screen

3.2.1 The ground screen will consist of 120 #8 soft drawn solid copper wires approximately 34m. long and will be installed every 3°. The ground screen will connect to the Tower Ground Ring (see section 3.2.1) and extend linearly outward.

### 3.4 Ground Rods

3.4.1 All ground rods shall be buried vertically at an angle of not more than 30° from vertical such that the top of the rod is installed at 400 mm below finished grade.

## Grounding

3.4.2 All ground rods shall be directly connected to the basic ground grid using thermite connectors.

3.4.3 Ground rods shall not be incased in concrete unless required as part of a building foundation or if the depth requirement cannot be achieved.

3.4.4 The minimum number and spacing of ground rods shall be site specific such as to reduce the ground grid impedance to that specified in section 5.2.

3.4.5 Ground rods which cannot be driven vertically shall be placed in a 76mm diameter drilled hole, filled with a Bentonite and water mixture. The procedure for placing the ground rod in Bentonite is as follows:

- Drill 76 mm diameter hole in rock, 3 m deep.
- Pour water 1/3 height of the hole.
- Insert ground rod.
- Add Bentonite powder in hole, alternating with water.

### 3.5 Guy Grounding

3.5.1 The tower contractor will connect tower guys to the grounding systems as follows:

- To the tower-using Burndy Versatail or exothermic welding (Cadweld)
- From tower to the guy wires – using Burndy KVSU or approved equal connectors, such that adverse reactions of different materials will not occur.
- To the ground ring – by means of exothermic welding (Cadweld).
- Wire to wire connections underground – using exothermic welding (Cadweld).
- All connections shall be made according to manufacturer's directions. Provide Burndy Pentrox E compound on all connections.

### 3.6 Tower Base & Guy Insulators

3.6.1 The tower contractor to supply and install tower base and guy insulators as follows:

- To the tower base with Austin base insulator and Austin insulator base plate, size to be determined to suit tower loading requirements. Minimum insulator breakdown voltage 44kV (including safety factor).
- To the structural guy wires with breakup insulator, primary insulators and compression sleeves.
- To the top loading elements at their interface to the remaining length of guy wire with failsafe insulator and compression sleeves. Minimum insulator breakdown voltage 44kV. (including Safety Factor)

### 3.7 Connections

3.7.1 Before making a ground system connection, remove all paint, foreign matter or dirt.

## Grounding

### **3.8 Measurement of Ground Resistance**

- 3.8.1 The Contractor shall measure the resistance to ground at a point near all anchors, the tower base and the transmission line entrance to the building. A report with readings shall be submitted to the Departmental Representative.

**END OF SECTION**

## **Excavation and Backfill**

### **Section 312310**

**Excavation and Backfill****Part 1 - General****1.1 Definitions**

1.1.1 Excavation Classes: Only two classes will be recognized, rock excavation and common excavation.

1.1.2 Rock excavation is defined as excavation of materials from solid masses of igneous, sedimentary or metamorphic rock, which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 cubic meter.

1.1.3 Common excavation is defined as excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy equipment.

**1.2 Requirements of Regulatory Agencies**

1.2.1 The Contractor shall adhere to Municipal, Provincial and Federal Codes where blasting is required. The Contractor to provide a minimum of **ONE-WEEK** notice to Departmental Representative prior to any blasting operation.

1.2.2 The Contractor shall adhere to Municipal, Provincial and Federal requirements relating to the safety of excavations and protection of workmen.

**1.3 Measurement**

1.3.1 The Contractor shall make his own computations of the amount and nature of all excavations required.

1.3.2 If soil conditions are inconsistent with the reported conditions indicated in the Geotechnical reports or drawings, report this immediately to the Departmental Representative.

**1.4 Existing Conditions**

1.4.1 Before commencing work, verify location of buried services on and adjacent to site.

**Part 2 - Products****2.1 Materials**

2.1.1 Backfill Material:

- Granular Backfill: Pit run natural or blend sand or gravel consisting of clean hard durable particles free from clay lumps, cementation or organic material, having less than 10% by mass passing a #0.075mm sieve, capable of being compacted to the

## Excavation and Backfill

degree specified herein and meeting the approval of the Departmental Representative.

- Common Backfill: selected materials from excavation, suitable to the Departmental Representative for the use intended, free from frozen materials, cinders, ashes, sods, organic materials, refuse and other deleterious substances.

### Part 3 - Execution

#### 3.9 Shoring and Bracing

3.1.1 Contractor is responsible for ensuring that all excavation work is performed in strict accordance with all Federal, Provincial and Municipal regulations. Provide and set all shoring, bracing, etc. necessary to prevent the caving in of excavating sides. Shoring shall be placed so as to be independent of all foundations and shall remain in place until forms have been and approval given to proceed with backfilling.

#### 3.10 Pumping and Drainage

3.2.1 Provide all pumping and drainage required to control ground and surface water during excavation and construction of sub grade work.

#### 3.11 Excavation

3.3.1 Strip top soil from within limits of excavation and stockpile as directed for spreading after backfilling.

3.3.2 Excavate to at least the depth shown on the drawings and to a width sufficient to perform the work properly.

3.3.3 Bottoms of all excavations shall be level, kept free of water and cleaned of all loose material and debris before concrete is poured. All foundations shall rest on undisturbed earth or rock. **The front face of all anchors, not anchored to rock shall bear against undisturbed soil.**

3.3.4 Should the bearing capacity at levels indicated be found inadequate by the Departmental Representative, the Departmental Representative may order the excavation to be carried down to a proper bearing. Such work shall be classified as additional work and cost thereof shall be determined on the basis of unit price quoted. Bearing levels are to be verified by Departmental Representative prior to proceeding with work.

3.3.5 When excavations are carried down to a greater depth than shown on the drawings without the Departmental Representative's written approval, the foundations shall be carried down to the excavated depth at the Contractor's expense. The method of deepening the foundation must be approved by the Departmental Representative.

## Excavation and Backfill

### 3.12 Rock Excavation

3.4.1 All rock excavations shall conform to alignments, profiles, and cross sections shown on the drawings. Carefully scale down all slopes and remove all rock, boulders and fragments, either on or outside the excavated area, liable to roll or slide down the side slopes of cut sections.

3.4.2 Excavated rock shall be disposed of off the site or as directed by the Departmental Representative.

### 3.13 Blasting

3.5.1 Blasting operations shall be undertaken only with the explicit written permission of the Departmental Representative. Blasting will only be considered when a machine operated buster cannot be used.

3.5.2 The supply, transportation, storage and use of all explosives and accessory equipment used for blasting shall be in accordance with regulations of the authority having jurisdiction. The Contractor shall be responsible for all necessary precautions and cost to prevent damage to surroundings, including responsibility for arrangements, and all costs involved in temporary removal and replacement of utilities.

### 3.14 Backfilling

3.6.1 Do not proceed with backfilling operations until the Departmental Representative has inspected and approved work in place. Provide **48 hours**' notice to the Departmental Representative.

3.6.2 Backfill spaces excavated and not occupied by parts of substructure or other permanent works with specified material placed up to the surface or surrounding ground.

3.6.3 Place backfill materials in uniform layers not exceeding 200mm loose thickness and simultaneously on sides of structure so that loading is equalized.

3.6.4 Compact each layer to following percentages of corrected maximum dry density in accordance with ASTM D698-78.

- Common Backfill 95%
- Granular Backfill 100%

3.6.5 Place backfill so as to prevent the accumulation of water around foundations or anchors.

### 3.15 Restoration

3.7.1 Upon completion of work dispose of any spoils neatly on the site by berming the anchors and the tower base and "feathering-out" excess materials.

3.7.2 Replace top-soil over excavated areas.

**Excavation and Backfill**

- 3.7.3 Restore areas affected by equipment outside the area of work to the condition which existed prior to commencement of work.
- 3.7.4 Remove surplus material and debris from the site to an area authorized for such disposition by those authorities having jurisdiction.

**END OF SECTION**

# **Chain Link Fences & Gates**

## **Section 322831**

## Chain Link Fences & Gates

### Part 1 - General

#### 1.1 Related Work

1.1.1 Excavation and Backfill (Section 312310)

1.1.2 Cast-in-Place Concrete (Section 033000)

#### 1.2 Reference Standards

1.2.3 Install chain link fence in accordance with CAN/CGSB-138.3-13 unless otherwise specified.

### Part 2 - Products

#### 2.1 Materials

2.1.1 Install chain link fence in accordance to tower installation drawings. The contractor supplied drawings shall include necessary details for the layout and installation of the compound fence.

#### 2.2 Finishes

2.2.1 Galvanizing:

- For chain link fabric to CAN2-138-13 Grade 2
- For pipe: 550 g/m<sup>2</sup> minimum to ASTM A90-13
- For other fittings: to CSA G164 M92(R2003).

### Part 3 - Execution

#### 3.1 Grading

3.1.2 Remove debris and correct ground undulations for 1.5m on both sides of fence line to obtain a smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface neither less than 40mm not more than 75mm.

#### 3.2 Erection of Fence

3.2.1 Contractor to supply and install and erect fence in accordance with details as shown on approved design drawings.

3.2.2 Erect fence along lines as indicated on drawings and in accordance with CAB/CGSB-138.3-M80.

3.2.3 Excavate post holes 1000mm depth by 300mm diameter by methods approved by Engineer. Bulb bottom of holes for corner, end at gate posts along fence line.

3.2.4 Space line posts 3m apart, measure parallel to ground surface.

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**Chain Link Fences & Gates**

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- 3.2.5 Space straining posts at equal intervals.
- 3.2.6 Place concrete in post holes then embed posts into concrete to depths indicated. Extend concrete 50mm above ground level and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- 3.2.7 Do not install fence fabric until concrete has cured in minimum of 5 days.
- 3.2.8 Install brace (mid-rail) between end and gate posts and nearest line posts, placed in center of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.
- 3.2.9 Install overhang tops and caps as indicated.
- 3.2.10 Install top rail between posts and fasten securely to terminal posts and secure waterproof caps and overhang tops.
- 3.2.11 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.
- 3.2.12 Lay out fence fabric: Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaces at 300mm intervals. Knuckled selvage at bottom. Twisted selvage at top.
- 3.3 Installation of Gates**
- 3.3.6 Install gates in location indicated.
- 3.3.7 Set gate bottom approximately 40mm above ground.
- 3.4 Tough Up**
- 3.4.3 Clean damaged surface with wire brush removing loosed and cracked coatings. Apply two coats of approved zinc pigmented paint to damaged areas.
- 3.5 Cleaning**
- 3.5.3 Clean and trim areas disturbed by operations. Dispense of surplus excavated material and replace damaged sod as directed by Engineer.

**END OF SECTION**

**Rock Anchors**

**Section 316813**

## Rock Anchors

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### Part 1 – General

#### 1.1 Description

1.1.1 This section covers the design and installation of anchors to rock for transfer of shear and tension foundation loads.

#### 1.2 Design

1.2.1 The minimum number of rock bolts to be installed at one anchor shall not be less than two. Alternatively, single rock bolts in certain applications may be approved by the Departmental Representative provided there is a comprehensive testing program implemented by the Contractor in accordance with the requirements of this section.

### Part 2 – Products

#### 2.1 Rock Bolts (Anchors)

2.1.1 Rock bolts shall be Williams Rock Bolts with expanding shield or approved equivalent. The shield shall be designed to provide even bearing around the hole and to develop the full ultimate tensile strength of the bolt. The shell type to suit rock conditions indicated in Geotechnical Report. Two nuts shall be supplied and installed to secure the anchor weldment. The second nut shall act as a locking nut and be of adequate quality for that purpose.

#### 2.2 Grout

2.2.1 Use Grout recommended by Rock Bolt Manufacturer. Grout shall be high early strength expanding type, with expansion of 3% to 4% prior of the gel stage. Grout shall have a minimum compressive strength of 40 MPa.

### Part 3 – Execution

#### 3.1 Holes

3.1.1 Drill holes to the diameter and length recommended by the rock bolt manufacturer for the bolt diameter to be used. Take care to ensure diameter is accurate and the hole is straight. Clean the hole before inserting the bolt.

#### 3.2 Bolt Placement

3.2.1 Tap bolt into position taking care not to damage the threaded end. Set expansion shield torquing bolt to value recommended by the manufacturer.

#### 3.3 Testing

3.3.1 Testing shall be carried out by the Contractor according to the manufacturer's instructions, and in the presence of the Departmental Representative. Establish a test procedure with the Departmental Representative prior to testing. Note that some bolt installations may, as part of the installation process, require tensioning of the bolt. This may constitute the required load test if approved by the Departmental Representative.

**Rock Anchors**

- 3.3.2 The contractor shall accurately record torquing and tension values for each bolt, along with the duration of the test. This information shall be submitted to the Departmental Representative for review.
- 3.3.3 Any bolt slippage shall be reported to the Departmental Representative immediately and a plan submitted for resolution.
- 3.3.4 The Contractor shall provide written confirmation of recent calibration of the jacking system from an independent testing firm.
- 3.3.5 The Contractor shall provide conversion charts issued by the jack manufacturer to convert pressure indicated to pounds of tension force.

**3.4 Grouting**

- 3.4.1 Insert flexible grout tube to the bottom of the drill hole. Pump in grout (mixed in accordance with the manufacturer's instruction), slowly withdrawing the grout tube while maintaining pressure on the grout pump until grout is visible at the surface. Grouting to be conducted in presence of the Departmental Representative. Adequate notice of at least 5 days to be provided for inspection.

**3.5 Protection**

- 3.5.1 Thoroughly protect the rock bolts above and below grade (minimum of 600 mm) by hot dip galvanizing to the requirements of CAN/CSA-S37-13 and the standards specified therein. In addition, when the bolt is backfilled and below grade, apply a heavy bituminous, corrosion resistant compound.
- 3.5.2 Follow manufacturer's instructions with regard to curing and protection prior to any backfilling of the anchor.

**END OF SECTION**