Fisheries and Oceans Canada | Pêches et Océans Canada

Canadian Coast Guard | Garde côtière canadienne

REMOTE SOLAR INSTALLATIONS

LL 1059.6, HAY POINT FRONT RANGE
LL 1064 STRIBLING POINT FRONT RANGE

ST. MARY'S RIVER
ST. JOESPH ISLAND
(VICINITY SAULT STE. MARIE)

MARITIME AND CIVIL INFRASTRUCTURE
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SECTION: 011100 GENERAL INSTRUCTIONS

PART 1 - GENERAL

1.1 Minimum Standards

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

.1 Meet or exceed requirements of:

.1 Contract documents;

.2 Specified standards, codes and referenced documents.

1.2 Definitions

.1 The following acronyms may be interpreted as follows:

.1 ATON: Aid to Navigation

.2 CCG: Canadian Coast Guard

.3 DFO: Department of Fisheries and Oceans

.4 MCI: Maritime Civil Infrastructure

.5 PA: Project Authority

.6 CA: Contracting Authority

.7 PV: Photovoltaic

1.3 Background

.1 CCG has plans to deploy remote operated video surveillance equipment at two ATON locations on St. Joseph Island (Vicinity Sault Ste Marie) to monitor ice accumulation in the St. Mary's River. Each installation will be powered by the PV generation system detailed in Section 260500 and in the appended Contract Drawings. It is the purpose of this contract to secure the supply and installation of the PV system complete with all electrical appurtenances, required external weatherproof enclosures, and structural support assembly.

1.4 Description of Work

.1 Work under this Contract includes, but is not limited to, the provision of all labour, materials, and equipment required to:

.1 Supply all core equipment components (panels, charge controllers, and batteries) complete

with all conductors and related fittings necessary;

.2 Design, fabricate and/or supply all equipment enclosures;

.3 Design, fabricate and/or supply ground mount structural support assembly for PV array and battery storage facilities;

.4 Mobilization to each of the project sites;

.5 Installation of each structural support assembly; and,

.6 Installation and commissioning of each PV system.

.2 The following work will be completed by CCG or others and is hereby excluded:

.1 Installation of the system load and all appurtenances.

1.5 Submittals

.1 Mandatory submittals and schedule for submission are detailed below and in Appendix B2. The following identifies general requirements only. The relevant sections must be consulted for a complete listing of mandatory content.

.2 Detailed Schedule:

.1 Deadline:

.1 No later than ten (10) working days following award.

.2 Deliverables:

.1 The Contractor shall furnish a high level schedule outlining:

.1 Anticipated start and finish dates of the project.

.2 Proposed submission dates for:

.1 Preliminary design package; and,

.2 Construction plan.

.3 Anticipated onsite periods (preliminary investigations, material staging, construction)

.3 The schedule is to be updated and revised as necessary throughout the duration of the project upon reasonable request of the CCG PA.

.3 Project participant listing:

.1 Deadline: With detailed schedule

.2 Deliverables:

.1 Contractor shall furnish listing of all core project team members and all relevant subcontractors. Listing must include; but, is not limited to the following:

.1 Project Manager: prime point of contact.

.2 Contractor's Engineer: responsible for the design of the necessary structural elements.

.3 Fabrication Facility: undertaking the construction of those components identified in Section 055000.

.4 Preliminary Design Package

.1 Deadline

.1 As identified in Contractor's schedule.

.2 Deliverables:

.1 Proposed structural assembly drawings (Section 055000)

.2 Proposed electrical servicing package (Section 260500);

.1 Including, site plan drawing of system layou

.3 Conceptual foundation design, (Section 310099).

.5 Construction Plan:

.1 Deadline:

.1 As identified in the Contractor's schedule.

.2 No less than ten [10] working days prior to mobilization.

.2 Deliverables:

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

.1 Project specific safety program (Section 013530);

.2 Project environmental protection plan (Section 013543);

.3 Concrete placement plan, if required (Section 033000);

.4 Electrical installation package (Section 260500); and,

.5 Foundation installation package (Section 310099).

.6 Maintenance Package

.1 Deadline:

.1 No more than 30 calendar days following substantial completion of the installation.

.2 Deliverables:

.1 Consolidated as-constructed/as-built documentation. Package is to include; but, is not necessarily limited to the following:

.1 Concrete test results (Section 033000);

.2 Electrical maintenance package (Section 260500);

.3 Foundation and anchorage maintenance package (Section 310099); and,

1.6 Contractor Qualifications

.1 The work shall be carried out under the supervision and responsibility of a sole specialized Contractor with experience in the installation of similar facilities.

.2 The Project Engineer must be licensed to practice the required discipline within the Province of Ontario.

.3 Subcontractor's engaged by the Contractor must possess all necessary licenses and certifications necessary to practice their trade within the Province of Ontario.

1.7 Site Locations

.1 The location of the sites is as indicated below:

Site	Name	Latitude	Longitude
1059.6	Hay Point Front Range	46°07'36.69"N	83°59'58.76"W
1064	Stribling Point Upbound Front Range	46°18'47.06"N	84° 6'55.44"W

.2 Each of the sites is located on St. Joesph Island, vicinity of Sault Ste Marie, Ontario.

.3 Each of the sites is remote and will require the contractor to arrange appropriate access either by vessel, helicopter, or ice road.

.4 A site visit is not required prior to bid submission.

1.8 Existing Conditions

.1 Bidders must make their own estimate of the difficulties associated with all phases of the works.

.2 The Contractor must include in their costs all expenses related to the difficulties of working at the sites.

.3 Photographs of the existing site are included in Appendix B1.

1.9 Contractor's Access to Site

.1 Contractor is responsible for transportation of all labour, materials, and equipment to and from the site.

.2 Access to the sites is remote. Neither location is accessible by road.

.3 Access is anticipated to be completed by Vessel, Ice Road, Helicopter (Rotary Wing) or a combination thereof.

.1 Access plan is to be made known to the CCG PA (schedule and project participants submittals).

.2 CCG requirements for each individual access method are listed in Appendix B5 under the appropriate heading.

1.10 Canadian Coast Guard Rotary Wing Support

.1 The Contractor may consider the use of either CCGs Bell 429 or Bell 412 in support of the execution of the works. Use of CCGs rotary wing assets will be subject to availability of airframe, crew and CCGs operational priorities.

.2 Use of CCGs rotary wing assets will be subject to full cost recovery from any amount payable under the Contract. Such costs include; but, are not necessarily limited to: all flying time (inclusive of ferry time to contractor's staging area), fuel consumption, and crew per diem.

.3 Use of CCG rotary wing assets is not mandatory. Use of such assets is at the Contractor's discretion. The Contractor's bid shall include their estimate of charges intend to be incurred in the use of such assets.

.1 Charge out rates, fuel consumption estimates, and airframe capacities are indicated in Appendix B5.3.

.1 Bidders may consult the use case provided as a baseline to establish an appropriate estimate.

.4 Coordination of CCG's rotary wing assets will be completed through CCG PA only.

1.11 Completion, Scheduling and Planning of the Works

.1 Work may commence as early as practical following CCGs acceptance and approval of

mandatory submissions.

.2 Site work shall not commence without written authorization of CCG PA.

.3 Work shall be completed no later than 31 MAR 18 unless otherwise negotiated and approved in writing by CCG PA and DFO Contract Authority.

1.12 Temporary Facilities

.1 Arrange, pay for, and maintain temporary electrical power supply as required for construction, and water supply as required, in accordance with governing regulations and ordinances.

.2 Maintain emergency spills kit on-site at all times.

1.13 Fees, Permits, Certificates and Information

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

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

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

.3 Contractor shall furnish certificates and permits when requested.

1.14 Reference Documents

.1 The most recent publication or edition of any document referenced in this specification should be used unless stated otherwise.

1.15 Required Submissions

.1 A summary of the minimum mandatory submissions required can be found in Appendix B2. This summary is not an exhaustive list of all submissions required for the duration of the project. Additional submissions may be required after award.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 Not Used

SECTION: 013300 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 General

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

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

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

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

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

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

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

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

1.2 Submission Requirements

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

.2 Allow at least three (3) working days, or as stipulated elsewhere in these specifications, for CCG PA to review the submission.

SECTION: 013530 HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 Scope

.1 The Contractor shall be responsible to develop, implement and enforce a safety program which addresses all elements of the work performed at the project locations.

1.2 References

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

.1 Canada Labour Code Part II

.2 NRC-CNRC National Building Code of Canada

.3 Ontario Occupational Health and Safety Act and Regulations

.4 Any and all other Provincial/Territorial Regulations and Policies; Worker's Compensation Board Policies; Local municipal regulations; pertaining to safety of the Contractors workers

1.3 Submittals

.1 Project Specific Safety Program

.1 Deadline:

.1 With Construction Plan

.2 Deliverables:

.1 Safety Program Document, include:

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

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

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

.4 Material Safety Data Sheets for hazardous products to be utilized in the execution of the works.

SECTION: 013543 ENVIRONMENTAL PROCEDURES

PART 1 - GENERAL

1.1 Scope of Work

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

1.2 References

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

.1 Canadian Environmental Protection Act

1.3 Related Sections

.1 Not used.

1.4 Submittals

.1 Contractor shall submit an Environmental Protection Plan.

.1 Deadline:

.1 With Construction Plan

.2 Deliverables:

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

.1 Equipment features (age, spill containment);

.2 Staging, refueling, and cleaning areas;

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

.4 Waste disposal methods and sites; and,

.5 Sedimentation control measures.

PART 2 - PRODUCTS

2.1 General

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

PART 3 - EXECUTION

3.1 Construction Area

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

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

3.2 Stockpiling of materials

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

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

3.3 Disposal of Wastes

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

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

.1 Recycle or reuse materials where possible.

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

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

3.4 Clearing and Grubbing

.1 Only clear vegetation that interferes with construction.

3.5 Drainage

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

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

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

.1 The use of filter bags;

.2 Straw bale check dams or silt fence;

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

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

3.6 Pollution Control

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

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

.3 Abide by local noise by-laws.

.4 Avoid unnecessary idling of vehicles or heavy machinery.

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

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

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

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

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

.1 Materials and equipment to intercept, contain, and clean-up any spill or other release shall be maintained on site throughout the construction period and must be readily accessible at all times.

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

.1 Provincial Authority: Ontario Spills Action Centre 1-800-268-6060

3.7 Traffic

.1 Minimize soil compaction by driving, parking vehicles, and walking, etc. on existing paved roadways/laneways. If soil is impacted by compaction, compensate by restoring areas with new soil, as required.

SECTION: 014500 QUALITY ASSURANCE AND CONTROL

PART 1 - GENERAL

1.1 Inspection

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

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

1.2 Procedures

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

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

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

1.3 Rejected Work

.1 Remove defective work, whether incorporated into the work or not, which has been rejected by CCG PA as failing to comply with the contract documents. Replace or re-execute in accordance with the Contract Documents.

1.4 Tests and Mixture Formulas

.1 Supply test reports and required mixture formulas.

1.5 Factory Tests

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

1.6 Acceptance of Work

.1 CCG PA will make acceptance visits of work executed by the Contractor at the critical milestones identified in the following sections.

.2 The Contractor is to inform CCG PA at least three (3) working days before achieving these milestones to allow time for inspection to be coordinated.

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

SECTION: 016100 COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 General

.1 Secure CCG PA's approval of all products to be incorporated into the works. Work shall not commence until product data and/or samples have received written approval.

.2 Supply and/or fabricate material and equipment of prescribed quality, with performance conforming to these specifications, references and industry standards.

.3 Use new material and equipment unless otherwise specified.

.4 Ensure replacements parts may be readily procured.

.5 Use products from one manufacturer for material and equipment of same type or classification, unless otherwise specified.

1.2 Manufacturer's Instructions

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

.2 Notify CCG PA in writing of any conflict between these specifications and manufacturer's instructions; CCG PA will designate which document is to be followed.

1.3 Compliance

.1 When material or equipment is specified by standard or performance specifications, upon request of CCG PA, obtain an independent testing laboratory report from the manufacturer, stating that material or equipment meets or exceeds specified requirements.

1.4 Substitution

.1 Where specific products have been specified, proposals for substitution may only be submitted after award of contract. Such requests must include statements of respective costs of items originally specified and the proposed substitution.

.2 No substitutions will be permitted without prior written approval of CCG PA. Substitutions will be considered by CCG PA only when:

.1 Materials specified in Contract Documents are not available; or,

.2 Delivery date of materials selected from those materials specified would unduly delay completion of contract; or,

.3 Alternative materials to those specified which are brought to the attention of, and are considered by CCG PA as equivalent to the material specified. Where the value of such

material is less than the material specified the difference is to be credited from the Contract amount.

.3 Should the proposed substitution be accepted either in whole or in part, the Contractor must assume full responsibility and costs when such substitution affects other work on the project including any and all design or drawing changes required as a result of substitution.

1.5 Submittals

.1 Provide product specifications and/or samples upon request from CCG PA.

SECTION: 033000 CONCRETE WORK

PART 1 - GENERAL

1.1 Scope of Work

.1 Work of this section details requirements pertaining to the construction of any concrete elements contemplated in the Contractor's approved design.

1.2 Related sections

.1 Section 013300 Submittals

.2 Section 310099 Foundations. Section stipulates design requirements.

1.3 References

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

.1 Canada Labour Code Part II

.2 NRC-CNRC National Building Code of Canada

.3 Ontario Occupational Health and Safety Act and Regulations

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

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

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

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

.8 CAN/CSA S269.3 Concrete Formwork

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

1.4 Submittals

.1 The following submittals are to be provided to the CCG PA:

.1 Concrete Placement Plan:

.1 Deadline:

.1 Furnish with Construction Plan (Section 011100)

.2 Deliverables:

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

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

.3 Finishing procedures;

.4 Curing methods and schedule;

.5 Clean-up procedures; and,

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

.2 Concrete test results

.1 Deadline: with Maintenance Package (Section 011100)

.2 Deliverables: results of all concrete testing undertaken by the Contractor.

1.5 Quality Assurance

.1 CCG's minimum inspection requirements are detailed below. The Contractor shall be responsible to notify CCG of the date and time that the works may be inspected.

.1 Upon completion of formwork and placement of reinforcement.

.2 During execution of concrete placement.

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

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

.2 Testing is to be completed by a third party independent Consultant and is to be completed by a certified technician in accordance with CSA Code A23.2.

PART 2 - MATERIALS

2.1 General

.1 All materials shall conform to requirements of CAN/CSA-A23.1.

2.2 Concrete

.1 Concrete supplier shall be a holder of valid “Certificate of Ready Mixed/Mobile Mix Concrete Production Facilities” as issued by the ‘Ready Mixed Concrete Association of Ontario’ (RMCAO)/Concrete Ontario.

.2 Concrete performance criteria must be as determined by Contractor and indicated on their approved engineering plans/drawings.

PART 3 - EXECUTION

3.1 General

.1 Concrete must be placed, finished, and cured in accordance with the Contractor's submitted construction plan and the Contractor’s engineered drawings.

3.2 Preparation

.1 Remove all loose and deleterious material.

.2 Construct forms and reinforcement in accordance with the Engineer’s specifications.

.3 All exposed 90° edges shall be chamfered.

3.3 Placement

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

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

.3 Concrete shall be placed in one continuous pour unless alternative arrangements specified by the Contractor’s Engineer.

.4 The development of cold joints shall be avoided.

.5 Exposed concrete surfaces are to be finished to provide a lightly brushed non-skid surface, unless otherwise specified.

.6 Cut control joints as specified.

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

3.4 Curing

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

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

SECTION: 055000 METAL FABRICATIONS

PART 1 - GENERAL

1.1 Scope of Work

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

.1 Design, fabricate (or supply) and install equipment enclosures (charge controllers & batteries); and,

.2 Design, fabricate (or supply) and install ground mount support assembly(s) for PV array and equipment enclosures.

1.2 Related Sections

.1 Concrete Work, Section 033000

.2 Electrical Requirements, Section 260500

.3 Foundations, Section 310099

1.3 References

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

.1 Canada Labour Code Part II

.2 NRC-CNRC National Building Code of Canada

.3 Ontario Occupational Health and Safety Act and Regulations

.4 CAN/CSA S16.1 – Limit States Design of Steel Structures

.5 CAN/CSA S157 – Strength Design in Aluminum

.6 CAN/CSA W47.1 – Certification of Companies for Fusion Welding of Steel Structures

.7 CAN/CSA W47.2 – Certification of Companies for Fusion Welding of Aluminum

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

.9 CAN/CSA W59.2 – Welded Aluminum Construction

.10 CAN/CSA G164 – Hot Dip Galvanizing of Irregularly Shaped Articles

1.4 System description

.1 Equipment enclosures are to provide a weatherproof means of containment for the system charge controllers and station batteries detailed in Section 260500.

.1 Equipment enclosures are intended to be mounted outdoors (exposed to weather) in close proximity to the PV array and may be affixed to the PV array structural support assembly.

.2 Equipment enclosures may be commercially available product, customized fabrication or combination of both.

.3 Equipment enclosures must be equipped with operable doors to facilitate maintenance, troubleshooting and repair by authorized personnel.

.1 All doors must be securable with 3/8 hasp standard padlock to prevent unauthorized access.

.4 Enclosures must incorporate passive ventilation.

.1 Ventilation system must include appropriate measures to restrict the infiltration of moisture, insects and vermin.

.5 Enclosures must be resistant to rusting, oxidation, or similar environmental degradation.

.6 Concept drawings of required enclosures are provided in Appendix B3.

.2 The support assembly/assemblies is/are to provide a means of mounting the proposed PV array detailed in Section 260500 and Contract Drawings, Appendix B3 as well as the equipment enclosures contemplated above.

.1 The support assembly must:

.1 Be of sufficient elevation to ensure that the PV array is unobstructed by snow or surrounding vegetation.

.2 Be installed in a location where the panels will receive maximum irradiation and will operate in an unshaded state.

.2 Tilt of PV panels is to be 70° and is to remain fixed following installation.

.3 Support assembly may be commercially available product, customized fabrication or a combination of both.

.4 Support assembly must be resistant to rusting, oxidation or similar environmental degradation.

.5 It is intended that the solar panels will be affixed and maintained from the ground using temporary access facilities (ladder, scaffolding, or similar means of access).

1.5 Design requirements

.1 Service life of each fabrication is to exceed 25 years.

.2 Enclosure and support assembly must be adequate to sufficiently resist all anticipated environmental loads reasonably expected to be encountered during the facilities service life.

.1 Environmental and climatic data used for design is to be derived from a reputable source within reasonable proximity to Sault Ste Marie, Ontario.

1.6 Submittals

.1 Submittals shall be forwarded to CCG PA in accordance with the provisions of section 013530.

.2 Fabrication Package

.1 Deadline: As indicated in Contractor's submitted schedule

.2 Deliverables

.1 Fabrication drawings for enclosures and support assemblies

.3 Fabrication Maintenance Package:

.1 Deadline: Furnish with Contract Maintenance Package (Section 011100)

.2 Deliverables:

.1 Material specification sheets and warranty information for all incorporated products.

.2 Amended fabrication drawings detailing any and all approved modifications.

.3 Site plan drawing detailing:

.1 Location and orientation of all metal fabrications relative to the existing ATON;

1.7 Quality Assurance

.1 CCGs minimum inspection requirements are detailed below. The Contractor shall be responsible to notify CCG of the date and time that the works may be inspected.

.1 Upon completion of fabrication prior to the application of any protective coating.

.2 Upon installation of fabricated facilities at the project site.

PART 2 - PRODUCTS

2.1 General

.1 Material selection shall be at the discretion of the Contractor provided attributes are in compliance with the above criteria.

PART 3 - EXECUTION

3.1 Fabrication

.1 Fabrication must not commence prior to receipt of the approval of CCG PA.

.2 Fabrication is to be completed by appropriately accredited facilities and tradesman.

3.2 Galvanizing

.1 All steel components must be hot dipped galvanized unless otherwise approved in writing.

.2 Galvanizing is not to be undertaken until fabricated facilities have been inspected and approved by CCG PA.

3.3 Installation

.1 Installation shall not commence until foundation elements have been approved and accepted by CCG PA.

SECTION: 260500 ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 Scope of Work

.1 Work of this section includes the supply of all labour, material, and equipment, necessary to complete the installation of photovoltaic system as detailed in Appendix B3, Drawings

.2 Work includes; but, is not limited to:

.1 Supply and installation of all components (panels, charge controllers, batteries, conductors) complete with all appurtenances necessary to make a complete system at each location

.2 commissioning of each completed system.

.3 The following work is to be completed by others and is hereby excluded:

.1 Installation of system loads

1.2 Related Sections

.1 Section 013300, Submittal Procedures

.2 Section 016100, Common Product Requirements

1.3 References

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

.1 Canada Labour Code Part II

.2 NRC-CNRC National Building Code of Canada

.3 Ontario Occupational Health and Safety Act and Regulations

.4 CAN/CSA C22.1 Canadian Electrical Code

1.4 Submittals

.1 The following submittals are to be provided to the CCG (CCG) Project Authority (PA):

.1 Proposed Electrical Servicing Package

.1 Deadline: with Preliminary design package (Section 011000)

.2 Deliverables:

.1 Plan drawings showing proposed servicing arrangement for each location and noting any amendments to the single line drawings provided in Appendix B3

.2 Electrical Servicing Package

.1 Deadline: with Construction Plan

.2 Deliverables:

.1 Updated plan drawing indicating servicing layout; and,

.3 Electrical Maintenance Package

.1 Deadline: with Maintenance Package

.2 Deliverables:

.1 As built drawings indicating adherence to, or approved deviation from, the design drawings (plan and single line).

.2 All site commissioning records indicating as a minimum:

.1 PV panel voltage and polarity as measured at the MNTRANSITION BOX and the charge controller;

.2 Battery voltage and amps;

.3 Charge controller configurations;

.4 Charge controller current and voltage outputs; and,

.5 Confirmation of the performance of the charge controller temperature compensation.

.3 Photographs of completed installation, illustrating

.1 All code required markings

.2 All bonding/earthing connections

1.5 Quality Assurance

.1 CCGs minimum inspection requirements are detailed below. The Contractor shall be responsible to notify CCG of the date and time that the works may be inspected.

.1 Upon installation of the system; and,

.2 Throughout system commissioning.

PART 2 - PRODUCTS

2.1 General

.1 PV system components are to be as detailed in Appendix B3, Drawings unless otherwise approved in writing by CCG PA.

2.2 System branch conductors (mechanical protection)

.1 Conductors are to be provided with mechanical protection from damage and wildlife. Protection may be in the form of Teck Cable or rigid PVC conduit.

2.3 Labels

.1 Red lucite panels complete with white lettering or approved alternative.

PART 3 - EXECTUTION

3.1 Installation

.1 Electrical equipment must not be installed prior to installation of foundation and the metal fabrications detailed within these specifications.

.2 Installation is to be completed by licensed electrician or trained PV system installer.

.3 Installation is to be completed in accordance with the requirements of the Canadian Electrical Code and all manufacturer installation instructions.

3.2 Servicing

.1 Contractor is to ensure that PV components are firmly affixed to the supporting structure and within the provided enclosures.

.2 Conductors must be strung in a professional manner following straight lines and with all unnecessary slack removed.

.3 All electrical connections are to be coated as recommended by the manufacturer or standard industry practice to prevent corrosion.

3.3 Earthing and Bonding

.1 Ensure all components are grounded in accordance with the requirements of the Canadian Electrical Code.

3.4 Commissioning

.1 Ensure system commissioning conforms with manufactures instructions and in compliance with the requirements of the Canadian Electrical Code.

.2 Review and document the performance of all system components.

3.5 Labelling

.1 Supply and affix all system labels in conformance with contract drawings and Canadian Electrical Code.

SECTION: 310099 FOUNDATIONS

PART 1 - GENERAL

1.1 Scope of Work

.1 Work of this section includes the design, supply and installation of the following:

.1 Supporting foundation for metal fabrications supporting the PV equipment detailed in Appendix B3, Drawings.

.1 Foundations may be cast in place concrete, pre-cast concrete, screw pile, or alternate system.

1.2 Related Sections

.1 Section 013300 Submittal Procedures

.2 Section 016100 Common Product Requirements

.3 Section 033000 Concrete Work. Section details requirements for concrete supply, placement and finishing.

.4 Section 055000 Metal Fabrications

.5 Section 260500 Electrical Requirements

1.3 References

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

.1 Canada Labour Code Part II

.2 NRC-CNRC National Building Code of Canada

.3 Ontario Occupational Health and Safety Act and Regulations

1.4 System Description

.1 The foundation element(s) is to provide a stable base for the metal fabrications detailed in Section 055000 in consideration of the anticipated site conditions and environmental loads.

1.5 Design Requirements

.1 Foundation is to be designed to resist all anticipated dead and live loads.

.2 Design is to be completed in consideration of the findings of the appended geotechnical investigation of the existing sites.

1.6 Performance Requirements

.1 Expected service life of this element is 25 years. The constructed foundation element is expected to perform as reasonably expected throughout this period.

1.7 Submittals

.1 The following submittals are to be forwarded to CCG PA:

.1 Conceptual foundation design

.1 Deadline: With preliminary design package (Section 011100)

.2 Deliverables:

.1 Concept drawings. Drawings must detail:

.1 Anticipated service loads

.2 Anticipated foundation dimensions

.2 Foundation Installation Package

.1 Deadline: With Construction Plan (Section 011100)

.2 Deliverables:

.1 Engineered drawings. Drawing shall be stamped and signed by an engineer licensed to practice in the Province of Ontario.

.1 Drawings must detail:

.1 Plan, elevation and relevant section views of the proposed installation;

.2 All incorporated products and/or performance parameters for bulk materials (i.e. ready mix concrete)

.3 Any pertinent commentary concerning construction of the proposed foundation facilities.

.2 Summary Report (if necessary). The summary report shall contain all additional technical references and requirements not otherwise detailed within the engineered drawings (i.e. chemical adhesive anchors -> manufacturer's installation instructions).

.3 Foundation and Anchorage Maintenance Package

.1 Deadline: With Project Maintenance Package (Section 011100)

.2 Deliverables:

.1 Amended project design drawings noting adherence, or any approved deviation completed, during construction

1.8 Quality Control

.1 CCG's minimum inspection requirements are detailed below. The Contractor shall be responsible to notify CCG of the date and time that the works may be inspected.

.1 Onsite throughout installation of the critical foundation elements.

PART 2 - PRODUCTS

2.1 General

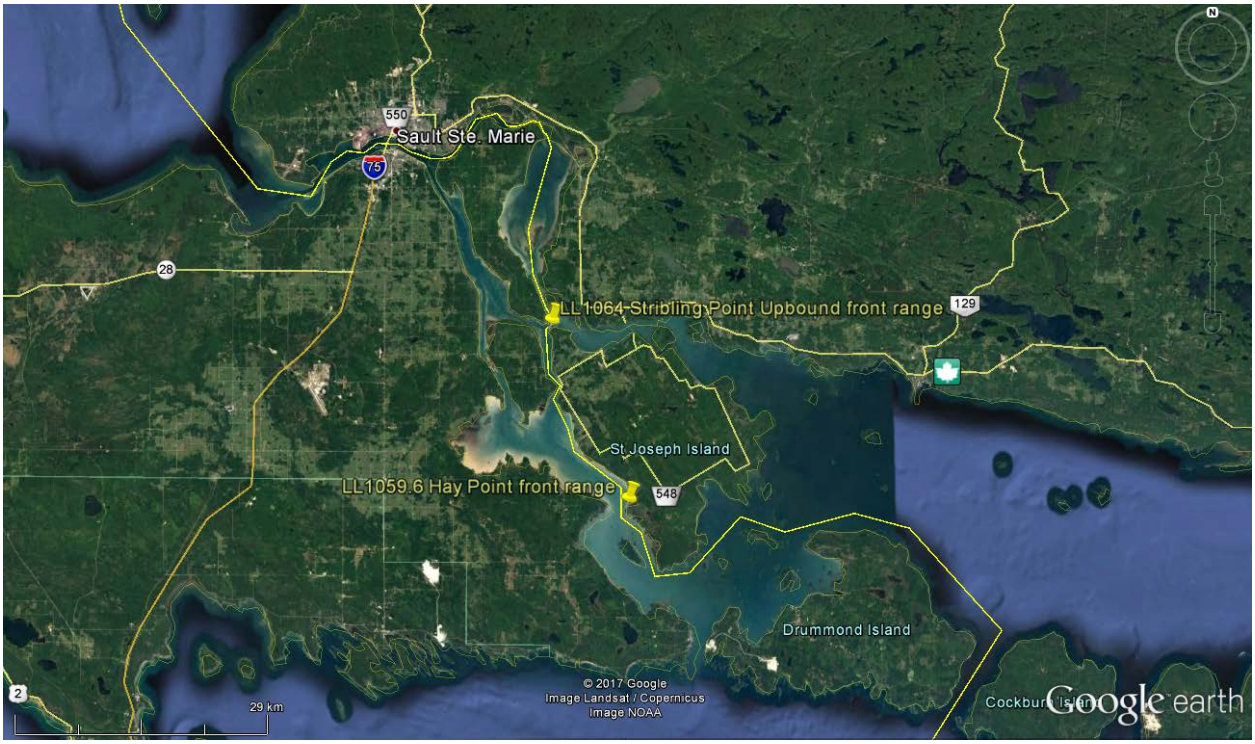
.1 Products shall be as stipulated by the Contractor's Engineer.

PART 3 - EXECUTION

3.1 General

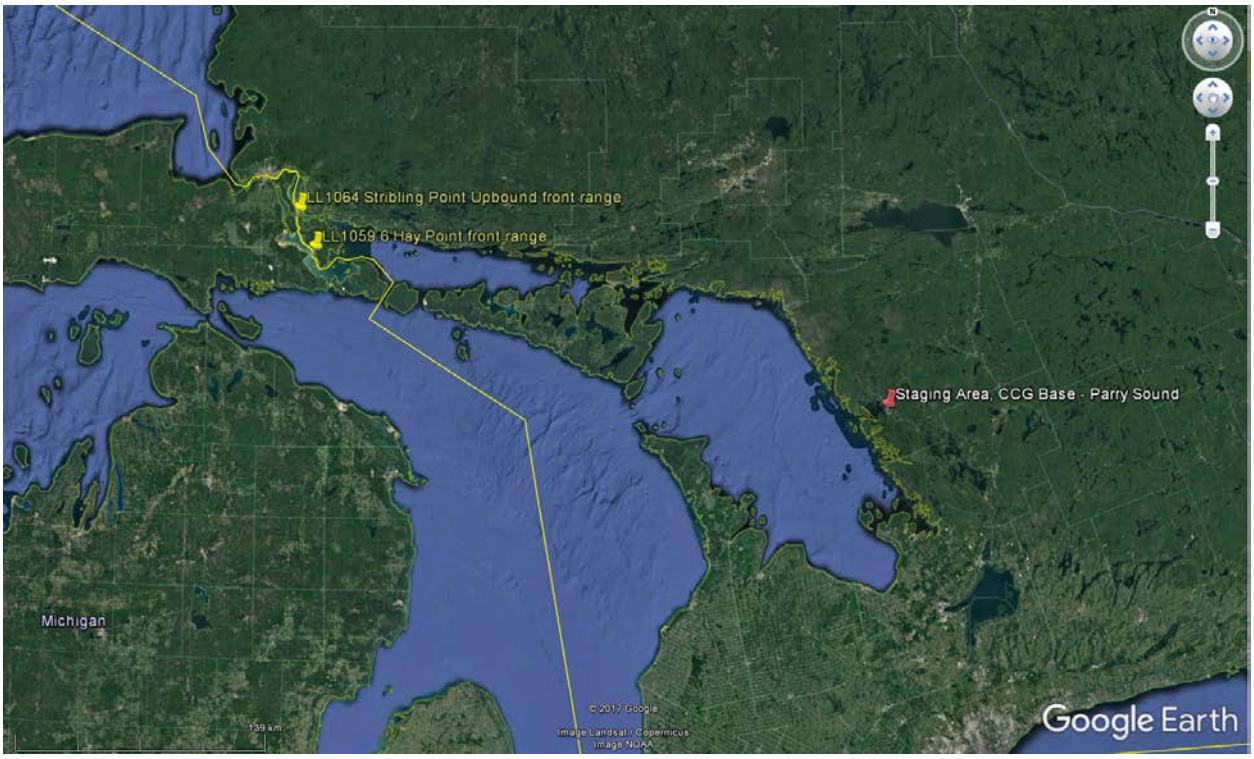
.1 Installation shall be undertaken in accordance with the Contractor's engineered drawings and accompanying materials as contained in the Contractor's Summary Report.

APPENDIX B1: SITE LOCATION AND PHOTOGRAPHS



Project locations

LL 1059.6	Hay Point Front Range, ...	46° 7'36.69"N, 83°59'58.76"W
LL 1064	Stribling Point Upbound Front Range ..	46°18'47.06"N, 84° 6'55.44"W



Staging location CCG Rotary Wing Assets

Approximate distance to Site 180 NM

Travel time 1h 40m (Bell 412) – 1h 30m (Bell 429)

Hay Point Range
Existing conditions

Picture taken
28 JUN 17
12:02 PM

Existing tower

Existing battery storage facilities are to be removed

Foundations are to be removed

Area north of tower at edge of channel

Area northwest of tower approximately along range line

View from top of tower towards rear range

Stribling Range

28 Jun 2017

Stribling Range

Proposed location PV facilities

SW of existing tower.

Stribling Range

Proposed location of PV facilities

APPENDIX B2 – SUMMARY OF CONTRACT SUBMITTALS (a)

Sect 011100 General Requirements		***Sect 013530 Health and Safety Requirements***	***Sect 013543 Environmental Procedures***	***Sect 033000 Concrete Work***	***Sect 055000 Metal Fabrications***	***Sect 260500 Electrical*** (c)	***Sect 310099 Foundations*** (c)
Deliverable	*Deadline*						
Detailed Schedule	*10 Working Days Following Award*						
Project Participants Listing	*With Schedule*						
Preliminary Design Package	***As Detailed In Contractor's Submitted Schedule***				*Proposed Structural Assembly Drawings*	*Proposed Electrical Servicing Package*	*Conceptual Foundation Design*
Construction Plan	***As Detailed In Contractor's Submitted Schedule (B)***	*Project Specific Safety Program*	*Environmental Protection Plan*	*Concrete Placement Plan (If required)*		*Electrical Installation Package*	*Foundation Installation Package*
Maintenance Package	*30 Days Following Substantial Completion*			*Concrete Test Results*		*Electrical Maintenance Package*	*Foundation And Anchorage Maintenance Package*
System Training Package	*Six (6) Months Following Substantial Completion*						

a) Requirements of Section 013300 Submittal Procedures govern all submissions

b) Documents to be submitted 10 days prior to mobilization

c) Submissions may be combined were feasible, for clarity electrical, foundation, and marine cable haul system drawings may be combined for each individual submittal

APPENDIX B3 – DRAWINGS

NOTE:

INSTALLATION REQUIREMENTS PER CANADIAN ELECTRICAL CODE 2015

1) ANY METALLIC PORTION OF SYSTEM MUST BE GROUNDED. ALL METAL PARTS OF FIXED EQUIPMENT SHALL BE BONDED TOGETHER AND CONNCETED TO GROUND IN ACCORDANCE 10-400. PV ARRAY TO BE BONDED THROUGH ALUMINUM RACKING SYSTEM AS PER MANUFACTURES INSTRUCTION AND SECTION 10.

2) GROUND MOUNT ARRAY WIRING AND CONNECTIONS MUST BE MADE AND INACCESSIBLE IN ACCORDANCE WITH 64-210 AND 64-220.

3) CHARGE CONTROLLERS HAVE ARC FAULT AND GROUND FAULT PROTECTION IN ACCORDANCE WITH 64-216.

4) PERMANENT MARKING MUST BE PROVIDED AT THE DC DISCONNECT FOR THE PV SYSTEM, IN ACCORDANCE TO 64-200. Voc X 1.25 CALCULATED IN ACCORDANCE WITH 64-202. Isc X 1.25 CALCULATED IN ACCORDANCE WITH 64-206.

5) SINGLE LINE DIAGRAM POSTED AT SITE.

6) THIS SYSTEM SIZE IS BASED ON SPECIFIC LOADS AND USAGE TIMES, ANY DEVIATION FROM THESE MAY RESULT IN POOR BATTERY PERFORMANCE

7) TWO WIRE DC CONDUCTORS MUST BE MARKED WITH PROPER COLORS IN ACCORDANCE TO 64-212. RED POSITIVE AND BLACK NEGATIVE

8) BATTERIES SHALL BE INSTALLED IN ACCORDANCE TO 64-800. BATTERY INTERCONNECTIONS SHALL BE COMPLIANT TO 64-810. BATTERIES WILL BE STORED IN DRY, VENTILATED AREA, AND A SAFE DISTANCE FROM CONDUCTIVE MATERIAL.

9) THE EQUIPMENT PROVIDED TO CONTROL THE CHARGING PROCESS OF THE BATTERY CAN ONLY BE ADJUSTED BY A QUALIFIED PERSON.

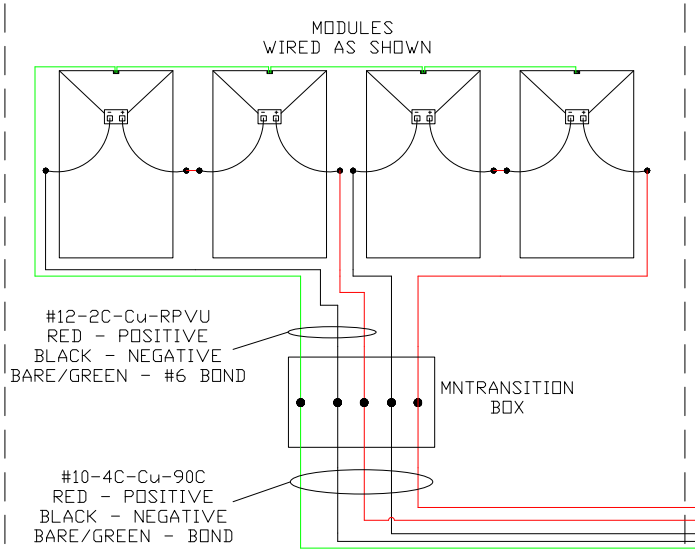
TOTAL PV SOURCE DETAILS

MODEL: HSQ-340-72P-QPLUS
QTY: 4
DIMENSIONS: 39.4"W x 1.38"D x 78.5"H

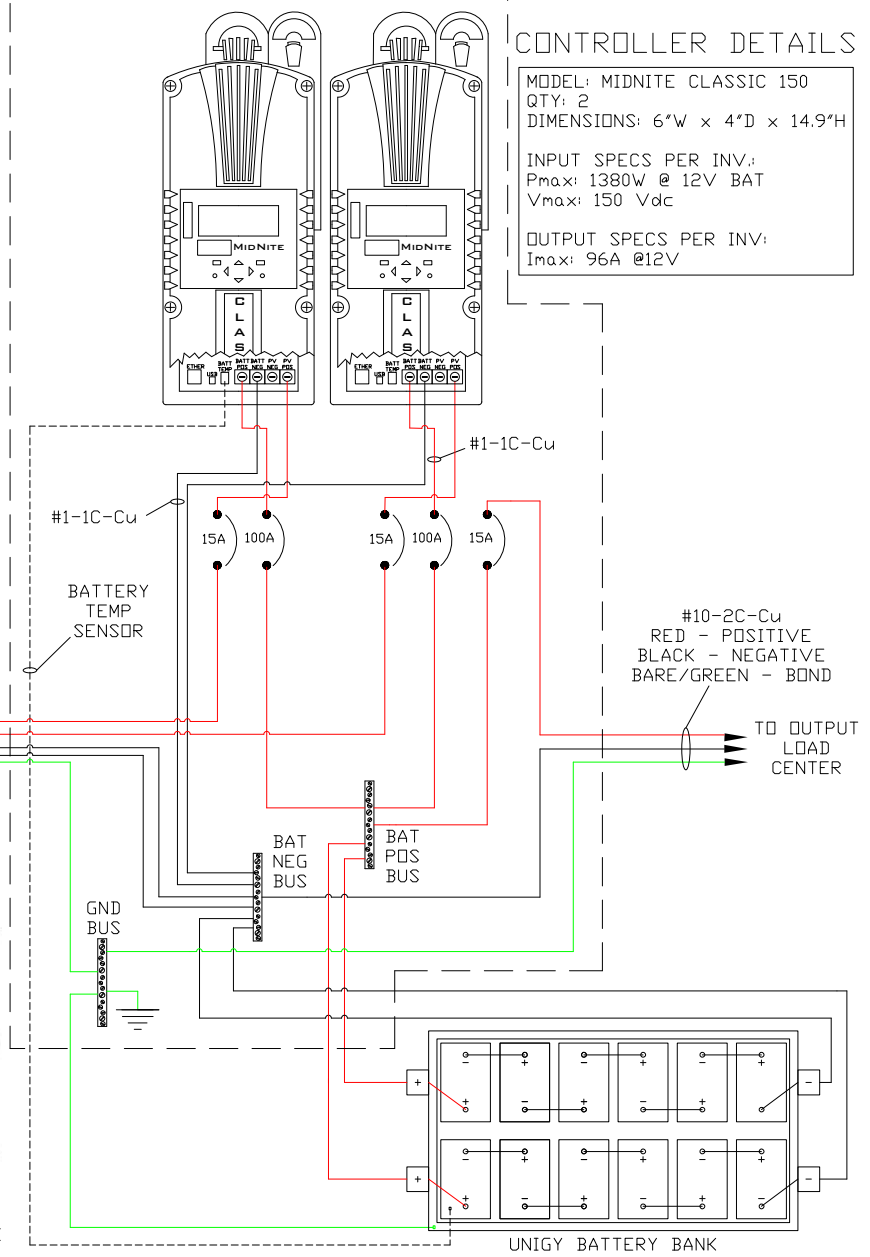
TOTAL SPECS:
Power: 1360 W
Voc x 1.25: 117.7 Vdc
Isc x 1.25: 12.0 Adc
Vpm: 75.26 Vdc
Ipm: 9.03 Adc

(4)

GROUND MOUNTED ARRAY



CONTROLLER ENCLOSURE



CONTROLLER DETAILS

MODEL: MIDNITE CLASSIC 150
QTY: 2
DIMENSIONS: 6"W x 4"D x 14.9"H

INPUT SPECS PER INV.:
Pmax: 1380W @ 12V BAT
Vmax: 150 Vdc

OUTPUT SPECS PER INV:
Imax: 96A @12V

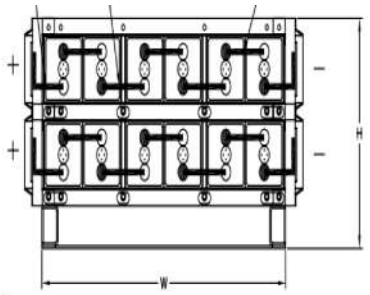
VOLTAGE DROP TABLE

Description	Breaker Size	Wire Type		Voltage	Phase	Current	Max Length	Voltage Drop	
	A	TYPE	cmils	V	AC/DC	A	ft	V	%
Array to MNTransition	na	#12-2C-Cu-RPVU1000V	6530	75.26	DC	9.03	52	1.496	2.0%
MNTransition to Controller	15	#10-2C-Cu-90C	10380	75.26	DC	9.03	82	1.484	2.0%
Controller to Battery Bank	100	#1-1C-CU	83690	12	DC	56	17	0.237	2.0%
Battery Bank to Load	15	#10-2C-Cu-90C	10380	12	DC	8.25	15	0.248	2.1%

BATTERY BANK DETAILS

MODEL: 6AVR95-15N-6
QTY: 2
DIMENSIONS: 37"W x 20.08"D x 27.88"H

TOTAL SPECS:
VOLTAGE: 12V
CAPACITY: C100 TO 1.84 v.p.c: 1840Ah



6AVR95-15N-6 UNIGY BATTERY BANK

REVISIONS			
REV.	DESCRIPTION	DATE	NAME
-	INITIAL RELEASE	06/27/17	CB
A	BATT BANK DECREASE	07/26/17	CB

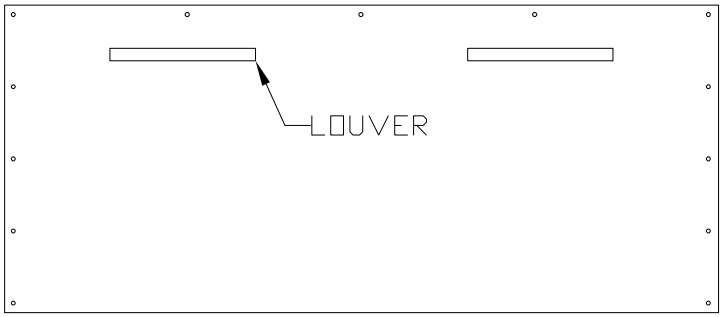
HES PV

320 MARY ST. VICTORIA, BC V9V 3V9
84 MORROW RD. BARRIE, ON L4N 3V8
17815-111 AVE. EDMONTON, AB T5S 2X3
1-866-258-0110
WWW.HESPV.CA

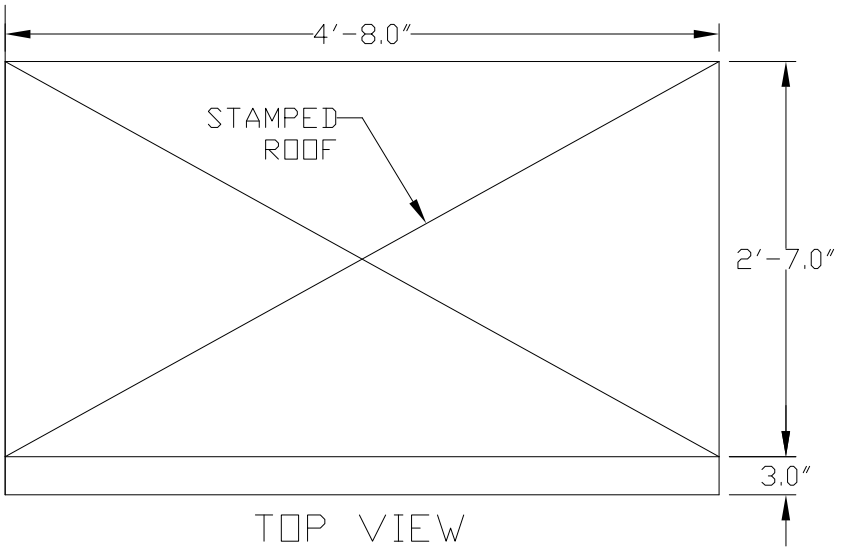
TITLE:
CANADIAN COAST GUARD-SLD
CENTRAL & ARCTIC REGION
4 LOCATIONS

105358 | A | 01

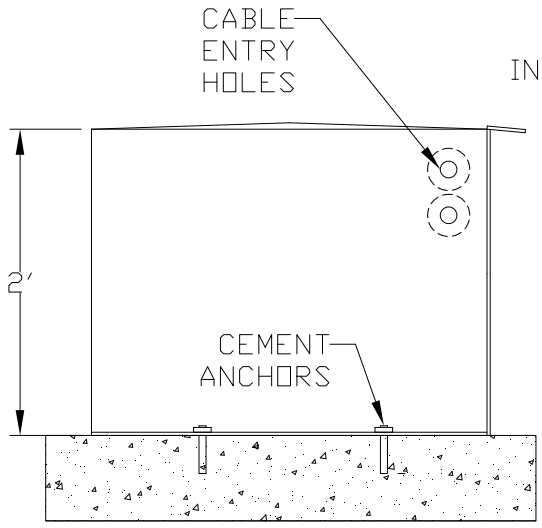
REVISIONS			
REVISIONS	DESCRIPTION	DATE	NAME
–	INITIAL RELEASE	08/01/17	CB



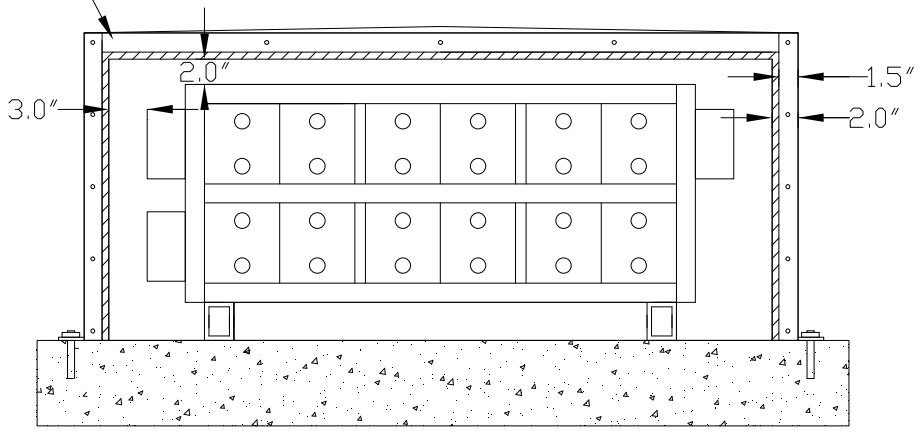
FRONT DOOR



TOP VIEW



SIDE VIEW



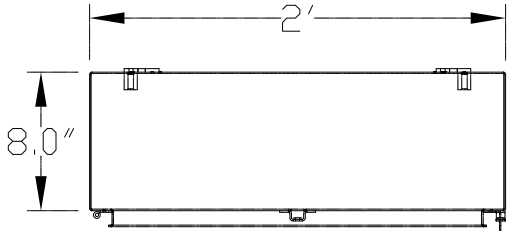
FRONT VIEW WITHOUT
FRONT DOOR

H.E.S. PV	COMMENTS:	UNLESS OTHERWISE SPECIFIED:		NAME	DATE
320 MARY ST. VICTORIA, BC V9V 3V9 1-866-258-0110 WWW.HESPV.COM			DRAWN	CB	08/01/17
			CHECKED		
		INTERPRET GEOMETRIC TOLERANCE PER: SO: XXXXXX	ENG APPR.		
			MFG APPR.		
			Q.A.		

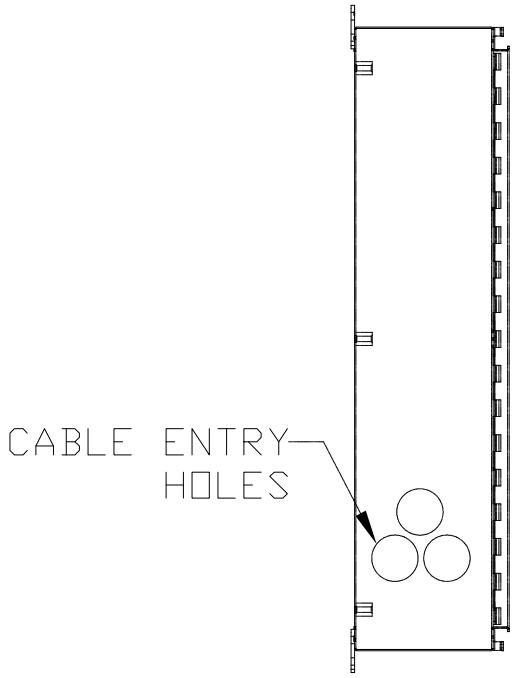
TITLE: CANADIAN COAST GAURD BATTERY BANK ENCLOSURE

DWG. NO. 105461 | REV – | PAGE 01

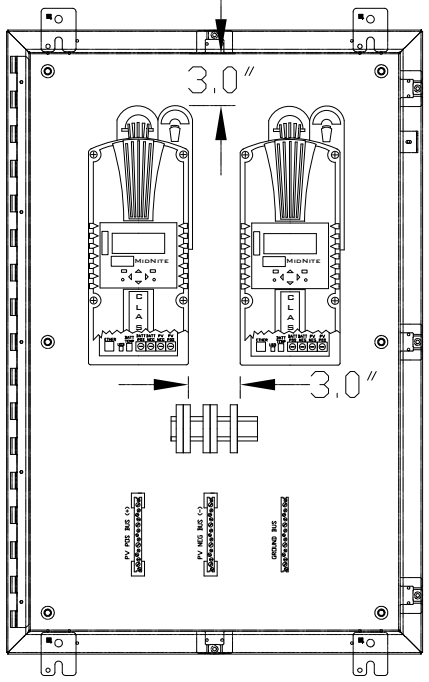
REVISIONS			
REVISIONS	DESCRIPTION	DATE	NAME
-	INITIAL RELEASE	08/01/17	CB



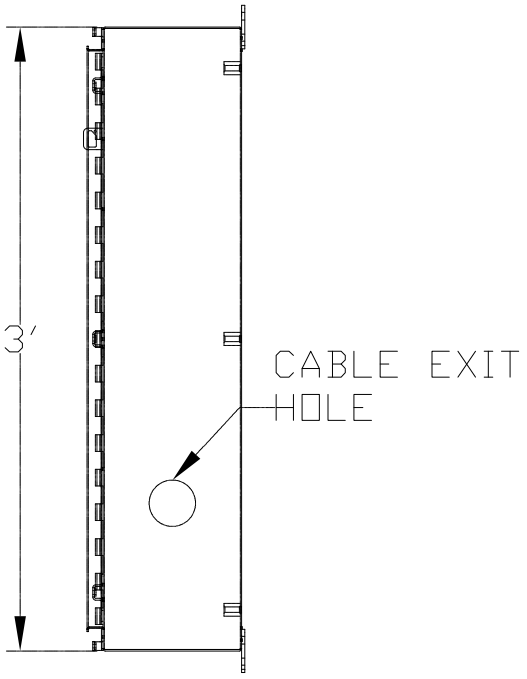
TOP VIEW



SIDE VIEW



FRONT VIEW



SIDE VIEW

H.E.S. PV	COMMENTS:	UNLESS OTHERWISE SPECIFIED:		NAME	DATE
320 MARY ST. VICTORIA, BC V9V 3V9 1-866-258-0110 WWW.HESPV.COM			DRAWN	CB	08/01/17
			CHECKED		
		INTERPRET GEOMETRIC TOLERANCE PER:	ENG APPR.		
			MFG APPR.		
			Q.A.		

TITLE: CANADIAN COAST GAURD CONTROLLER ENCLOSURE

DWG. NO.	REV	PAGE
105465	-	01

APPENDIX B4 – GEOTECHNICAL INFORMATION

GEOTECHNICAL INVESTIGATION
HAY POINT FRONT AND REAR RANGE TOWER REPLACEMENTS
ST. JOSEPH ISLAND, ONTARIO

Submitted to:

Parry Sound Coast Guard Base
28 Waubeek Street
Parry Sound, Ontario
P2A 1B9

Submitted by:

AMEC Earth & Environmental
A Division of AMEC Americas Limited
131 Fielding Road
Lively, Ontario
P3Y 1L7
(705) 682-AMEC

17 December 2007
AMEC Project No.: TY630201

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC), has been retained by the Canadian Coast Guard, Central and Artic Region (CCG) to complete a geotechnical investigation at two navigation light range towers on St. Joseph Island, Ontario (see Figure 1). This report is a continuation of AMEC's previous investigation report, TY63020 dated September 2007 (included in Appendix A), and focuses on the following tower locations:

1. Haypoint Rear Range (LL1059.6)
2. Haypoint Front Range (LL1059.7)

It should also be noted that an environmental assessment of these two tower locations was requested and reported under separator cover within AMEC's report TY71027 dated December 2007.

The purpose of this geotechnical investigation was to determine the subsurface conditions and relevant soil properties at the subject sites in order to provide recommendations for the geotechnical design aspects of the proposed developments.

The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. The feasible construction methods, however, express our opinion and are not intended to direct contractors how to carry out construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all factors that may have an affect upon construction.

We assume that the work will be carried out in accordance with good engineering practises and all applicable standards and regulations. Environmental considerations were not part of the scope of work for this geotechnical investigation.

There should be continuous liaison with AMEC during both the design and construction phases of the project to ensure that the recommendations in this report have been interpreted and implemented correctly. If any further clarification and/or evaluation are needed concerning the geotechnical aspects of the project, AMEC should be contacted immediately.

2.0 PROJECT DESCRIPTION

The Hay Point range light towers will be a maximum of 10 m high and are shown on Figure 2. A typical tower is shown as Photograph 1.

Access to the site was difficult due to the relative obscure location of the towers. Low water levels limited boat access and the lack of roads required an alternate form of access. As a result, an all terrain vehicle with a trailer was used which traveled through private property (with permission) and along the beach to the towers.

Photograph 1 (17 October 2007): Existing Hay Point Front Range tower.

3.0 INVESTIGATION PROGRAM

The field work for this project was carried out on 16 to 19 October 2007, when two boreholes (BH07-01 and 02) were advanced at the Front Range tower and two more boreholes (BH07-03 and 04) were advanced at the Rear Range tower. The boreholes were extended to a maximum depth of 4.4 m, using micro drilling apparatus, supplied by Marathon Drilling Company.

Continuous soil samples were taken at 0.6 m intervals during Standard Penetration Testing (SPT 'N' values). These 'N' values provide an indication of the compactness condition, or consistency of the soil strata. Test results are recorded on the Borehole Logs (Appendix A). The samples were placed in containers and delivered to our Sudbury laboratory for further examination and testing.

All boreholes had groundwater monitoring wells installed to the depths indicated on the logs. The wells comprised 40 mm diameter, Schedule 40, PVC piping, with a screened base, encompassed by filter sand. The depth to groundwater in the wells was recorded prior to our departure from the site and can be found on the borehole logs.

4.0 SUBSURFACE CONDITIONS

A description of the stratigraphy encountered in the boreholes is shown on the logs included in Appendix B. A general summary of the subsurface conditions is presented below.

4.1 Front Range (BH07-01 and 02)

The ground surface elevation at this borehole was referenced to the northeast corner of the existing concrete tower pad foundation. This benchmark was assigned an arbitrary elevation of 100 m.

Based on the information from both boreholes, this site is overlain by a 1.2 m thick layer of sand with trace silt. SPT 'N' values of 3 to 28 indicate a very loose to compact condition. Natural moisture contents were measured to be between 4 and 25%.

Underlying the sand in both boreholes is a wet silty sand with trace gravel layer. SPT 'N' values ranged between 25 and greater than 50 indicating a compact to very dense condition. Natural moisture contents were measured to be between 13 and 18%. A grain size distribution analysis of the silty sand in BH07-01 SS3 is shown on Figure 3.

Both boreholes BH07-01 and 02 were terminated in the silty sand deposit following refusal to the micro drilling equipment on boulders or possible bedrock at 2.0 m and 1.9 m depth below present grade, respectively.

4.2 Rear Range (BH07-03 and 04)

The ground surface elevation at boreholes BH07-03 and 04 were referenced to the northwest corner of the existing concrete tower pad foundation. This benchmark was assigned an arbitrary elevation of 100 m.

Based on the information from both boreholes, this site is overlain by a 3.1 to 4.4 m thick layer of sand with trace silt. SPT 'N' values ranged between 4 to greater than 50 which indicates a very loose to very dense condition. Natural moisture contents were measured to be between 8 and 26%.

Both boreholes BH07-03 and 04 were terminated in the sand deposit following refusal to the micro drilling equipment on boulders or possible bedrock at 3.1 m and 4.4 m depth below present grade, respectively.

4.3 Groundwater

The freestanding groundwater elevations were measured prior to leaving the site and again on 15 November 2007 following a period of stabilization. Depth to the groundwater table in the monitoring wells was recorded to be between 0.4 and 0.7. m below present grade. The long term groundwater level is expected to fluctuate with Lake Huron and in line with the precipitation regime.

5.0 DISCUSSIONS AND RECOMMENDATIONS

5.1 Conventional Foundations

Based on the borehole information, foundations for the towers can be placed on native inorganic compact soils, below the depth of frost penetration which, in accordance with the published data, is 1.8 m below the finished grade. Alternatively, where shallower embedment depths are necessary, such as at the Front Range tower, rigid insulation can be substituted for insufficient soil cover. As a rough approximation, 25 mm of rigid insulation is thermally equivalent to 300 mm of soil cover.

Once the foundation subsoil is exposed, it should be inspected by a geotechnical engineer prior to the construction of forms for concrete. Any deleterious material encountered should be sub-excavated and replaced with Granular 'A' fill or equivalent and compacted to 100% of the material's standard Proctor maximum dry density (SPMDD).

Any non-cohesive soil layers, such as the anticipated native sand and silty sands, exposed at the founding elevation, should be properly dewatered and proof rolled prior to placing a protective layer, such as a mud-mat (lean concrete) or clear stone wrapped in a geotextile. The dewatering should be conducted from filtered wells to temporarily drawdown the water table below the foundation grade, so that no upward seepage occurs from the base of the excavation. Given the high permeability characteristics of the soils and the elevated groundwater table, the dewatering for these sites should be completed by a specialty contractor, with an approved dewatering plan.

The available bearing capacities of the native soil at the tower locations are as follows:

Location	Borehole	Foundation Grade	Bearing Soils	Allowable Net Bearing Pressure (kPa)
Front Range	BH07-01& BH07-02	Below El. 97.8	Compact to Dense Silty Sand	150
Rear Range	BH07-03 & BH07-04	El. 98 to 96	Compact to Dense Sand	75
		Below El. 96	Dense to Very Dense	200

It should be noted that if the quoted bearing capacities are insufficient, the footings can be carried down to bedrock, especially in the case of the Front Range, where the bedrock possibly could be as shallow as 2 m below grade. In the case of the Rear Range, short driven piles to refusal may be considered.

In general, footings placed on sound bedrock will provide a minimum allowable bearing pressure of 1 MPa. End bearing piles driven to practical refusal on proven bedrock would generate an ultimate geotechnical capacity comparable to the pile structural capacity. However, the geotechnical factors to determine the allowable pile capacity would range between 0.4 to 0.6, depending on the proven capacity at the specific piling locations. AMEC can provide further assistance for the piling design, should it be required.

5.2 Uplift and Overturning

With most towers, uplift loads in addition to downward loadings may be expected. Common practice to resist uplift usually involve installing anchors, utilizing the weight of mass concrete, footing protrusions or the use of friction piles driven into the subsoil. Buoyancy considerations must be considered in conjunction with the design flood levels at this site. Whichever mode to resist uplift is selected, it must ensure an adequate factor of safety.

The tower and its foundation must be designed against overturning. If the backfill is used to stabilise the tower against uplift and overturning, the foundation should be backfilled with granular engineered backfill, compacted at the optimum moisture content to a bulk unit weight of at least 18 kN/m^3. The following earth pressure coefficients should be utilized:

- Active 0.35
- At rest 0.5
- Passive 3

As mentioned earlier, the buoyancy of the backfill should be incorporated in the design by using the submerged unit weight of 8 kN/m^3.

It should be noted that gradation testing of the native soil (sample from BH07-03) from the Rear Range tower location indicates a uniform material, which may not be compactable, to meet the desired strength characteristics. Additional testing from different locations is necessary to determine the sources of adequate backfill materials.

5.3 Limit States Design

If the foundation design is to be completed using the Limit States method, we will be happy to provide detailed assistance in the geotechnical calculations. The Limit States design as per the applicable Building Code is based on the more realistic soil-structure interaction mechanism and as such requires close cooperation between the structural and geotechnical consultants.

As an example for preliminary ultimate limit state analysis, a 3 m square raft foundation, with 1.8m of embedment, bearing on undisturbed native soil, within the range of elevations described above, could be designed for the following design parameters:

Load Combination	Unfactored Bearing Capacity (kPa)	Factored Vertical Geotechnical Resistance – Compression (kN)
Vertical and Centric	380	1700
15° Inclined Load and Centric	220	970
15 ^{0} Inclined Load with 10% (0.3 m) eccentricity	120	425

As shown, the ultimate bearing resistance could greatly decrease under combined 3-directional loads and overturning moments. It is customary to have the Designer prepare the preliminary foundation design and return this data to the Geotechnical Consultant, along with the design load combinations at ULS and SLS. The Geotechnical Consultant will review this information and provide recommendations for the design adjustments, if required.

The verifications at serviceability limit state (SLS) for most usual situations are automatically fulfilled if the foundation size was established on the basis of 'allowable' bearing pressures, satisfying all of the design SLS load combinations, and in conjunction with the conventional acceptable 25 mm (1 inch) for maximum settlement, and 20 mm (¾ inches) for differential settlement. In the case of more complex structures, and/or when specific SLS criteria are defined, other than the conventional settlement limits discussed above, an interactive design approach should be undertaken between the structural and geotechnical consultants.

5.4 Excavation

Above the groundwater table, the shallow excavations side slopes should be stable at 1H:1V. However, the groundwater table is expected to be near the current ground surface and without positive dewatering (lowering of the groundwater table), seepage from the excavation slopes and base could be significant.

Excavations that penetrate the water table are expected on this site and will be increasingly difficult. As mentioned, these excavations will require positive methods of groundwater control, which could include for example, but not restricted to dewatering from filtered wells or excavating within the confines of interlocking steel sheeting combined with dewatering from filtered sumps cut below the dredge line. Open excavations within undewatered soils could develop Type 4 Soil conditions.

Steel sheet piling or shoring may also be required if the excavation limits are to be controlled, i.e., insufficient property or structures, such as the existing towers, to contain the anticipated large excavation area. If shored excavations are contemplated, a licensed engineer should approve the proposed shoring method.

It is recommended to excavate test pits prior to construction, in the presence of potential contractors, to determine precise ground conditions (specifically the water table at the time of construction), in order to allow them to assess excavation and dewatering techniques.

All excavations should be carried out in accordance with the Occupational Health and Safety Regulations of the Province. A qualified geotechnical engineer should be retained to review the proposed excavation procedures.

5.5 Reuse of Excavated Soil

Generally, the native soils are uniform sands and well graded silty sands that can be reused as engineered backfills, if properly sorted from foreign materials and preconditioned in terms of moisture content and grain size. Depending on the intended use, various compaction levels will be necessary, typically from 95 % SPMDD to 100% SPMDD.

5.6 Earthquake Considerations

In conformance to the criteria in Table 4.1.8.4A, Part 4, Division B of the National Building Code (NBC 2005), the project site is classified as Site Class “D-Stiff Soil”. The four values of the Spectral response acceleration S_a (T) for different periods and the Peak Ground Acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the NBC (2005). The design values of F_a and F_v for the project site should be calculated in accordance to Table 4.1.8.4 B and C.

5.7 Analytical Testing

Split spoon sample 2 from BH07-03 was sent to an independent laboratory for analytical testing comprising pH, sulphate, resistivity and chloride determination and is presented in Appendix C and summarized below.

Laboratory testing results indicates a pH of 4.7, chloride content of < 2 µg/g, sulfate content of 61 µg/g and a resistivity of 5,040 ohm-cm.

The concentration of water soluble sulphate within the soil sample tested does not exceed the limit of 0.1%, above which CSA A.23 recommends the use of sulphate resistant cement. Therefore, sulphate resistant concrete is not required.

The chloride content and resistivity test values do not indicate a corrosive environment. However, a corrosion specialist should review these results.

6.0 CLOSURE

The Limitations of Report, as presented in Appendix D, forms an integral part of this report.

The recommendations included in this report, although site specific, have a general nature. Once the intended design details and construction methods are available, we recommend a geotechnical consultant be retained to review this information to ensure conformance with the assumptions and limitations considered.

We trust that the information presented in this report is complete within our terms of reference. If you have any questions, please do not hesitate to contact our office.

Respectfully Submitted,

AMEC Earth & Environmental

Prepared by:
David M Brown.
Project Manager

Reviewed by:
Dan Dimitriu, P.Eng.
Senior Geotechnical Engineer

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and Depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *Modified Unified Soil Classification System*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows *(Ref. Canadian Foundation Engineering Manual)*:

Compactness of Cohesionless Soils	SPT N-Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	Undrained Shear Strength kPa	Undrained Shear Strength psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	Over 200	Over 4000

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core	GS	Grab Sample
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample	AR	Air Return Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

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www.amec.com

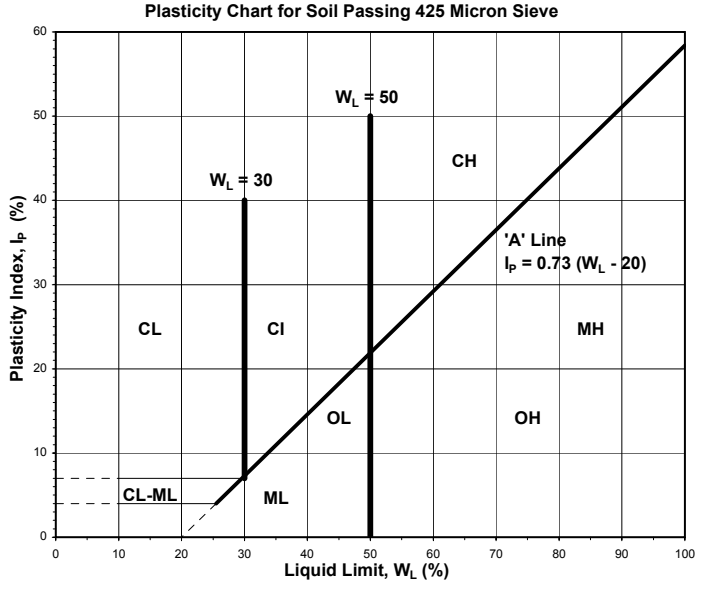
MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L < 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L < 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SLITS & CLAYS BELOW "A" LINE	W_L < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L < 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SOIL COMPONENTS

FRACTION	U.S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	76 mm	19 mm	35-50	AND
				20-35	Y/EY
	FINE	19 mm	4.75 mm	10-20	SOME
				1-10	TRACE
SAND	COARSE	4.75 mm	2.00 mm		
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					
ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm				NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS > 0.76 CUBIC METRE IN VOLUME	



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Note 1: Soils are classified and described according to their engineering properties and behaviour.

Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992.)

Rev. 5 Nov. '06

Parry Sound Coast Guard Base	DWN BY: KKJ	PROJECT: Geotechnical Investigation Hay Point Front and Rear Range Tower Replacements	REV. NO.: A DATE: December 2007
AMEC Earth & Environmental 131 Fielding Road Lively, Ontario P3Y 1L7 705-682-2632	CHK'D BY: DMB	TITLE: Site Location Map	PROJECT NO: TY630201
	SCALE: n.t.s.		FIGURE No. 1

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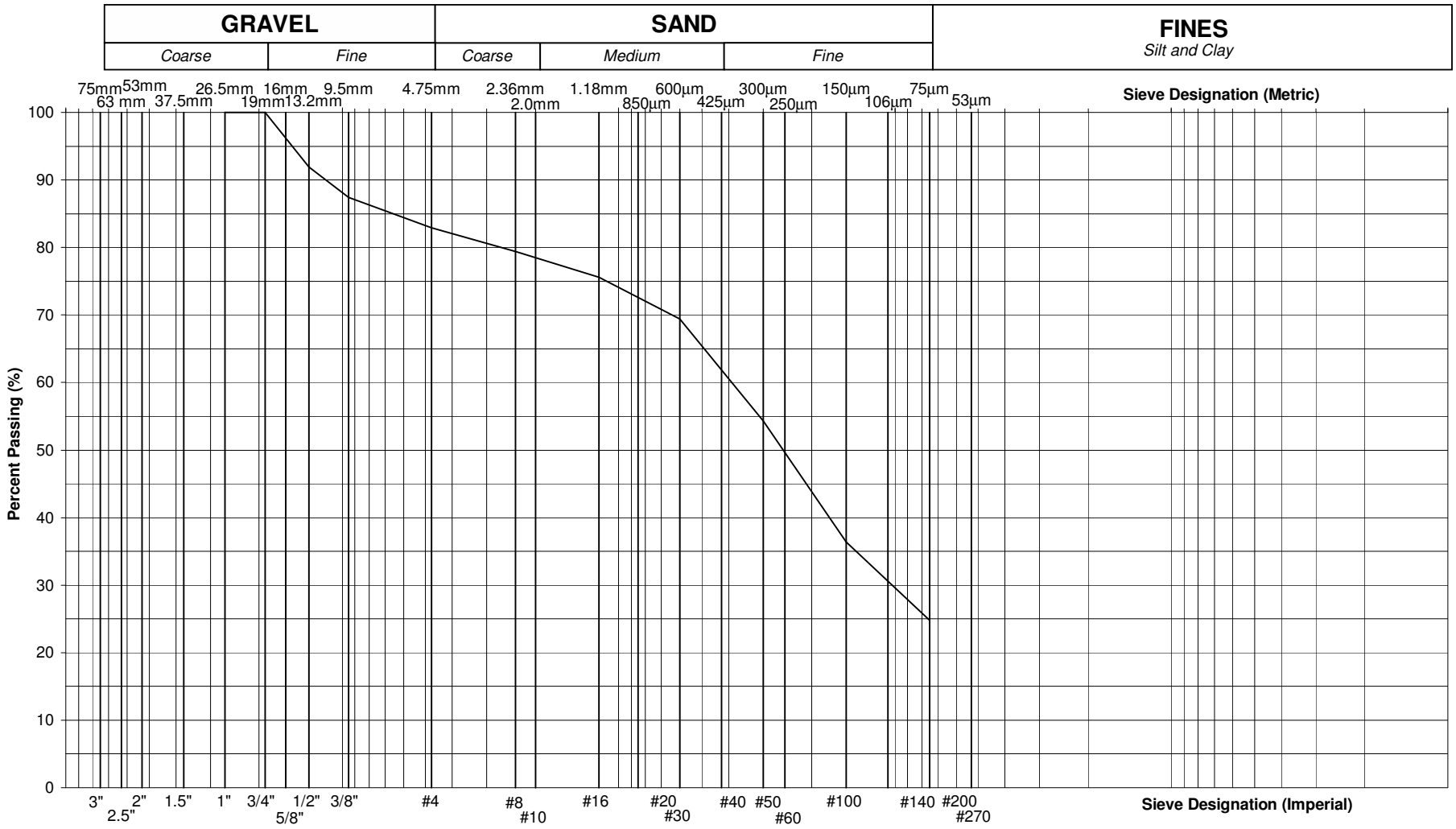
705-682-2632

Parry Sound Coast Guard Base

PROJECT: Geotechnical Investigations Hay Point Front and Rear Range Tower Replacements	DWN BY: KKJ	REV. NO.: A	DATE: December 2007
			PROJECT NO: TY630201
TITLE: Borehole Location Plan	CHK'D BY: DMB	SCALE: n.t.s.	FIGURE No. 2

UNIFIED SOIL CLASSIFICATION SYSTEM
GRAIN SIZE DISTRIBUTION ANALYSIS ASTM D 422



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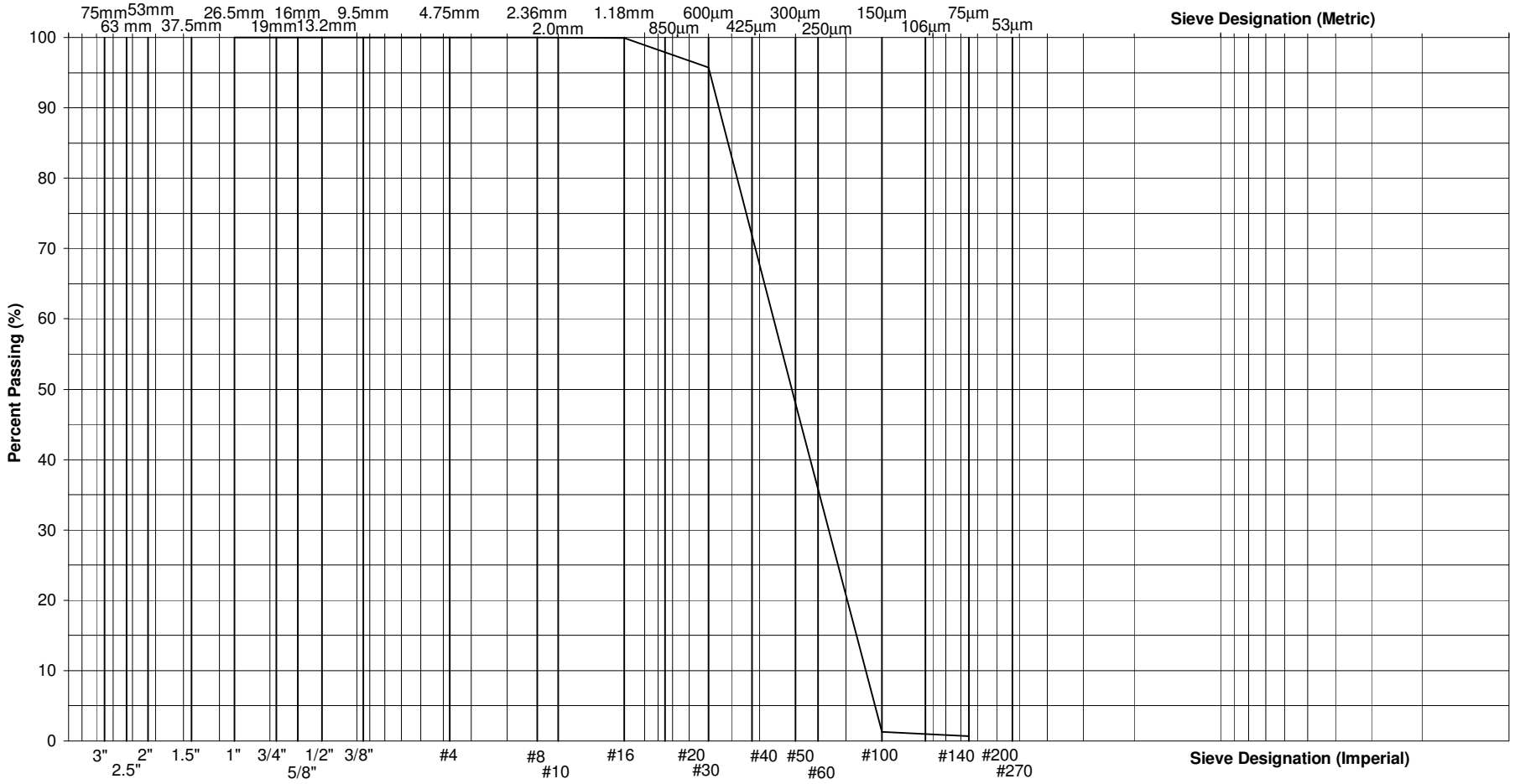
CLIENT LOGO:	SAMPLED BY: DM Brown, AMEC	PROJECT: Geotechnical Investigation Hay Point Front and Rear Range Tower Replacements St. Joseph Island, Ontario	REV. No.: 0
	RECIEVED BY: PR Lachance, AMEC		LAB No.: SB07253
CLIENT: **Parry Sound Coast Guard Base**	TESTED BY: PR Lachance, AMEC	Sample Location: **BH07-01 SS3**	PROJECT No.: TY630201
	DATE: December 2007	Sample Identification: **SILTY / CLAYEY SAND, some gravel**	FIGURE No.: 3

UNIFIED SOIL CLASSIFICATION SYSTEM
GRAIN SIZE DISTRIBUTION ANALYSIS ASTM D 422

GRAVEL		SAND			FINES
Coarse	*Fine*	*Coarse*	*Medium*	*Fine*	*Silt and Clay*



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CLIENT LOGO:

CLIENT:
Parry Sound Coast Guard Base

SAMPLED BY: DM Brown, AMEC

RECIEVED BY: PR Lachance, AMEC

TESTED BY: PR Lachance, AMEC

DATE: December 2007

PROJECT:
Geotechnical Investigation
Hay Point Front and Rear Range Tower Replacements
St. Joseph Island, Ontario

Sample Location: **BH07-03 SS2**

Sample Identification: **SAND, trace silt**

REV. No.: **0**

LAB No.: **SB07254**

PROJECT No.: **TY630201**

FIGURE No.: **4**

APPENDIX A

PREVIOUS GEOTECHNICAL INVESTIGATION REPORT

GEOTECHNICAL INVESTIGATION
VARIOUS NAVIGATION TOWER REPLACEMENTS
ST. JOSEPHS ISLAND, ONTARIO

Submitted to:

Parry Sound Coast Guard Base
28 Waubeek Street
Parry Sound, Ontario
P2A 1B9

Submitted by:

AMEC Earth & Environmental
A Division of AMEC Americas Limited
131 Fielding Road
Lively, Ontario
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(705) 682-AMEC

September 17, 2007
AMEC Project No. TY63020

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FIGURES

APPENDICES

1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC), has been retained by the Canadian Coast Guard, Central and Artic Region (CCG) to complete geotechnical investigations at the following navigation tower replacements (see Figure 1):

1. Haypoint Rear Range (LL1059.6)
2. Haypoint Front Range (LL1059.7)
3. Sailor's Encampment Upbound Rear Range (LL1061)
4. Sailor's Encampment Upbound Front Range (LL1060)
5. Stribling Point Rear Range (LL1065)

The purpose of this geotechnical investigation was to determine the subsurface conditions and relevant soil properties at the subject sites in order to provide recommendations for the geotechnical design aspects of the proposed developments.

The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. The feasible construction methods, however, express our opinion and are not intended to direct contractors how to carry out construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all factors that may have an affect upon construction.

We assume that the work will be carried out in accordance with good engineering practises and all applicable standards and regulations. Environmental considerations were not part of the scope of work for this geotechnical investigation.

There should be continuous liaison with AMEC during both the design and construction phases of the project to ensure that the recommendations in this report have been interpreted and implemented correctly. If any further clarification and/or evaluation are needed concerning the geotechnical aspects of the project, AMEC should be contacted immediately.

2.0 PROJECT DESCRIPTION

The replacement towers will be a maximum of 10 m high and will likely utilize standard concrete pad foundations. The tower locations are shown on Figure 2. A typical tower is shown as photo 1.

Photo 1: Existing Hay Point Rear Range tower.

3.0 INVESTIGATION PROGRAM

The field work for this project was carried out on November 22 to 24, 2006, when one (1) borehole (BH 06-1 to 5) was advanced at each tower location, for a total of 5 boreholes. Boreholes 01 to 03 were advanced to a maximum depth of 7.3 m using a track mounted drill rig (photo 2), while boreholes 04 and 05 were drilled with hand equipment due to access restrictions (photo 3).

Photo 2: Mobilizing drill rig to borehole location.

Photo 3: Hand sampling at BH06-05 because of access restrictions.

Soil samples were taken at frequent depth intervals during Standard Penetration Testing (SPT 'N" values). These 'N' values provide an indication of the compactness condition, or consistency of the soil strata. Test results are recorded on the Borehole Logs (Appendix A). The samples were placed in containers and delivered to our laboratory for further examination and testing.

It is important to note that the advancement of the boreholes with hand equipment was impeded by the fact that the boreholes would not stay open for subsequent sampling attempts. This was mainly due to the high moisture content of the soils, i.e., the proximity to the groundwater elevation.

4.0 SUBSURFACE CONDITIONS

A description of the stratigraphy encountered in the boreholes is shown the logs included in Appendix A. A general summary of the subsurface conditions is presented below.

4.1 Stribling Point (BH 06-01)

The ground surface elevation at this borehole was referenced to the northeast corner of the existing concrete tower pad foundation. This benchmark was assigned an arbitrary elevation of 100 m.

Based on the borehole information from BH 06-01, this site is overlain by a surficial layer of grass and topsoil that is about 300 mm thick. The topsoil layer is expected to vary in thickness and quality across the site. Beneath the topsoil is a brown, moist to wet silty sand with decreasing gravel content with depth. A grain size distribution of the silty sand is shown on Figure 3. Laboratory testing indicates moisture contents between 10 and 16%. SPT N values ranged from 2 to greater than 50, indicating a very loose to very dense condition. This borehole was terminated in the sand deposit following refusal to the augers at a depth of 4.9 m below present grade.

4.2 Sailors Encampment (BH 06-02 and 03)

The ground surface elevation at boreholes BH06-02 and 03 were referenced to the south and the northwest corner of the existing concrete tower pad foundation, respectively. This benchmark was assigned an arbitrary elevation of 100 m.

Based on the borehole information from BH 06-02 and 03, this site is overlain by a thin surficial layer of grass and topsoil. The topsoil layer is expected to vary in thickness and quality across the site. Beneath the topsoil in BH 06-02 is a brown, silty sand with some clay layer that is about 2.1 m thick. Laboratory testing indicates moisture contents of 25 and 26%. A SPT N value of 2 for both retrieved samples indicates a very loose condition.

Underlying the silty sand in BH 06-02 is a grey silty clay with sand content decreasing with depth. Laboratory testing indicates moisture contents between 37 and 47%. SPT N values for all retrieved samples were 0. These data indicate a very soft condition. However, field vane testing recorded peak shear strengths between 46 and 60 kPa, indicating a firm to stiff condition. Not withstanding, the elevated moisture contents and the visual / tactile examination reveal a prevalent soft and sensitive condition.

This borehole was terminated in the silty clay deposit without encountering refusal to the augers at a depth of 7.3 m below present grade without encountering drilling refusal.

In BH 06-03, beneath a thin topsoil layer is predominantly a sand with varying amounts of clay, silt and gravel, and most likely represents a glacial till deposit. A grain size distribution of the till is shown on Figure 4. Laboratory testing indicates moisture contents between 7 and 10%. SPT N values ranged from 11 to 41, indicating a compact to dense condition. This borehole was terminated in the sand deposit following refusal to the augers at a depth of 4.9 m below present grade.

4.3 Hay Point (BH 06-04 and 05)

The ground surface elevation at these boreholes was not surveyed.

Based on the limited borehole information from BH 06-04 and 05, the subsoils comprise moist to wet sand with trace silt and some gravel. A grain size distribution of the sand is shown on Figure 5. Laboratory testing indicates moisture contents between 8 and 25%. SPT N values ranged from 2 to 62 indicating a very loose to loose condition. These boreholes were terminated in the sand deposit at a depth of 1.2 m below present grade because of sloughing soils.

4.4 Groundwater

Groundwater observations in the open boreholes on completion of drilling are included as notes on the logs. The long term groundwater level is expected to fluctuate in line with the precipitation regime and especially the adjacent water bodies.

5.0 DISCUSSIONS AND RECOMMENDATIONS

5.1 Conventional Foundations

Based on the borehole information, foundations for the towers can be situated on native soils, free of deleterious materials. Once the foundation subsoil is exposed, it should be inspected by a geotechnical engineer prior to the construction of forms for concrete. Any deleterious material encountered should be sub-excavated and replaced with Granular "A" fill or equivalent and compacted to 100% of the material's Standard Proctor maximum dry density (SPMDD).

Any non-cohesive soil layers, such as sand, exposed at the founding elevation, should be properly dewatered and proof rolled prior to placing forms for the footing. Footings should be founded at least 2.5 m below final grades to minimize frost penetration into founding soils. Alternatively, rigid insulation can be substituted for soil cover, where 25 mm of rigid insulation is equal to 300 mm of soils cover as a rough approximation.

The available bearing capacities of the native soil, at different founding depths, are as follows:

Location	BH#	Foundation Grade	Bearing Soils	Allowable Net Bearing Pressure kPa)
Stribling Point	06-01	Between El.98 and El. 97 m	Compact Silty Sand	75
		Below El.97	Dense Silty Sand	200
Sailors Encampment	06-02	Below El.96.5	Very Loose Silty Sand/ Soft Saturated Silty Clay	40
Sailers Encampment	06-03	Below El. 98 m	Compact Sand	100
Hay Point (*)	N/A	N/A	N/A	N/A

(*) For the Hay Point site we recommend a preliminary design based on 40 kPa net allowable bearing pressure at a depth of 2.5 m below grade. However, this should be confirmed by the Geotechnical Consultant, and amended, if necessary, by appropriate deeper drilling or test pits during construction).

It should be noted that if the quoted bearing capacities are insufficient, deep foundations will be required and as such, will require further investigation through the advancement of deeper boreholes. AMEC can provide costing on such an investigation, should it be required.

5.2 Uplift and Overturning

With most towers, uplift loads in addition to downward loadings may be expected. Common practice to combat uplift problems usually involve installing anchors, utilizing the weight of mass concrete, footing protrusions or the use of friction piles driven into the subsoil. Buoyancy considerations must be considered in conjunction with the design flood levels at the site.

Whichever mode of combating uplift is selected, it must ensure an adequate factor of safety.

The tower and its foundation must be designed against overturning. If the backfill is used to stabilise the tower against uplift and overturning, the foundation should be backfilled with free draining, well graded granular backfill engineered fill, compacted at the optimum moisture content to a bulk unit weight of at least 22 kN/m^3. The following earth pressure coefficients should be utilized:

- Active 0.35
- At rest 0.5
- Passive 3

5.3 Excavation

Above the groundwater table, the shallow excavations side slopes should be stable at 1H:1V. Seepage from a surface water source should be moderate and if necessary can be handled by gravity drainage and pumping (properly filtered) from open sumps.

Excavations that penetrate the water table are expected to be increasingly difficult. These excavations will probably require positive methods of groundwater control, which could include for example, but not restricted to dewatering systems or excavating within the confines of interlocking steel sheeting, properly designed and driven to an adequate depth.

Steel sheet piling or shoring may also be required if the excavation limits are to be controlled, i.e., insufficient property to contain the anticipated large excavation area. If shored excavations are contemplated, a licensed engineer should approve the proposed shoring method.

It is recommended to excavate test pits prior to construction, in the presence of potential contractors, to determine precise ground conditions (specifically the water table at the time of construction), in order to allow them to assess excavation and dewatering techniques.

All excavations should be carried out in accordance with the Occupational Health and Safety Regulations of the Province. A qualified geotechnical engineer should be retained to review the proposed excavation procedures.

5.4 Reuse of Excavated Soil

Generally the native soils are fine and should only be used for landscaping purposes. When sand is encountered, it should be reviewed by a geotechnical engineer and may possibly be used as backfill against the foundation, if properly conditioned.
The native soils may not be used as structural (bearing) fill.

5.5 Earthquake Considerations

In conformance to the criteria in Table 4.1.8.4A, Part 4, Division B of the National Building Code (NBC 2005), the project site is classified as Site Class "E- Soft Soil". The four values of the Spectral response acceleration S_a (T) for different periods and the Peak Ground Acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the NBC (2005). The design values of F_a and F_v for the project site should be calculated in accordance to Table 4.1.8.4 B and C.

6.0 CLOSURE

The Limitations of Report, as presented in Appendix B, forms an integral part of this report.

The recommendations included in this report, although site specific, have a general nature. Once the intended design details and construction methods are available, we recommend a geotechnical consultant be retained to review this information to ensure conformance with the assumptions and limitations considered.

We trust that the information presented in this report is complete within our terms of reference. If you have any questions, please do not hesitate to contact our office.

Respectfully Submitted,

AMEC Earth & Environmental

Prepared by:
Dan Cacciotti, P.Eng.
Office Manager

Reviewed by:
Dan Dimitriu, P.Eng.
Senior Geotechnical Engineer

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and Depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *Modified Unified Soil Classification System*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows *(Ref. Canadian Foundation Engineering Manual)*:

Compactness of Cohesionless Soils	SPT N-Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	Undrained Shear Strength kPa	Undrained Shear Strength psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	Over 200	Over 4000

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core	GS	Grab Sample
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample	AR	Air Return Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

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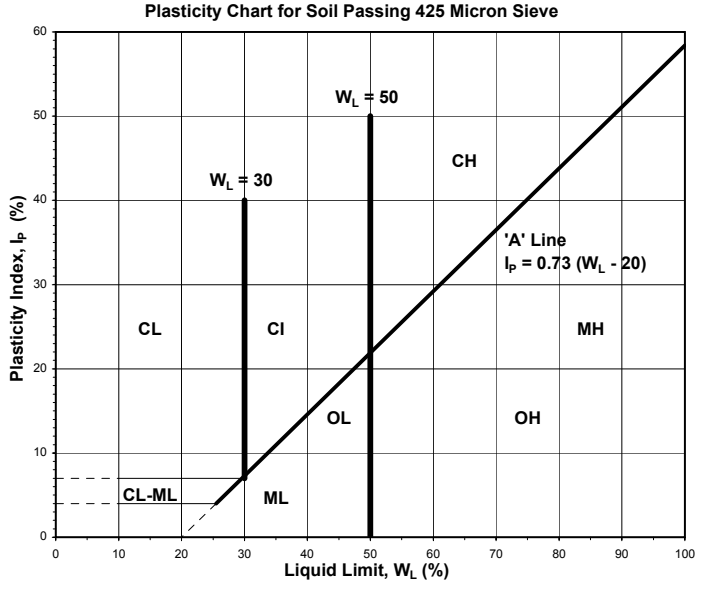
MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L < 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L < 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SLITS & CLAYS BELOW "A" LINE	W_L < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L < 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SOIL COMPONENTS

FRACTION	U.S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	76 mm	19 mm	35-50	AND
				20-35	Y/EY
	FINE	19 mm	4.75 mm	10-20	SOME
				1-10	TRACE
SAND	COARSE	4.75 mm	2.00 mm		
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					
ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm				NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS > 0.76 CUBIC METRE IN VOLUME	



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Note 1: Soils are classified and described according to their engineering properties and behaviour.

Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992.)

Rev. 5 Nov. '06


Site
Parry Sound Coast Guard Base
DWN BY: KKJ
PROJECT
Geotechnical Investigations
Various Navigation Tower Replacements
REV. NO.: A
DATE: September 2007
CHK'D BY: DMC
TITLE
Site Location Map
PROJECT NO: TY63020
SCALE: n.t.s.
FIGURE No. 1
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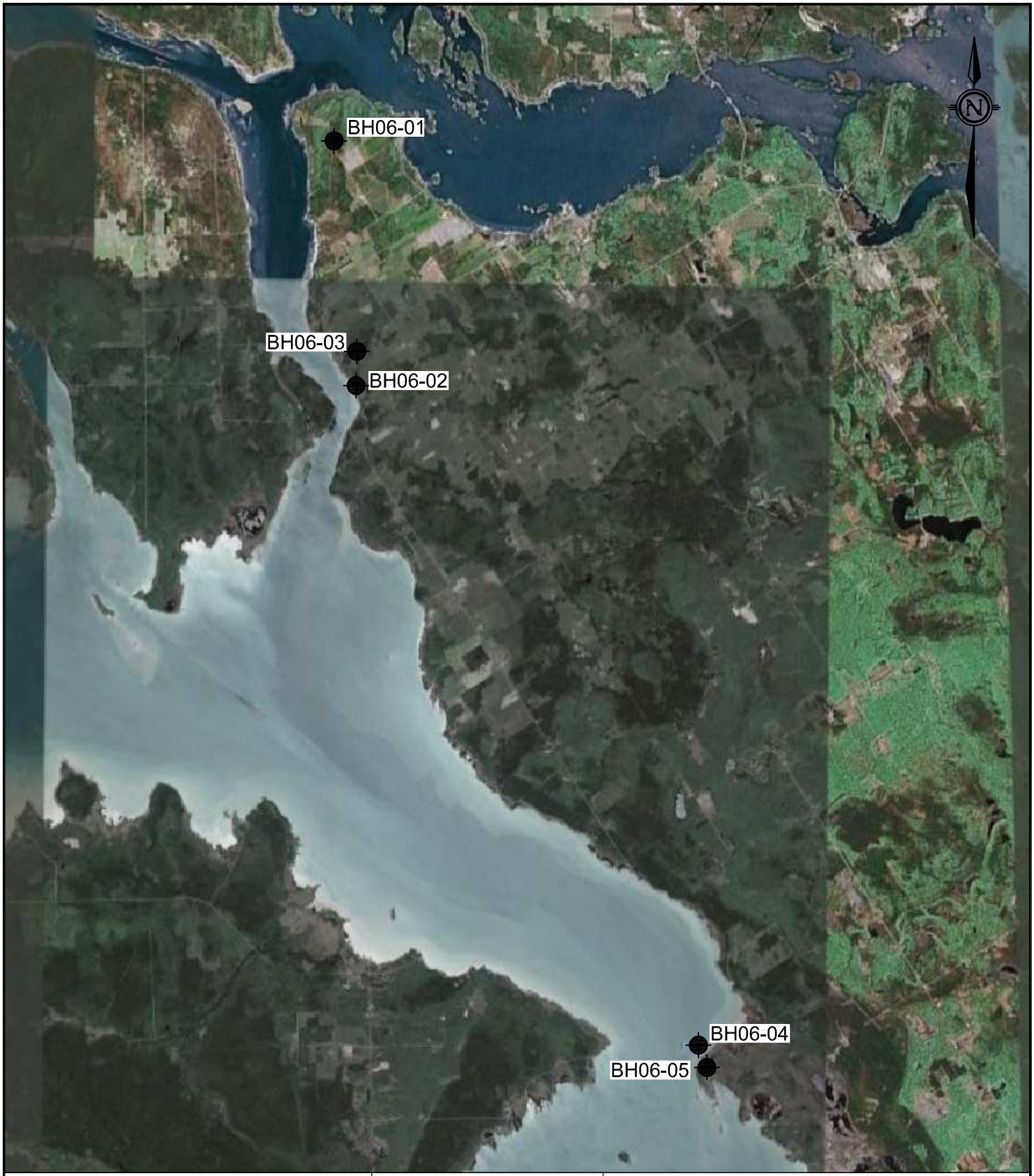

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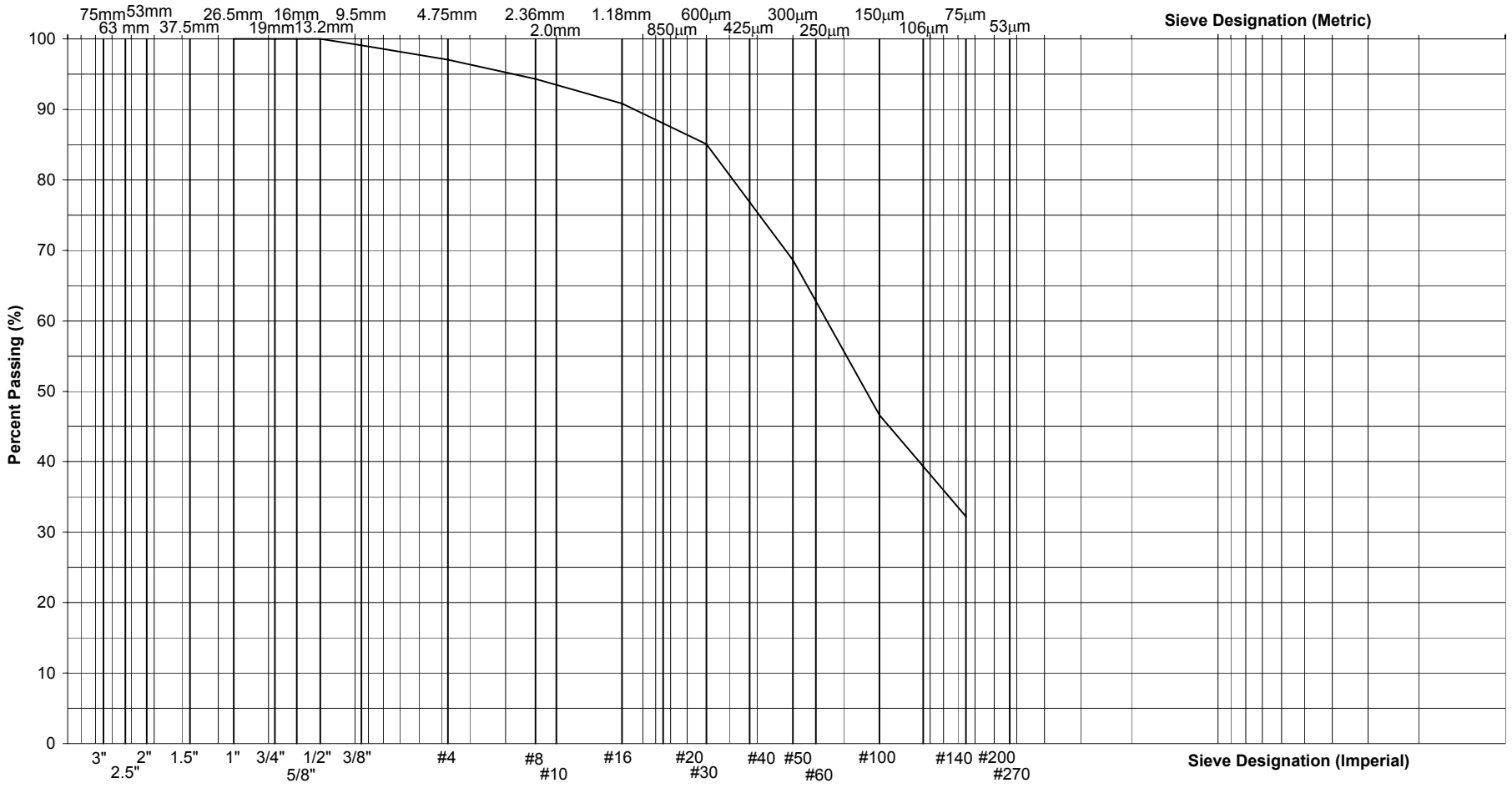
Parry Sound Coast Guard Base

PROJECT: Geotechnical Investigations Various Navigation Tower Replacements	DWN BY: KKJ	REV. NO.: A	DATE: September 2007
			PROJECT NO: TY63020
TITLE: Borehole Location Plan	CHK'D BY: DMC	SCALE: n.t.s.	FIGURE No. 2

GRAIN SIZE DISTRIBUTION ANALYSIS (ASTM D 422)
UNIFIED SOIL CLASSIFICATION SYSTEM

GRAVEL		SAND			FINES
Coarse	*Fine*	*Coarse*	*Medium*	*Fine*	*Silt and Clay*



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CLIENT LOGO:

CLIENT:
Parry Sound Coast Guard Base

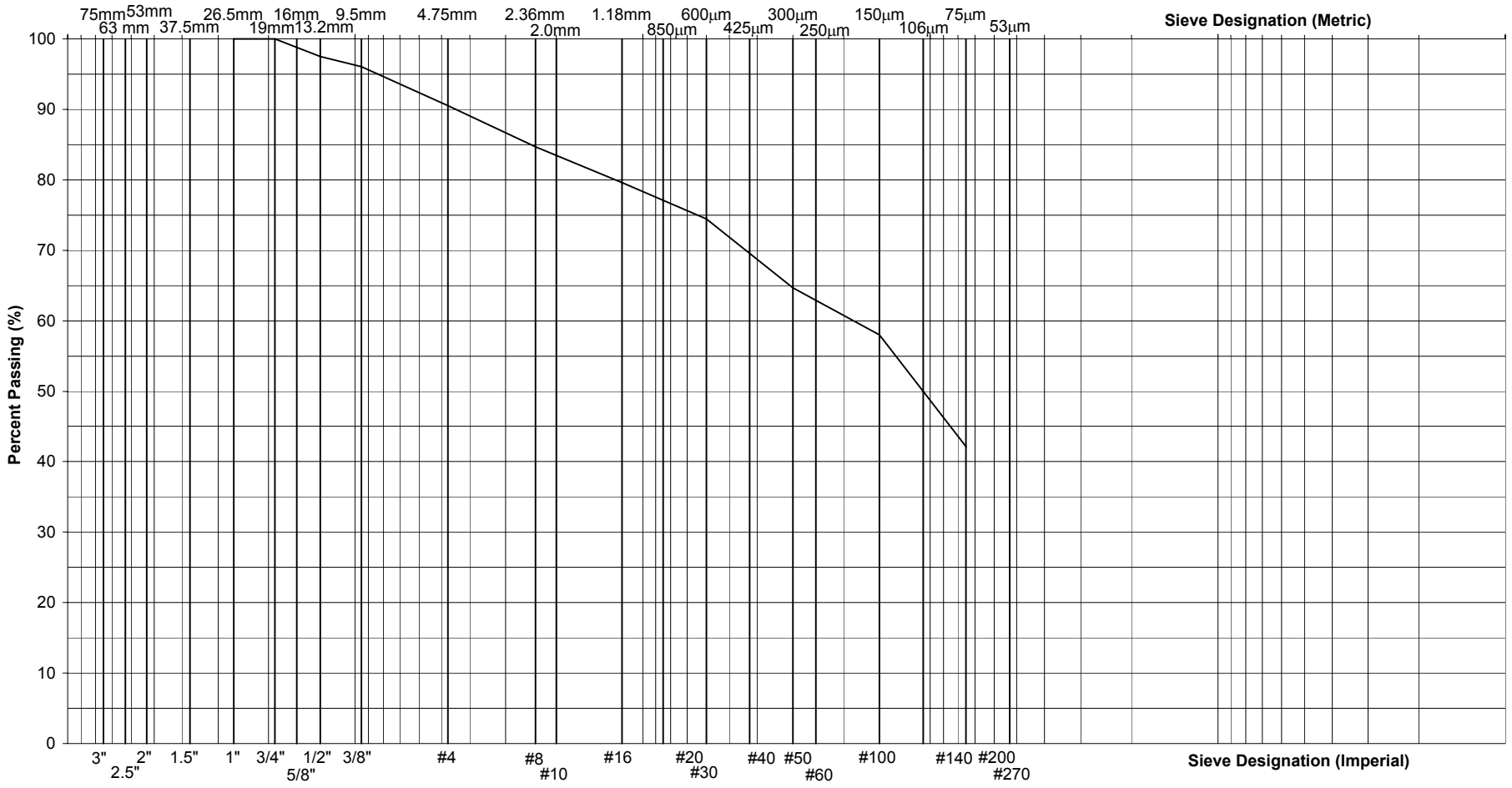
SAMPLED BY: SG Lefebrve, AMEC
RECIEVED BY: DM Brown, AMEC
TESTED BY: PR Lachance, AMEC
DATE: Sept. 2007

PROJECT:
Various Navigation Tower Replacements
St. Josephs Island, Ontario
Sample Location: **BH06-01 SS4**
Sample Identification: **SILTY SAND, trace gravel**

REV. No.: **0**
LAB No.: **SB06393**
PROJECT No.: **TY63020**
FIGURE No.: **3**

GRAIN SIZE DISTRIBUTION ANALYSIS (ASTM D 422)
UNIFIED SOIL CLASSIFICATION SYSTEM

GRAVEL		SAND			FINES
Coarse	*Fine*	*Coarse*	*Medium*	*Fine*	*Silt and Clay*



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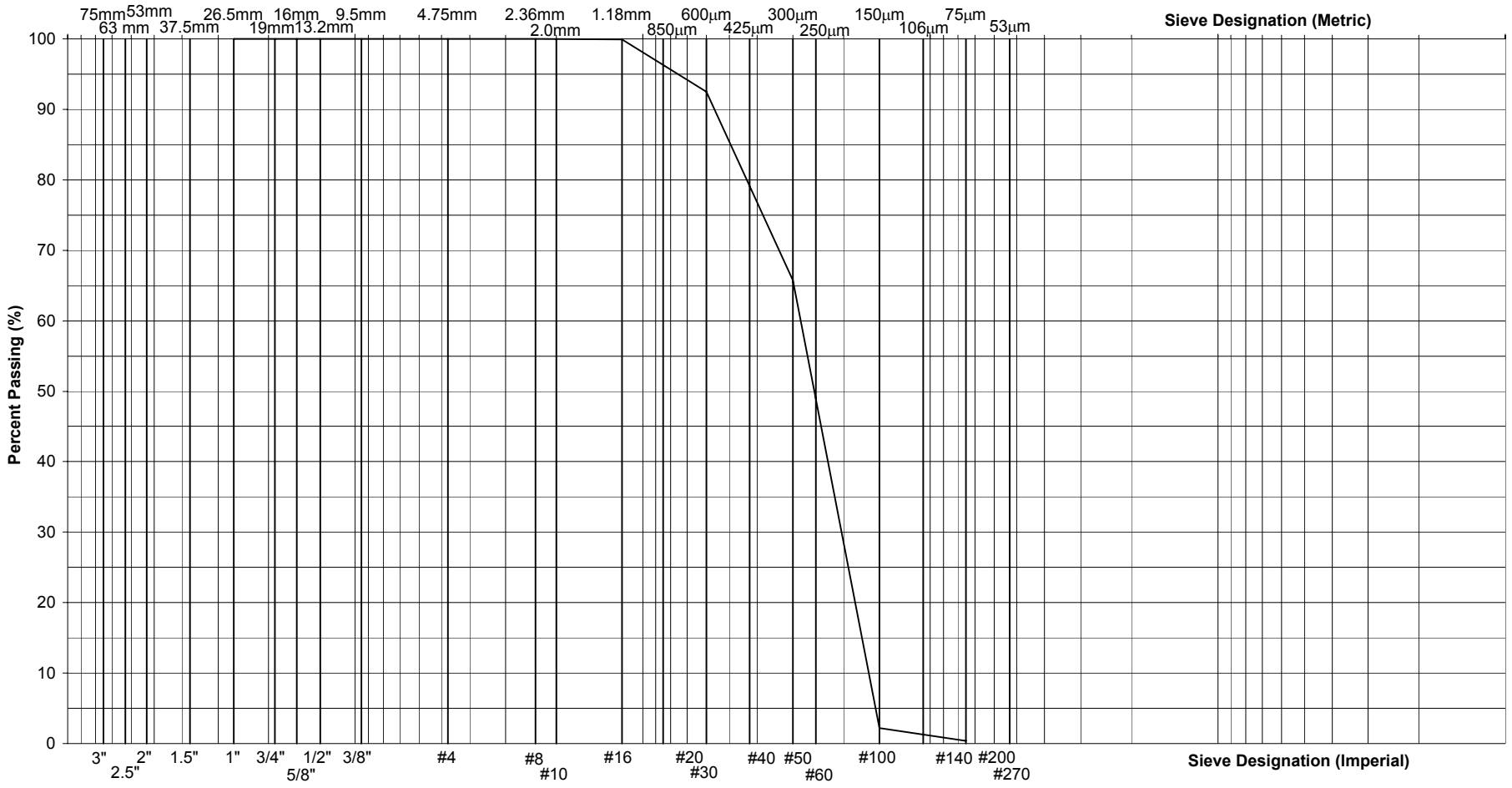
CLIENT LOGO:	SAMPLED BY: SG Lefebrve, AMEC	PROJECT: **Various Navigation Tower Replacements**	REV. No.: **0**
	RECIEVED BY: DM Brown, AMEC	**St. Josephs Island, Ontario**	LAB No.: **SB06394**
CLIENT: **Parry Sound Coast Guard Base**	TESTED BY: PR Lachance, AMEC	Sample Location: **BH06-03 SS3**	PROJECT No.: **TY63020**
	DATE: Sept. 2007	Sample Identification: **SAND & SILT, trace gravel**	FIGURE No.: **4**

GRAIN SIZE DISTRIBUTION ANALYSIS (ASTM D 422)
UNIFIED SOIL CLASSIFICATION SYSTEM

GRAVEL		SAND			FINES
Coarse	*Fine*	*Coarse*	*Medium*	*Fine*	*Silt and Clay*



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CLIENT LOGO:	SAMPLED BY: SG Lefebrve, AMEC	PROJECT: **Various Navigation Tower Replacements**	REV. No.: **0**
	RECIEVED BY: DM Brown, AMEC	**St. Josephs Island, Ontario**	LAB No.: **SB06409**
CLIENT: **Parry Sound Coast Guard Base**	TESTED BY: PR Lachance, AMEC	Sample Location: **BH06-05 SS2**	PROJECT No.: **TY63020**
	DATE: Sept. 2007	Sample Identification: **SAND, trace silt**	FIGURE No.: **5**

APPENDIX A

BOREHOLE LOGS

RECORD OF BOREHOLE No. BH06-01 Co-Ord. 072300 E, 5132548 N

Project Number:	TY63020	Drilling Location:	Stribling Point	Logged by:	SGL
Project Client:	Parry Sound Cost Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Tower Replacement	Drilling Machine:	Track Mounted Drill	Reviewed by:	DMB
Project Location:	St. Josephs Island	Date Started:	22 Nov 06 Date Completed: 22 Nov 06	Revision No.:	4, 17/09/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 99.22 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits: W_P W W_L Plastic Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	GRASS & TOPSOIL 98.9										
	brown SILTY SAND gravel content decreasing with depth 0.3	SS	1	41	2		99	○	○16		
		SS	2	84	14	1	98	○	○12		
		SS	3	75	12	2	97	○	○12		
		SS	4	75	49			○	○12 ✳32		
		SS	5	92	81	3	96	○	○10		
		SS	6	75	50 / 5	4	95		○10		
	94.3	SS	7	58	50 / 3				○10		
	END OF BOREHOLE 4.9 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS OR BEDROCK										

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▽ Groundwater depth on completion of drilling at: 1.4 m.

▪ Cave in depth recorded on completion of drilling: 1.7 m.

Scale: 1 : 50

RECORD OF BOREHOLE No. BH06-02 Co-Ord. 0723620 E, 5127162 N

Project Number:	TY63020	Drilling Location:	Sailers Encampment Front	Logged by:	SGL
Project Client:	Parry Sound Cost Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Tower Replacement	Drilling Machine:	Track Mounted Drill	Reviewed by:	DMB
Project Location:	St. Josephs Island	Date Started:	22 Nov 06 Date Completed: 22 Nov 06	Revision No.:	4, 17/09/07

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 97.81 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits W_P W W_L Plastic Liquid ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	GRASS & TOPSOIL	97.6										
	brown SILTY SAND some clay	0.2	SS	1	67	3				○18		
			SS	2	67	2	1	97		○26		
			SS	3	67	2	2	96		○25		
		95.5										
	grey SILTY CLAY sand content decreasing with depth	2.3	SS	4	100	0				○37		
			SS	5	100	0	3	95		○39		
							4	94	▲22 △46 ▲27 △46			
			SS	6	100	0	5	93		○47		
									▲17 △48 ▲6 △51			
							6	92				
			SS	7	100	0				○38		
							7	91	▲22 △60 ▲30 △54			
		90.5										
	END OF BOREHOLE (no refusal)	7.3										

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 50

RECORD OF BOREHOLE No. BH06-03 Co-Ord. 0723795 E, 5127819 N

Project Number:	TY63020	Drilling Location:	Sailers Encampment Rear	Logged by:	SGL
Project Client:	Parry Sound Cost Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Tower Replacement	Drilling Machine:	Track Mounted Drill	Reviewed by:	DMB
Project Location:	St. Josephs Island	Date Started:	22 Nov 06	Date Completed: 22 Nov 06	Revision No.: 4, 17/09/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 99.41 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits W_P W W_L Plastic Liquid ✳ Passing 75 um (%) ○ Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	black TOPSOIL over 99.1	SS	1	33	3		99	○	○29		
	reddish brown 0.3 SAND varying amounts of clay, silt and gravel probable till	SS	2	59	13	1	98	○	○9		
		SS	3	33	11	2		○	○10		
		SS	4	25	41		97	○	○7		
		SS	5	33	19	3	96 ▽	○	○9		
		SS	6	75	16	4		○	○9		
	94.5	SS	7	65	50 / 5		95		○9		
	END OF BOREHOLE 4.9 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS OR BEDROCK										

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▽ Groundwater depth on completion of drilling at: 3.4 m.

◆ Cave in depth recorded on completion of drilling: 3.7 m.

Scale: 1 : 50

RECORD OF BOREHOLE No. BH06-04 Co-Ord. 0268264 E, 5112527 N

Project Number:	TY63020	Drilling Location:	Hay Point Front	Logged by:	SGL
Project Client:	Parry Sound Cost Guard Base	Drilling Method:	50 mm A Rods	Compiled by:	KKJ
Project Name:	Tower Replacement	Drilling Machine:	Hand Equipment	Reviewed by:	DMB
Project Location:	St. Josephs Island	Date Started:	23 Nov 06	Date Completed: 23 Nov 06	Revision No.: 4, 17/09/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits: W_P W W_L; Plastic Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%); 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	brown SAND some gravel, trace silt	SS	1	50	4			○	18		***Notes:*** 1. Standard Penetration Testing (SPT) 'N' values have been corrected for the half weight hammer used during hand sampling operations.
		SS	2	33	6	1		○	20		
	END OF BOREHOLE 1.2 (no refusal)										

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▽ Groundwater depth on completion of drilling at: 0.3 m.

◘ Cave in depth recorded on completion of drilling: 0.3 m.

Scale: 1 : 50

RECORD OF BOREHOLE No. BH06-05 Co-Ord. 0268527 E, 5112291 N

Project Number:	TY63020	Drilling Location:	Hay Point Rear	Logged by:	SGL
Project Client:	Parry Sound Cost Guard Base	Drilling Method:	50 mm A Rods	Compiled by:	KKJ
Project Name:	Tower Replacement	Drilling Machine:	Hand Equipment	Reviewed by:	DMB
Project Location:	St. Josephs Island	Date Started:	24 Nov 06	Date Completed: 24 Nov 06	Revision No.: 4, 17/09/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation:	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits: W_P W W_L; Plastic Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%); 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	brown SAND some gravel, trace silt	SS	1	58	2			○	○ 8		***Notes:*** 1. Standard Penetration Testing (SPT) 'N' values have been corrected for the half weight hammer used during hand sampling operations.
		SS	2	67	3	1		○	○ 25		
	END OF BOREHOLE 1.2 (no refusal)										

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▽ Groundwater depth on completion of drilling at: 0.6 m.

◪ Cave in depth recorded on completion of drilling: 0.6 m.

Scale: 1 : 50

APPENDIX B

LIMITATIONS OF REPORT

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LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the geotechnical engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in boreholes.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

APPENDIX B

BOREHOLE LOGS

RECORD OF MONITORING WELL No. BH07-01 Co-Ord. 0268255 E, 5112540 N

Project Number:	TY630201	Drilling Location:	Front Range	Logged by:	DMB
Project Client:	Parry Sound Coast Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Hay Point Front and Rear Range Tower Replacement	Drilling Machine:	Micro Drilling Apparatus	Reviewed by:	DMB
Project Location:	St. Joseph Island, Ontario	Date Started:	18 Oct 07 Date Completed: 18 Oct 07	Revision No.:	2, 19/12/07

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 99.30 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	brown SAND trace silt, damp, very loose to compact	SS	1	25	3				4		86 cm Stick-Up
		SS	2	50	28	1			25		
	98.1										
	grey 1.2 SILTY SAND some gravel, wet, dense to very dense	SS	3	51	36				13, 25		
	97.3	SS	4	0	50/15cm						
	END OF BOREHOLE 2.0 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS						95				

FIELD TESTING: Penetration Testing — SPT, DCPT; MTO Vane* Intact, Remould; Nilcon Vane* Intact, Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Atterberg Limits W_P W W_L Plastic Liquid; Passing 75 um (%); Moisture Content (%); Intact Lab Vane; 20 40 60 80

INSTRUMENTATION INSTALLATION: 1 riser pipe in backfill; 1 riser pipe in sand; 1 slotted pipe in sand

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Groundwater depth on completion of drilling at: 0.5 m.

Groundwater depth observed on 11/15/2007 at a depth of: 0.6 m.

Scale: 1 : 25

RECORD OF MONITORING WELL No. BH07-02 Co-Ord. 0268263 E, 5112524 N

Project Number:	TY630201	Drilling Location:	Front Range	Logged by:	DMB
Project Client:	Parry Sound Coast Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Hay Point Front and Rear Range Tower Replacement	Drilling Machine:	Micro Drilling Apparatus	Reviewed by:	DMB
Project Location:	St. Joseph Island, Ontario	Date Started:	18 Oct 07	Date Completed: 18 Oct 07	Revision No.: 2, 19/12/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 99.10 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits: W_P W W_L; Plastic Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%); □ Intact Lab Vane; 20 40 60 80	INSTRUMENTATION INSTALLATION	1 riser pipe in backfill 1 riser pipe in sand 1 slotted pipe in sand
	brown SAND trace silt, damp	SS	1	25	5			○	13		86 cm Stick-Up
		SS	2	51	7	1		○	23		
	97.9 grey 1.2 SILTY SAND some gravel, wet	SS	3	41	25			○	18		
	97.2 END OF BOREHOLE 1.9 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS	SS	4	0	50 / 150mm		95				

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▽ Groundwater depth on completion of drilling at: 0.6 m.

▼ Groundwater depth observed on 11/15/2007 at a depth of: 0.6 m.

RECORD OF MONITORING WELL No. BH07-03 Co-Ord. 0268520 E, 5112272 N

Project Number:	TY630201	Drilling Location:	Rear Range	Logged by:	DMB
Project Client:	Parry Sound Coast Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Hay Point Front and Rear Range Tower Replacement	Drilling Machine:	Micro Drilling Apparatus	Reviewed by:	DMB
Project Location:	St. Joseph Island, Ontario	Date Started:	19 Oct 07 Date Completed: 19 Oct 07	Revision No.:	2, 19/12/07

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 99.30 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting: SPT ○ DCPT ●; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits W_P W W_L; Plastic Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%); □ Intact Lab Vane; 20 40 60 80	INSTRUMENTATION INSTALLATION	1 riser pipe in backfill 1 riser pipe in sand 1 slotted pipe in sand
	brown to grey SAND trace silt, wet, loose to compact	SS	1	41	5			○	17		96 cm Stick-Up
		SS	2	41	5	1		○	23 ✳ 1		
		SS	3	33	16			○	20		
		SS	4	25	40	2		○	25		
	96.3	SS	5	33	50/ 150mm	3			23		
	END OF BOREHOLE 3.1 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS						95				

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▽ Groundwater depth on completion of drilling at: 0.4 m.

▼ Groundwater depth observed on 11/15/2007 at a depth of: 0.7 m.

Scale: 1 : 25

RECORD OF MONITORING WELL No. BH07-04 Co-Ord. 0268516 E, 5112296 N

Project Number:	TY630201	Drilling Location:	Rear Range	Logged by:	DMB
Project Client:	Parry Sound Coast Guard Base	Drilling Method:	200 mm Hollow Stem Augers	Compiled by:	KKJ
Project Name:	Hay Point Front and Rear Range Tower Replacement	Drilling Machine:	Micro Drilling Apparatus	Reviewed by:	DMB
Project Location:	St. Joseph Island, Ontario	Date Started:	19 Oct 07 Date Completed: 19 Oct 07	Revision No.:	2, 19/12/07

Local Ground Surface Elevation: 99.00 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Undrained Shear Strength (kPa)	LAB TESTING: Atterberg Limits / Moisture Content (%)
	brown to grey SAND trace silt, wet, loose to very dense	SS	1	41	4	0			8
		SS	2	41	11	1			21
		SS	3	51	7				21
		SS	4	33	10	2			24
		SS	5	33	15				26
		SS	6	25	54	3			21
		SS	7	25	55	4	95		24
	94.6	SS	8	100	50/60cm				24
	END OF BOREHOLE 4.4 DUE TO AUGER REFUSAL ON POSSIBLE BOULDERS								

PenetrationTesting: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Atterberg Limits: W_P W W_L; Plastic Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%); □ Intact Lab Vane; 20 40 60 80

INSTRUMENTATION INSTALLATION

96 cm Stick-Up

COMMENTS
- 1 riser pipe in bentonite
- 1 riser pipe in sand
- 1 slotted pipe in sand
- no installation, only backfill

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▽ Groundwater depth on completion of drilling at: 0.3 m.

▼ Groundwater depth observed on 11/15/2007 at a depth of: 0.4 m.

Scale: 1 : 25

APPENDIX C

LABORATORY
CERTIFICATE OF ANALYSIS

TESTMARK Laboratories Ltd.

Committed to Quality and Service

(Revised) Analytical Report

Client:	David M. Brown	**Work Order Number:**	**44850**
Company:	AMEC Earth & Environmental	**Date Order Received:**	11/5/2007
Address:	131 Fielding Road	**Regulation:**	Information not provided
	Lively, Ontario, P3Y 1L7	**PO #:**	
Phone:	(705) 682-2632	**Project #:**	TY630201
Fax:	(705) 682-2260		
Email:	davidm.brown@amec.com		

Report revised to display resistivity result appropriately. The electronic report sent in excel displayed the result correctly. LH

Supercedes report printed :11/16/2007

Analyses were performed on the following samples submitted with your order.

The results relate only to the items tested.

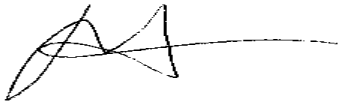
Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
BH07-04 SS4@6'-8'	147258	Soil	Grab		11/2/2007	14:30

The following instrumentation and references methods were used for your sample(s)

Method Name	Description	Reference
Anions Soil	Determination of Anions in Soil **Instrument group:** Dionex DX300 IC	Mod. SW846-9056
pHSOIL	Determination of soil pH by ion selective electrode **Instrument group:** Fisher Scientific Model 915 pH Meter	Mod. APHA-4500
Resistivity Soil	Determination of Resistivity in Soil (1:1) **Instrument group:** Orion Conductivity Meter	Carter 18.3

This report has been approved by:

Dr. Xiaojing Li
Chief Chemist



Ryan Lawrence, B.Sc.
Inorganic Section Head

Sample Data:

Sample Name: BH07-04 SS4@6'-8' **Date: 11/2/2007** **Matrix: Soil** **Lab #: 147258**

Anions Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chloride	2	<2	µg/g	20071105.R5A
Chloride (Dup)	2	<2	µg/g	20071105.R5A
Sulfate	9.7	61	µg/g	20071105.R5A
Sulfate (Dup)	10	64	µg/g	20071105.R5A

pHSOIL				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
pH	N/A	4.70	pH	20071105.R2B

Resistivity Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Resistivity	N/A	0.00504032	Mohm-cm	20071106.R12A

MDL Method detection limit or minimum reporting limit.
% Rec Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.
QAQCID This is a unique reference to the quality control data set used to generate the reported value.
Data reported for organic analysis in soil samples are corrected for moisture content
Matrix If the matrix is a leachate, the sample was extracted according to regulation 558.
INT Interferences
TNTC Too numerous to count
ND Not detected

APPENDIX D

LIMITATIONS OF REPORT

AMEC EARTH & ENVIRONMENTAL

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the geotechnical engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in boreholes.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

APPENDIX B5 – ACCESS

APPENDIX B5.1 – MARINE ACCESS REQUIRMENTS

.1 Marine Access

.1 Vessel(s) employed in the performance of the contract shall be certified as required by the Canada Shipping Act 2001 and its applicable regulations including Marine Personnel Regulation.

.1 The bidder shall ensure that the vessel(s) proposed for the work meets all requirements of the Canada Shipping Act 2001 and the applicable Regulations under the Canada Shipping Act.

.2 Bidders shall provide copies of the following documentation to facilitate evaluation and award:

.1 Proof of vessel registration as a commercial vessel in accordance with the Canada Shipping Act 2001. Either one of two registrations will be accepted:

.1 Proof of commercial vessel registration in the Small Vessel Register (SVR) if less than 15 Gross Tons or;

.2 Proof of commercial vessel registration in the Canadian Register of Vessels (CRV) if more than 15 Gross Tons.

.3 NOTE: Pleasure Craft and Fishing Vessels are not acceptable for the performance of this work – it must be a commercially registered vessel.

.2 Where the vessel is registered in the SVR the bidder shall also provide the following:

.1 Copy of vessel certification and any limitations the vessel is operating under. Where the vessel is restricted, the operator shall ensure that the vessel can be used to safely perform the work in this specification;

.2 Copy of inspection according to the Small Vessel Compliance Program; Bidder shall submit proof of enrolment in the compliance program and;

.3 Either a copy of the initial inspection report or the most recent copy of an annual inspection report and;

.4 Copy of the crew certification that will be operating the vessel. Crewing and certification of crew shall be in accordance with the Marine Personnel Regulations, latest edition.

.3 Where the vessel is registered in the CRV the bidder shall also provide the following:

.1 Copy of the latest Annual Inspection Certificate endorsement and;

.2 Copy of any restrictions that the vessel is operating under and the general sailing limitations of the vessel. Where the vessel is restricted, the operator shall ensure that the vessel can be used to safely perform the work in this specification;

.3 Copies of the crew certification that will be operating the vessel. Crewing and certification of crew shall be in accordance with the Marine Personnel Regulations, latest edition.

.2 Vessels and crew found to be in contravention of the act will not be permitted to be engaged in any elements of the works identified herein. In the event that a vessel or crew is found non compliant a suitable replacement vessel and/or crew will be retained by the Contractor at their sole expense.

APPENDIX B5.2 – ICE ROAD ACCESS

.1 Operations Over Ice

.1 Contractors electing to access the project site via ice bridge in the performance of this work must familiarize themselves and their employees with Treasury Board Secretariat publication 5-03 "Safety Guide for Operations Over Ice", http://collectionscanada.gc.ca/eppp-archive/100/201/301/tbs-sct/tb_manual-ef/Pubs_pol/hrpubs/TBM_119/CHAP5_3_e.html

.2 The Contractor must at all times ensure that the ice bridge is of sufficient thickness and composition to support all intended loads.

.3 In no case may the Contractor utilize an ice bridge where the thickness has not been verified by testing.

.1 Thickness is to be determined by drilling test holes at maximum spacing of 15m on rivers and 30m on lakes.

.2 Ice must exceed 150mm (6") for all operations.

.3 When average air temperatures exceed -5° C, thickness is to be measured daily. In all other instances ice thickness and composition is to be measured weekly.

.4 Copies of all testing are to be provided to CCG PA upon completion.

.4 Utilization of an ice bridge must be suspended if the average air temperature exceeds 0°C for 72 hours.

.5 The route must be clearly marked and speed is to be limited to 15 km/h.

.6 The Contractor's submitted Project Specific Safety Program must address the hazards associated with operations over ice and list all mitigations to be employed.

.7 The Contractor's submitted Construction Plan must detail routing of the ice bridge as well as intended maximum and average daily loading.

APPENDIX B5.3 – ROTARY WING ACCESS

.1 Rotary Wing (Helicopter) Access.

.1 Helicopter(s), Operators and Crew employed in the performance of the contract must be certified and licensed to operate in accordance with the requirements of the Aeronautics Act and the Canadian Aviation Regulations.

.2 Helicopters utilized in the performance of the work must be equipped with CCG mandatory safety equipment as detailed in CCG FO 218, *Helicopter Safety Equipment Requirements.*

.3 Passengers embarked aboard the helicopter are to be provided with Personal Protective Equipment (PPE) as detailing in CCG FO 218, *Helicopter Safety Equipment Requirements.*

.4 In no case may the Contractor overrule or supersede the discretion of the Pilot in Command or in other way jeopardize the safety of the airframe or the employees engaged in the performance of the work.

.5 The Contractor's submitted Project Specific Safety Program must address the hazards associated with rotary wing operations including slinging.

.6 The Contractor's submitted Construction Plan must detail planned rotary wing operations, inclusive of all routing, loads (internal/external), landing and refueling areas.

.2 Canadian Coast Guard Helicopter Support

.1 The Contractor may consider the use of either CCGs Bell 429 or Bell 412 in support of the execution of the works. Use of CCGs rotary wing assets will be subject to availability of airframe, crew and CCGs operational priorities.

.1 Relevant operating parameters for each airframe are provided in Table 1.

.2 Use of CCGs rotary wing assets will be subject to full cost recovery from any amount payable under the Contract. A representative example is provided for consideration

TABLE 1			
Airframe/ Operating Characteristics	Notes	Bell 429	Bell 412
Flight rules		Visual, daylight operations only	Visual, daylight operations only
Maximum Lift Capacity (lbs)	(a)	2200 (1750)	2900 (2200)
Cruise Speed (kts)		125	110
Operating Rate ($/h)		$ 1748.00	$ 1871.00
Fuel Burn Rates (l/h)		297	428
Fuel consumption cost ($/h)	(b)	320	460
Passengers	(c)	7 max (3)	6 max (4)
Per diem rate, Ontario ($/day/crew)	(d)	$ 250.00	
Per diem rate, Nunavut ($/per)		$ 550.00	
Overtime rate ($/h/crew)	(e)	$ 75.00	

a) Assumes airframe fully stripped and minimal fuel load, value shown in brackets is standard threshold for comparison.

b) Value provided for budgeting only, recovery will be based on actuals. Fuel consumption cost assumes fuel cost of $1.08

c) Value excludes Pilot. Assumes airframe configured to maximum passenger configuration value shown in brackets is typical

d) Value provided for budgeting only, recovery will be for actual costs incurred. Travel costs will be incurred in accordance with Government of Canada National Joint Committee Travel Directive.

e) Overtime standard rate

Example - For Reference Only

Provisional costing CCG Rotary Wing Support - Projects subject to Cost Recovery

Project:	Tower Replacement	Tasking:	
Location:	List of Light 15XX 17 km SW of Sault Ste Marie	from CCG Parry Sound (kts)	175
Tasking	Sling six (6) loads of material, non-hazardous, from forward staging area to project location,hazard free distance 2.0 km. Fuel available onsite. Helicopter to depart and return CCG Base Parry Sound		

Helicopter	Capacity Standard Configuration (lbs)	Capacity Heavy Cargo Configuration (lbs)	Cruise Speed (kts)	Operating Rate ($/h)	Fuel Burn Rates (l/h)	Fuel consumption cost ($/h)	Flight Time Cost / hour ($/h)
Bell 412	1750	2200	110	$ 1,871.00	428	$ 460.00	$ 2,331.00

Operation	Ground time (h:mm)	Ground time cummulative (h:mm)	Flight time (h+mm/60)	Flight Time ($)	Fuel Consummed (L)	Fuel ($)	Total Operation Cost ($)
Mission prep	4:00						$ -
Sunrise		8:00					
Transit	1:36	9:36	1.4	$ 2,619.40	599.2	$ 644.00	$ 3,263.40
Flight briefing	0:30	10:06					$ -
Rigging	0:30	10:36					$ -
Refueling	0:30	11:06					$ -
Load 1	0:25	11:31	0.33	$ 623.67	142.7	$ 153.33	$ 777.00
Load 2	0:15	11:46	0.25	$ 467.75	107.0	$ 115.00	$ 582.75
Load 3	0:15	12:01	0.25	$ 467.75	107.0	$ 115.00	$ 582.75
Refueling	0:30	12:31					$ -
Stand by	1:25	13:56					$ -
Load 4	0:25	14:21	0.25	$ 467.75	107.0	$ 115.00	$ 582.75
Load 5	0:15	14:36	0.25	$ 467.75	107.0	$ 115.00	$ 582.75
Load 6	0:15	14:51	0.25	$ 467.75	107.0	$ 115.00	$ 582.75
Transit	1:36	16:27	1.4	$ 2,619.40	599.2	$ 644.00	$ 3,263.40
Sunset		16:30					
Clean up	1:00	17:30					$ 75.00
Total			4.38	$ 8,201.22	1876.07	$ 2,016.33	$ 10,217.55

Quoted job $	$ 200,000.00
Cost Recovery	-$ 10,217.55
Value payable	$ 189,782.45