Fisheries and Oceans Canada

Structure #402 and #403 Reconstruction

Georgetown, Kings County, PEI
Project No. C2-00003

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DIVISION 31 - EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

APPENDIX

1. List of Drawings

DWG. No.	TITLE
M1 of 15	Key Plan and Existing Site Plan
M2 of 15	Plan Detail and West Elevation of Existing Conditions
M3 of 15	Cross Sections of Existing Conditions
M4 of 15	Plan Details of Removals and New Construction
M5 of 15	Sections
M6 of 15	Wall Elevations
M7 of 15	Details
M8 of 15	Details and Sections
M9 of 15	Details and Sections
M10 of 15	Details and Sections
M11 of 15	Details and Section
M12 of 15	Details and Sections
M13 of 15	Plan View of New Containment Area, Section and Details
M14 of 15	Borehole Reports
M15 of 15	Dynamic Cone Penetration Test Reports
A1 of 1	Plan, Sections and Details of Electrical Building
E1 of 6	Plan Details of Removals and Demolition
E2 of 6	Plan Details of Removals and New Construction
E3 of 6	Enlarged Plan of New Construction and Details
E4 of 6	Electrical Service Schematic and Details
E5 of 6	New Construction Cross Section and Details
E6 of 6	Panel Schedules

Part 1 General

1.1 PROJECT LOCATION

.1 The project is located at Georgetown Queens Wharf. The work is located on the outermost portion of the main pier, accessed by Kent Street, Provincial Route 3.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Fisheries and Oceans, Small Craft Harbours Branch is preparing to reconstruct Structures 402 and 403 at the harbour facility.

Work includes but is not necessarily limited to; demolitions and/or removals necessary to permit installation of new steel sheet pile bulkhead walls to the alignment shown on the drawings. These walls will extend from the southern limit of Berlin Wall structure 409 to the northern limit of rehabilitated SSP structure 404. The work will require significant existing timberwork removals, including partial removal of interconnecting structural features of adjacent pier 405. Removals at this pier connection will require reinstatement (complete with transition ramp) as detailed to restore access to the affected attached piers. Steel sheet piling shall be installed to the indicated tip and cut-off elevations, including the various termination junctions at structures 404 and 409. A concrete slab-on-grade is to be installed throughout the new structure as well as on the deck area of Structure 404. This work will also necessarily require removal of existing marine sediments from behind the final SSP wall alignment, including handling, transport to and deposition in final containment as indicated, including provision and installation of all geomembranes and geotextiles as detailed on the drawings and specified herein. Construction of the containment, as detailed, will involve removal of existing material to permit installation of armoured slopes as indicated. This removed material (from behind the wall only) will be deposited into the containment. Creation of construction-vehicle access and post-construction restitution to the containment (in the area indicated) is also involved. The work shall also include the supply and installation of all electrical components including light standards, power centers, power shrouds, underground and in-slab conduit, electrical buildings and all electrical panels required to complete the work.

.2 Demolition work includes the removal of the existing timber decking, supporting stringers, pilecaps, braces, timber fenders, wales, timber piling (in whole or in part) and any associated fastenings or hardware. Demolition shall be as defined on the contract drawings.

.1 Demolition design shall include all the access, safe removals, and mitigation measures required to complete the work in a safe and environmentally friendly manner.

.2 All materials shall be removed from site and disposed or recycled in an approved method.

.3 The above listed work is subject to the following constraints during construction:

.1 In-water work shall be in accordance with all Provincial and Federal environmental regulations and any accompanying documents completed for this project.

.2 In-water work is limited to the timberwork removals, excavation, demolition, and reconstruction of the existing and new bulkhead walls for the pier. New rock fill will be used as a leveling course below the new concrete slab-on-grade. Any excess in-situ material on the harbour bottom, unsuitable for use behind the new bulkhead wall shall be removed and disposed of in an approved method as indicated in 1.2.1 above.

.3 Construction activities shall not detrimentally impact the surrounding environment or waterway, shall respect allowable windows for in water work, and shall respect the requirements of cultural resources.

.4 The Contractor is responsible for the delineation of the construction zones.

.5 All work to be carried out in accordance with applicable federal, provincial regulations for those agencies having jurisdiction for the work. This shall also include any existing local Municipal restrictions governing construction noise generated by the activity of the work, as it may impact residents of the Town of Georgetown as described in the Town Nuisance and Noise Control Bylaw

.6 The Contractor must be aware that other construction work or on-going fishery activity may potentially be underway at other locations near the project site during the time frame of this contract. No claims shall be accepted due to failure to co-ordinate this work with other construction or fishery efforts in the area.

1.3 CONTRACT METHOD

.1 Construct Work under Unit Price and Lump Sum items contract.

1.4 CODES AND STANDARDS

.1 Perform work in accordance with any code of federal, provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Materials and workmanship must conform to or exceed applicable standards of Canadian General Standards Board (CGSB), Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM) and other standards organizations.

.3 Conform to latest revision at the date of Tender of any referenced standard as re-affirmed or revised to date of specification. Standards or codes not dated shall be deemed editions in force on date of tender advertisement.

1.5 SITE CONDITIONS

.1 The Contractor will be responsible to visit the site and review existing site conditions.

.2 Before submitting a bid, it is recommended that bidders visit the site to review and verify the form, nature and extent of the work, materials needed, the means of access and the temporary facilities required to perform the Work.

.3 Directional orientation for the site shall be set as South being the direction of travel onto the pier from Kent St. (Rte. 3) and North being the direction departing the pier.

.4 Obtain prior permission from the Departmental Representative before carrying out such site inspection.

.5 Contractors, bidders or those they invite to site are to review specification Section 01 35 29.06 – Health and Safety Requirements before visiting site. Take all appropriate safety measures for any visit to site, either before or after acceptance of bid.

.6 Details of the existing structure are for the Contractor to determine in considering use with over-weight and non-conforming vehicles in carrying out work on this project and in the demolition of the structure.

.7 For geotechnical and borehole information, refer to Drawings and Appendiced information.

1.6 INTERPRETATION OF DOCUMENTS

.1 Supplementary to the Order of Precedence article of the General Conditions of the Contract, the Division 01 Sections take precedence over the technical specification sections in other Divisions of the Specifications Manual.

1.7 TERM ENGINEER

.1 Unless specifically stated otherwise, the term Engineer where used in the Specifications and on the Drawings shall mean the Departmental Representative as defined in the General Conditions of the Contract.

1.8 SITE SURVEY AND SETTING OUT WORK

.1 There was a topographic survey of the area used in preparation of these documents

.2 Contractor to carry out all layout. The Contractor is responsible for the layout of the new structure as per the contract drawings. For vertical geometry, a project specific datum is available and is defined on the contract drawings. Refer to the structure layout notes in the contract drawings for more details.

.3 The Contractor shall assume full responsibility for and execute complete layout of work locations, lines and elevations indicated.

.4 The Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.

.5 The Contractor shall provide coordinates, elevations and dimensions in the field, as required by the Departmental Representative.

1.9 WORK WITHIN SITE BOUNDARIES

.1 The project is within a working fishing harbour within the Town of Georgetown. It is essential that DFO lands and adjacent residential properties remain as undisturbed as possible. The Contractor will be expected to use standards and methods beyond those for normal construction in order to protect the environment and ensure minimal residential impact from the work. Contract limits shall be strictly adhered to and every precaution shall be taken to minimize environmental damage and disruption to vegetation, wildlife habitat, adjacent residential areas and properties, structures or existing services, on construction and storage sites and on access routes/roads to the worksite.

.1 If any damage occurs during construction, the Contractor is responsible to bear the expense to immediately restore such damaged areas to the satisfaction of Departmental Representative.

.2 If Contractor fails to repair damage to the satisfaction of the Departmental Representative, the Departmental Representative may have repairs completed by others at the Contractor's expense.

.3 The Contractor shall ensure that contracted work meets the standards outlined in the contract specification and drawings.

.4 The Contractor shall ensure that no damage will be done to any existing utilities.

.5 All sources of aggregate must be submitted to the Departmental Representative for approval at least two weeks prior to the start of any work.

.6 The Contractor will make arrangements with authorities or owners of private properties for quarrying and transporting materials and machinery over their properties and be responsible for obtaining and paying of fees.

.7 Special move permits for any over-weight and over-dimensional vehicles required to travel provincial highways must be secured by the Contractor and submitted to the Departmental Representative for review and approval prior to movement within Site boundaries.

1.10 MEASUREMENT FOR PAYMENT

.1 Notify Departmental Representative sufficiently in advance of operations to permit required measurements for payment.

.2 Items included under "Measurement for payment". All lump sum and all unit price items shall include all materials, labour, equipment and all other items necessary to complete the work. See also Section 01 29 10.

Item 1: Mobilization and Demobilization

.1 Mobilization and demobilization shall constitute a lump sum for measurement purposes. Mobilization and demobilization shall constitute a lump sum for measurement purposes. 50% of this amount to be paid when mobilization is complete. The remainder to be paid when all work is complete and all materials, equipment and other facilities are removed, the site cleaned and left in a condition satisfactory to the Departmental Representative.

Item 2: Siteworks, Demolitions and Removals, Survey Control and Silt Curtain

.1 Siteworks, demolition (including selective demolition) and removals of miscellaneous items, survey control and silt curtain, shall constitute a lump sum for measurement purposes. This item includes the reinstatement of the road structure affected by electrical trenching outside of the identified new asphalt work. The reinstated road structure shall match the identified asphalt structure for the project, including the gravel sub-base. This item includes demolition removal and disposal of all or portions (as detailed) of the existing pile-supported pier superstructure (deck, curbing, wales, fenders, pilecaps, braces and all or portions of timber piles) and all or portions of interior ballasted cribworks. This item also includes material of whatever nature encountered to access existing structural features for the purpose of demolition, excavation and preparation of slopes for the placement of new backfill materials. Layout and survey control and the collection and creation of cross sections during fill placement, shall be included in this

item. Survey control to include a post-deposition survey of all deposited material within the containment structure after levelling. All associated costs with the silt curtain (supply, installation, removal and reinstallation as required to complete the work) shall be included in this item.

.2 This item also includes the construction of the timber transition ramp from the new structure to Structure #405, as well as the temporary dredge spoil containment-access corridor as shown on the plan including post-construction restitution to conditions existing before the work. Construction of the temporary access corridor to the containment location, as detailed, to include any necessary tree removals (and associated disposal), stripping of top soil, all required site grading, supplementary sandstone fills and/or gravel, all as required to create functional equipment-access for construction of containment embankments and/or dump-truck access for dredged unsuitable material (402,403 reconstruction) deposition. Restitution to include regrading or restoration of top soil, re-sodding (or hydro-seeding) of equipment-damaged grassed areas or road shoulder areas as directed by a Departmental Representative.

Item 3: Creosoted Timber Disposal

.1 Creosoted Timber Disposal shall constitute a lump sum for measurement purposes. This quantity includes all costs required to remove, transport and pay tippage fees for appropriate environmental disposal of creosoted timber at Provincial approved location.

Item 4: Excavation and Disposal (within existing Structures #402, 403))

.1 Excavation and Disposal (within existing Structures #402,403) of existing soils shall constitute a price per cubic meter based on truck measure for measurement purposes. This work shall include transportation and spreading of the material in the containment area. Verification of the underside of existing timber cribs shall be considered incidental to the work. Only material behind new SSP wall alignments to be removed to containment or measured for payment.

Item 5: Asphalt Paving

.1 Asphalt paving shall constitute a price per tonne installed and compacted as indicated on the drawings and specified. This work shall include milling or sawcutting of adjacent asphalt surfaces on each structure, installation and compaction of asphalt mat to indicated thickness. This item shall include all materials and equipment required to construct the specified asphalt structure including necessary prime coat, A-Base, and B-Seal layers.

Item 6: Cast-in-Place Concrete

.1 Cast in Place (CIP) Concrete shall include all cast in place concrete elements (including steel reinforcing) and shall constitute a price per cubic meter for measurement purposes, based on dimensions shown on drawings. Item to include supply and installation, necessary formwork and steel reinforcing as detailed.

Item 7: Pre-Cast Concrete

.1 Pre-Cast Concrete shall include all pre-cast concrete elements (including steel reinforcing) and shall constitute a price per cubic meter for measurement purposes, based on dimensions shown on drawings. Item to include supply and installation. Item shall include all precast concrete deadmen and transition slabs between the new structure and Structure #404.

Item 8: Structural Steel

.1 Structural Steel shall include all non-galvanized miscellaneous metals (besides steel sheet piles, ladder/holdfast assemblies and tie-rods) and shall constitute a price per tonne for measurement purposes. Item to include supply and installation. All connection hardware shall be considered incidental to the work. Horizontal steel angles incorporated into the fenders shall be included in Item 14. Waler splice plates, corner connection plates, spacers and any oversized washer used to connect the waler to the SSP and tie-rods shall be considered incidental to the work.

Item 9: Galvanized Structural Steel

.1 Galvanized Structural Steel shall include all galvanized miscellaneous metals including steel curb, curb legs and curb leg baseplates, integrated mooring holdfasts, ladder holdfasts and ladder uprights with vertical holdfasts and shall constitute a lump sum for measurement purposes. Item to include supply and installation. All connection hardware shall be considered incidental to the work.

Item 10: Tie-Rods

.1 Tie-Rods shall include only the tie rod, standard nuts, washers and oversized washers on the back of the concrete deadman and shall constitute a price per unit for measurement purposes. Item to include supply and installation.

Item 11: Containment Toe-Dredging

.1 Containment toe-dredging to permit installation of armour, filter and non-woven geotextile to indicated elevations and limits as shown on drawings shall constitute a price per cubic metre for measurement purposes. Quantities to be determined from sections taken after toe-dredging and before rock installation. This item shall also include deposition of this material into the containment as it is being excavated.

Item 12: Containment Armourstone (500-750 kg)

.1 Containment Armourstone shall constitute a price per metric tonne for measurement purposes. Item shall include supply and installation. Scale tickets shall be provided for each load entering the site. Item shall include supply and installation.

Item 13: Containment Filterstone (50-75 kg)

.1 Filterstone shall constitute a price per metric tonne for measurement purposes. Item shall include supply and installation. Scale tickets shall be provided for each load entering the site. Items shall include supply and installation. Item shall include supply and installation.

Item 14: Fenders

.1 Fenders shall constitute a price per unit for measurement purposes. Item to include supply and installation. Item shall include the vertical timber fender, horizontal steel angles and all connection hardware.

Item 15: Structural Fill

.1 Structural fill shall constitute a price per metric tonne for measurement purposes. Item to include supply and installation.

Item 16: Rock Fill

.1 Rock fill shall constitute a price per metric tonne for measurement purposes. Item to include supply and installation.

Item 17: Class “A” Gravel

.1 Class “A” Gravel shall constitute a price per metric tonne for measurement purposes. Item to include supply and installation.

Item 18: Geotextile (Wharf 402,403, Non-Woven)

.1 Geotextiles (Non-Woven) shall constitute a price per square meter for measurement purposes. Item to include supply and installation.

Item 19: Geotextile (Containment Cell, Non-Woven)

.1 Geotextiles (Non-Woven) shall constitute a price per square meter for measurement purposes. Item to include supply and installation.

Item 20: Geotextile (Containment Cell, Woven)

.1 Geotextiles (Woven) shall constitute a price per square meter for measurement purposes. Item to include supply and installation into the containment as detailed

Item 21: Geomembrane (Containment Cell Scrim Reinforced)

.1 Geomembrane shall constitute a price per square meter for measurement purposes. Item to include supply and installation into the containment as detailed

Item 22: Sandstone Fill (Containment Cell Core)

.1 Sandstone fill shall constitute a price per cubic metre for measurement purposes. Item to include supply and installation.

Item23: Steel Sheet Piles (Supply)

.1 Steel Sheet Piles (Supply) shall constitute a price per square meter of projected area for measurement purposes. This item includes all supply and onsite storage of all SSP sections, corners, interconnection jaws or other associated products required in the work. Price quoted in tender to account for any necessary variation in required supply length to provide full length SSP sections (no splices) in finished work, with allowance for cut-off, trimming during installation or required penetration into sandstone bedrock.

Item 24: Steel Sheet Piles (Install)

.1 Steel Sheet Piles (Install) shall constitute a price per square meter of projected area for measurement purposes. Includes installation of steel sheet piles to lines, grades and limits as specified in the contract documents.

Item 25: Ladders

.1 Ladders shall constitute a price per unit for measurement purposes. Item to include supply and installation.

Item 26: Electrical

.1 Electrical work shall constitute a lump sum for measurement purposes. Item to include supply and installation of all new electrical work as detailed (including fixtures, poles, precast concrete light bases, wiring, conduits, trenching and backfilling to the underside of road structure for underground conduits, new power shrouds, power centers, steel shroud enclosures, steel power centers enclosures complete with levelling shims as required, protective steel bollards, bird spikes on light fixtures and electrical service building). Removals of existing or former electrical features within the work, whether visible or buried, and road structure reinstatement required for electrical trenching are included in Item 2 – Siteworks, Demolitions and Removals and Survey Control. This item shall include provision of all maintenance manuals and circuit diagrams and commissioning and system demonstration to Harbour Authority officials.

1.11 MAINTENANCE OF WORK DURING CONSTRUCTION

.1 Maintain work during construction. Undertake continuous and effective maintenance work day by day, with adequate equipment and forces so that the roadway or structures are continuously kept in a condition satisfactory to Departmental Representative.

1.12 WORK SCHEDULE

.1 Provide to the Departmental Representative in writing and within 5 working days after Contract award, a detailed construction schedule. The schedule shall show proposed work to be undertaken and anticipated completion dates for each category of work in both Unit Price and Lump Sum items. Work of the contract to be substantially complete by June 30, 2023.

.2 Work must be undertaken without environmental impact.

.3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

.4 No work will begin until the pre-construction meeting is held.

.5 Following the pre-construction meeting and approval of the schedule, traffic control plan environmental protection plan and occupational health and safety plan, the work will be so scheduled to meet the time restraints and have the project completed on time.

1.13 CONTRACTOR'S USE OF SITE

.1 Use of site: for execution of work within close proximity of the pier and those areas specified by the Departmental Representative.

.2 The Departmental Representative will specify the areas for work and storage.

1.14 SANITARY SERVICES

.1 The Contractor shall provide and maintain sanitary facilities for the use of workers at locations specified by the Departmental Representative. Provision of sanitary facilities shall meet requirements of provincial government and municipal statutes and authorities.

1.15 PROJECT MEETINGS

.1 Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

.2 After receiving the Contractor's schedule, traffic control plan, health and safety hazard assessment, and environmental protection plan, and prior to start of construction, a meeting involving Contractor, Departmental Representative and DFO-SCH will be held at a place and time to be determined by the Departmental Representative. This meeting will review implications of the contract, design, schedule of work health and safety, methods of construction, environment protection methods and traffic control.

.3 Interim reviews of work progress based on work schedule will be conducted as decided by the Departmental Representative and schedule updated by the Contractor in conjunction with and approval of the Departmental Representative.

.4 No work will begin until the pre-construction meeting is held, and all submittals have been approved.

.5 Following the pre-construction meeting and approval of submittals, the work will be carried out to meet the time restraints and have the project completed on time.

1.16 DEPARTMENTAL REPRESENTATIVE

.1 Departmental Representative will be assigned after contract award.

1.17 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each of following:

- .1 Contract drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed drawings.
- .5 Change orders.
- .6 Other modifications to Contract.
- .7 Copy of approved work schedule.
- .8 Field test reports
- .9 Manufacturer's installation and application instructions.
- .10 Site specific Health and Safety Plan and other safety related documents.
- .11 Other documents as stipulated elsewhere in the Contract Documents.

1.18 ADDITIONAL DRAWINGS

.1 Departmental Representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

1.19 MEASUREMENT FOR PAYMENT

.1 Notify Departmental Representative sufficiently in advance of operations to permit required measurements for payment.

1.20 CUTTING AND PATCHING

.1 Cut and patch as required to make work fit.

.2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work. This is of particular importance with regard to reinstatement of the perpendicular junction between the new work and Pier 405

1.21 RELICS, ANTIQUITIES AND WILDLIFE HABITAT

.1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as animal nesting site or similar objects found during course of work.

.2 Give immediate notice to Departmental Representative and await Departmental Representative's written instructions before proceeding with work in this area.

.3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

1.22 MEASUREMENT OF QUANTITIES

.1 Linear: Items which are measured by metre are to be measured along centreline of installation unless otherwise shown on plans.

.2 Area:

.1 Longitudinal and transverse measurements for areas to be measured horizontally.

.3 Mass:

.1 Term "tonne" shall mean 1000 kg.

.2 Materials which are specified for measurement by mass shall be weighed on approved scales. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.

.4 Time:

.1 Unless otherwise provided for elsewhere or by written authority of the Departmental Representative, hourly rental of equipment will be measured in actual working time and necessary travelling time of equipment within limits of project at an all-inclusive rate. Equip each unit of mobile equipment with an approved device to register hours of operation. Devices which only measure hours of running of motor will not be accepted.

1.23 PERMITS/AUTHORITIES

.1 The Contractor shall obtain, and pay for, permits from authorities as required for all operations and construction. He shall also comply with all pertinent regulations of all authorities having jurisdiction over the work. The Contractor shall provide copies of all permits to the Departmental Representative prior to starting the work. The Contractor

shall be responsible for obtaining all applicable permits, inspections and approvals required and shall pay all changes in connection therewith.

1.24 EQUIPMENT RENTAL RATES

.1 Upon written request, the Contractor will supply the Departmental Representative with a list of the rental equipment to be used on work beyond the scope of bid items. Equipment rental rates will be in accordance with current rates published by the PEI Department of Transportation, Infrastructure and Environment.

1.25 PROTECTION

.1 Store all materials and equipment to be incorporated into work to prevent damage by any means.

.2 Repair and replace all materials or equipment damaged in transit or storage to the satisfaction of the Departmental Representative and at no cost to Crown.

.3 Contractor will take adequate precautions to protect existing structures when operating tracked equipment. Contractor shall also take care as to not detrimentally surcharge new and existing wharf structures during construction activities.

.4 Exercise care so as not to obstruct or damage public or private property in the area.

.5 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.

1.26 EXISTING SERVICES

.1 Carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.

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

.3 Submit Schedule to and obtain approval from Departmental Representative for any shut down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

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

.5 Record locations of maintained, re-routed and abandoned service lines.

.6 Verify locations of any underground utilities.

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

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

.2 Provide for personnel and vehicle access.

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

1.3 ALTERATIONS, ADDITIONS OR REPAIRS

.1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

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

.2 Provide for personnel, pedestrian and vehicular traffic.

1.5 SPECIAL REQUIREMENTS

.1 Maintenance to vehicles and equipment is prohibited on Harbour Authority property.

.2 Blasting is not permitted.

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

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

END OF SECTION

Part 1 General

1.1 WORK SCHEDULE

.1 Upon acceptance of bid, submit:

.1 Work schedule within 7 calendar days of contract award.

.2 Schedule to indicate all calendar dates from commencement to completion of all work within the time stated in the accepted bid.

.3 Provide sufficient details in schedule to clearly illustrate entire implementation plan, depicting efficient coordination of tasks and resources, to achieve completion of work on time and permit effective monitoring of work progress in relation to established milestones.

.4 Work schedule content to include as a minimum the following:

.1 Bar (GANTT) Charts, indicating all work activities, tasks and other project elements, their anticipated durations, planned dates for achieving key activities and major project milestones supported with;

.2 Written narrative on key elements of work illustrated in bar chart, providing sufficient details to demonstrate a reasonable implementation plan for completion of project within designated time.

.5 Work schedule must take into consideration and reflect the work phasing, required sequence of work, special conditions and operational restrictions as specified elsewhere and below and indicated on drawings.

.6 Schedule work in cooperation with the Departmental Representative. Incorporate within Work Schedule, items identified by Departmental Representative during review of schedule.

.7 Completed schedule shall be approved by Departmental Representative. When approved, take necessary measures to complete work within scheduled time. Do not change schedule without Departmental Representative's approval.

.8 Ensure that all subtrades and subcontractors are made aware of the work restraints and operational restrictions specified.

.9 Schedule Updates:

.1 Submit when requested by Departmental Representative.

.2 Provide information and pertinent details explaining reasons for necessary changes to implementation plan.

.3 Identify problem areas, anticipated delays, impact on schedule and proposed corrective measures to be taken.

.10 Departmental Representative will make interim reviews and evaluate progress of work based on approved schedule. Frequency of such reviews will be as decided by Departmental Representative. Address and take corrective measures on items identified by reviews and as directed by Departmental Representative. Update schedule accordingly.

.11 In every instance, change or deviation from the Work Schedule, no matter how minimal the risk or impact on safety or inconvenience to the Harbour Authority or the public might appear, will be subject to prior review and approval by the Departmental Representative.

1.2 PROJECT PHASING

.1 Be aware that certain sections of both worksite approaches and associated marginal wharves to be reconstructed must be kept operational for the full duration of work of this contract.

1.3 OPERATIONAL RESTRICTIONS

.1 The Contractor must recognize that harbour users will be affected by implementation of this Contract. The Contractor must perform the Work with utmost regard to the safety and convenience of Harbour users. All work activities must be planned and scheduled with this in mind.

.2 Site access must be restricted to only those approved by Contractor and knowledgeable of the Contractor's Site Specific Safety Plan (SSSP).

.3 Safety Signage:

.1 Provide on-site, and erect as required during progress of work, proper signage, mounted on self-supporting stands and/or fencing, warning the public of construction activities progress and alerting need to exercise caution in the area. This shall include signage to notify approaching vessels of construction activities in the harbour.

.2 Signage to be professionally printed and mounted on wooden backing, coloured and to express messages as directed by the Departmental Representative.

.3 Include costs for the supply and installation of these signs in the bid price.

.4 Stock pile materials on site in laydown area identified as agreed upon by the Departmental Representative and the local Harbour Authority.

.5 Dust and Dirt Control:

.1 See section 01 50 00 and 01 74 11 for dust control and cleaning requirements.

.2 Effectively plan and implement dust control measures and cleaning activities as an integral part of all construction activities. Review all measures with the Departmental Representative before undertaking work, especially for major dust generating activities.

.3 Do not allow demolition debris and construction waste to accumulate on site and contribute to the propagation of dust.

.4 As work progresses, maintain construction areas in a tidy condition at all times.

.5 Do not stockpile removed fill material any higher than 3m.

1.4 PROJECT MEETINGS

.1 Schedule and administer project meetings for entire duration of work and more often when directed by Departmental Representative. Refer to Section 01 31 19 for required project meeting frequency.

.2 Hold meetings at project site or where approved by Departmental Representative.

1.5 WORK COORDINATION

.1 The Contractor is responsible for coordinating the work of the various trades and predetermining where the work of such trades interfaces with each other.

.1 Designate one person from own employees having overall responsibility to review contract documents and shop drawings, plan and manage such coordination.

.2 No extra costs to the Contract will be considered by the Departmental Representative as a result of Contractor's failure to effectively coordinate all portions of the Work. Disputes between the various trades as a result of their not being informed of the areas and extent of interface work shall be the sole responsibility of the Contractor to be resolved at own cost.

END OF SECTION

Part 1 GENERAL

.1 This section covers the measurement of Work done for payment purposes.

.2 There shall be no measurement or payment for Work carried out beyond the limits defined on the Drawings.

.3 The Contractor will only be entitled to payment when prior written authorization has been received from the Departmental Representative for utilization and then only to the extent of the work authorized by the Departmental Representative.

.4 The lump sum prices for all items in the Unit Price and Lump Sum Table shall represent the full compensation for the work of the item and shall include the cost of furnishing all materials, labour, tools, and equipment necessary to complete the work in accordance with the Contract, the Drawings and Specifications, and shall cover all costs of surety. Each item shall include all necessary supervision, plant and services, and all operations and allowances customary and necessary to complete each item and the Contract as a whole, notwithstanding the fact that not every such necessary operation is mentioned or included specifically for measurement.

.5 Unless specified otherwise, all materials necessary to complete the items listed in the Unit Price and Lump Sum Table and the finished Work, shall be new materials supplied by the Contractor and the cost of such material is to be included in the Contractor's prices.

.6 All measurements for progress payment purposes shall be taken jointly by the Contractor and the Departmental Representative.

.7 The following measurement procedures are for the purpose of measuring progress on the lump sum contract:

- .1 Items which are measured by the metre shall be measured along centreline of installation unless otherwise indicated.
- .2 Longitudinal and transverse measurement shall be made on the actual flat or sloped surface.
- .3 In computing volumes of excavation or for infill quantities, average end area method will be used unless otherwise directed by Departmental Representative.
- .4 All volume measurements refer to in-place measures unless specified otherwise.
- .5 Materials which are specified for measurement by mass shall be weighed on scales approved by Departmental Representative refer to Section 01 54 30 – Temporary Weigh Scales. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.

.8 Payment for lump sum items and unit prices items.

- .1 Refer to section 01 10 10 – General Instructions for measurement for payment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections.

1.2 APPOINTMENT AND PAYMENT

.1 Departmental Representative will appoint and pay for services of testing laboratory except as follows:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balancing of equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
- .6 Additional tests specified as follows in the following paragraph.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:

- .1 Provide access to Work for inspection and testing.
- .2 Facilitate inspections and tests.
- .3 Make good Work disturbed by inspection and test.
- .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 PRECONSTRUCTION MEETING

.1 After receiving the Contractor's schedule, traffic control plan, health and safety hazard assessment, and environmental protection plan, and prior to start of construction, a meeting involving Contractor, Departmental Representative, field inspectors and DFO-SCH and end users will be held at a place and time to be determined by the Contractor.

.2 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.3 Agenda to include:

- .1 Review of the design and the intentions of the project.
- .2 Implications of the contract.
- .3 Health and safety.
- .4 Methods of construction.
- .5 Environment protection methods.
- .6 Traffic control.
- .7 Appointment of official representative of participants in the Work.
- .8 Schedule of Work: to be in GANTT Chart format.
- .9 Schedule of submission of shop drawings, samples, etc. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .10 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
- .11 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .12 Proposed changes, change orders, procedures, approvals required, and administrative requirements.
- .13 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .14 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .15 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .16 Monthly progress claims, administrative procedures, photographs, hold backs.
- .17 Appointment of inspection and testing agencies or firms.
- .18 Insurances, transcript of policies.

1.2 PROGRESS MEETINGS

.1 Contractor will arrange bi-weekly progress meetings and assume responsibility for setting times and recording and distributing minutes. Minutes shall be distributed within 3 business days of the meeting. Contractor shall notify all attending parties a minimum of 5 days in advance of the meeting.

.2 Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.

.3 Progress meeting agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Refer to Technical Specifications which reference “SUBMITTALS” under PART 1 – GENERAL of each section.

1.2 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

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

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Prince Edward Island, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow ten (10) business days, unless otherwise noted, for Departmental Representative's review of each submission

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments change the original scope of work and therefore the contract value, state such in writing to Departmental Representative for review prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 2 years of date of contract award for project.

.13 Submit electronic copy of certificates for requirements requested in specification Sections and as directed by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copy of manufacturer’s instructions for requirements requested in specification Sections unless otherwise directed by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Documentation of the testing and verification actions by manufacturer’s representative to confirm compliance with manufacturer’s standards and instructions.

.16 Delete information not applicable to project.

.17 Supplement standard information to provide details applicable to project.

.18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.19 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that

pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.4 SAMPLES

.1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's site office.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

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

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract. No site work to occur until insurance transcript has been received.

.3 Submit Certificates of Conformance to the Departmental Representative, stating that the component(s) has been installed in conformance with the approved shop drawings. Certificate of Conformance to bear the seal and signature of a Professional Engineer licensed in the province of Prince Edward Island.

.4 Certificates of Conformance required for, but not limited to, the following:

.1 All components where shop drawings are required (unless otherwise directed by the Departmental Representative).

.2 As specified elsewhere in the Contract Documents.

1.6 PROCEDURES

.1 Provide procedures required as specified in the Contract documents or as directed by the Departmental Representative.

1.7 OTHER SUBMISSIONS

.1 Provide a construction schedule and cash flow forecasts updated every month as well as any additional interim updates requested by the departmental representative.

.2 Provide all other submissions as required by law and the Contract documents.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Fire Safety Requirements

.2 Hot Work Permit

.3 Existing Fire Protection and Alarm Systems

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 Health and Safety Requirements.

1.3 REFERENCES

.1 National Fire Code 2015

.2 National Building Code 2015

1.4 DEFINITIONS

.1 Hot Work defined as:

- .1 Welding work.
- .2 Cutting of materials by use of torch or other open flame devices.
- .3 Grinding with equipment which produces sparks.
- .4 Use of open flame torches such as for roofing work.
- .5 Use of cellphone or mobile device in area of equipment refueling.

1.5 SUBMITTALS

.1 Submit copy of Hot Work Procedures and sample of Hot Work permit to Departmental Representative for review, within 14 calendar days of acceptance of bid.

.2 Submit in accordance with section 01 33 00.

1.6 FIRE SAFETY REQUIREMENTS

.1 Implement and follow fire safety measures during Work. Comply with following:

- .1 National Fire Code 2015.
- .2 National Building Code 2015.
- .3 Federal and Provincial Occupational Health and Safety Acts and Regulations.

.2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

1.7 HOT WORK AUTHORIZATION

.1 Obtain Departmental Representative's written "Authorization to Proceed" before conducting any form of Hot Work on site.

.2 To obtain authorization submit to Departmental Representative:

.1 Contractor's typewritten Hot Work Procedures to be followed on site as specified below.

.2 Description of the type and frequency of Hot Work required.

.3 Sample Hot Work Permit to be used.

.3 Upon review and confirmation that effective fire safety measures will be implemented and followed during performance of hot work, Departmental Representative will give authorization to proceed as follows:

.1 Issue one written "Authorization to Proceed" covering the entire project for duration of work or;

.2 Subdivide the work into pre-determined, individual activities, each activity requiring a separately written authorization to proceed.

.4 Requirement for individual authorization will be based on:

.1 Nature or phasing of work;

.2 Risk to Facility operations;

.3 Quantity of various trades needing to perform hot work on project or;

.4 Other situation deemed necessary by Departmental Representative to ensure fire safety on premises.

.5 Do not perform any Hot Work until receipt of Departmental Representative's written "Authorization to Proceed" for that portion of work.

1.8 HOT WORK PROCEDURES

.1 Develop and implement safety procedures and work practices to be followed during the performance of Hot Work.

.2 Hot Work Procedures to include:

.1 Requirement to perform hazard assessment of site and immediate work area beforehand for each hot work event in accordance with Safety Plan specified in section 01 35 29.06.

.2 Use of a Hot Work Permit system with individually written permit issued by Contractor's Superintendent to specific worker or subcontractor granting permission to proceed with Hot Work.

.3 Permit required for each Hot Work event.

.4 Designation of a person on site as a Fire Safety Watcher responsible to conduct a fire safety watch for a minimum duration of 30 minutes immediately following the completion of the Hot Work.

.5 Compliance with fire safety codes, standards and occupational health and safety regulations specified.

.6 Site specific rules and procedures in force at the site as provided by the Harbour Authority.

.3 Generic procedures, if used, must be edited and supplemented with pertinent information tailored to reflect specific project conditions. Label document as being the Hot Work Procedures for this contract.

.4 Procedures shall clearly establish responsibilities of:

.1 Worker performing hot work,

.2 Person issuing the Hot Work Permit,

.3 Fire Safety Watcher,

.4 Subcontractor(s) and Contractor.

.5 Brief all workers and subcontractors on Hot Work Procedures and of Permit system. Stringently enforce compliance.

.6 Failure to comply with fire safety procedures may result in the issue of a Non-Compliance notification as specified in Section 01 35 29.06.

1.9 HOT WORK PERMIT

.1 Hot Work Permit to include the following:

.1 Project name and project number;

.2 Structure name and specific area where hot work will be performed;

.3 Date of issue;

.4 Description of Hot Work type needed;

.5 Special precautions to be followed, including type of fire extinguisher needed;

.6 Name and signature of permit issuer.

.7 Name of worker to which the permit is issued.

.8 Permit validity period not to exceed 8 hours. Indicate start time/date and termination time/date.

.9 Worker's signature with time/date of hot work completion.

.10 Stipulated time period of safety watch.

.11 Fire Safety Watcher's signature with time/date.

.2 Permit to be typewritten form. Industry Standard forms shall only be used if all data specified above is included on form.

.3 Each Hot Work Permit to be completed in full, signed and returned to Contractor's Superintendent for safe keeping on site.

1.10 FIRE PROTECTION AND ALARM SYSTEMS

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut-off, unless approved by Departmental Representative.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Costs incurred, from the fire department, Harbour Authority and tenants, resulting from negligently setting off false alarms will be charged to the Contractor in the form of financial progress payment reductions and holdback assessments against the Contract.

1.11 DOCUMENTS ONSITE

.1 Keep Hot Work Permits and Hazard assessment documentation on site for duration of Work.

.2 Upon request, make available to Departmental Representative or to authorized safety Representative for inspection.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Procedures to isolate and lockout electrical facility and other equipment from energy sources.

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 : Health and Safety

1.3 REFERENCES

.1 CSA C22.1-06 - Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA C22.3 No.1-06 - Overhead Systems.

.3 CSA C22.3 No.7-06 - Underground Systems.

.4 COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.

1.4 DEFINITIONS

.1 Electrical Facility: means any system, equipment, device, apparatus, wiring, conductor, assembly or part thereof that is used for the generation, transformation, transmission, distribution, storage, control, measurement or utilization of electrical energy, and that has an amperage and voltage that is dangerous to persons.

.2 Guarantee of Isolation: means a guarantee by a competent person in control or in charge that a particular facility or equipment has been isolated.

.3 De-energize: in the electrical sense, that a piece of equipment is isolated and grounded, e.g. if the equipment is not grounded, it cannot be considered de-energized (DEAD).

.4 Guarded: means that an equipment or facility is covered, shielded, fenced, enclosed, inaccessible by location, or otherwise protected in a manner that, to the extent that is reasonably practicable, will prevent or reduce danger to any person who might touch or go near such item

.5 Isolate: means that an electrical facility, mechanical equipment or machinery is separated or disconnected from every source of electrical, mechanical, hydraulic, pneumatic or other kind of energy that is capable of making it dangerous.

.6 Live/alive: means that an electrical facility produces, contains, stores or is electrically connected to a source of alternating or direct current of an amperage and voltage that is dangerous or contains any hydraulic, pneumatic or other kind of energy that is capable of making the facility dangerous to persons.

1.5 COMPLIANCE REQUIREMENTS

.1 Comply with the following in regards to isolation and lockout of electrical facilities and equipment:

.1 Canadian Electrical Code

.2 Federal and Provincial Occupational Health and Safety Acts and Regulations.

.3 Regulations and code of practice as applicable to mechanical equipment or other machinery being de-energized.

.4 Procedures specified herein.

.2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

1.6 SUBMITTALS

.1 Submit copy of proposed lockout procedures and sample of lockout permit or lockout tags to Departmental Representative for review, within 14 calendar days of acceptance of bid.

.2 Submit in accordance with section 01 33 00.

1.7 ISOLATION OF EXISTING SERVICES

.1 Obtain Departmental Representative's written authorization prior to working on existing live or active electrical facilities and equipment and before proceeding with isolation of such item.

.2 To obtain authorization, submit to Departmental Representative the following documentation:

.1 Written request to isolate the particular service or facility and;

.2 Copy of Contractor's Lockout Procedures.

.3 Make a Request for Isolation for each event, unless directed otherwise by Departmental Representative, as follows:

.1 Fill-out standard form in current use at the Facility as provided by Departmental Representative or;

.2 Where no form exist, make written request indicating:

.1 The equipment, system or service to be isolated and its location;

.2 Duration of isolation period (ie: start time & date and completion time & date).

.3 Voltage of service feed to system or equipment being isolated.

.4 Name of person making the request.

.4 Do not proceed with isolation until receipt of written notification from Departmental Representative granting the Isolation Request and authorization to proceed with the work.

.1 Note that Departmental Representative may designate another person at the Facility being authorized to grant the Isolation Request.

.5 Conduct safe, orderly shutdown of equipment or facility. De-energize, isolate and lockout power and other sources of energy feeding the equipment or facility.

.6 Determine in advance, as much as possible, in cooperation with the Departmental Representative, the type and frequency of situations which will require isolation of existing services.

.7 Plan and schedule shut down of existing services in consultation with the Departmental Representative and the Harbour Authority. Minimize impact and downtime of Facility operations. Follow Departmental Representative's directives in this regard.

.8 Conduct hazard assessment as part of the process in accordance with health and safety requirements specified Section 01 35 29.06.

1.8 LOCKOUTS

.1 De-energize, isolate and lockout electrical facility, mechanical equipment and machinery from all potential sources of energy prior to working on such items.

.2 Develop and implement clear and specific lockout procedures to be followed as part of the Work.

.3 Prepare typed written Lockout Procedures describing safe work practices, procedures, worker responsibilities and sequence of activities to be followed on site by workforce to safely isolate an active piece of equipment or electrical facility and effectively lockout and tagout it's sources of energy.

.4 Include as part of the Lockout Procedures a system of lockout permits managed by Contractor's Superintendent or other qualified person designated by him/her as being "in-charge" at the site.

.1 A lockout permit shall be issued to specific worker providing a Guarantee of Isolation before each event when work must be performed on a live equipment or electrical facility.

.2 Duties of person managing the permit system to include:

.1 Issuance of permits and lockout tags to workers.

.2 Determining permit duration.

.3 Maintaining record of permits and tags issued.

.4 Making a Request for Isolation to Departmental Representative when required as specified above.

.5 Designating a Safety Watcher, when one is required based on type of work.

.6 Ensuring equipment or facility has been properly isolated.

.7 Collecting and safekeeping lockout tags returned by workers as a record of the event.

.5 Clearly establish, describe and allocate responsibilities of:

.1 Workers.

.2 Person managing the lockout permit system.

.3 Safety Watcher.

.4 Subcontractor(s) and General Contractor.

.6 Generic procedures, if used, must be edited and supplemented with pertinent information to reflect specific project requirements.

.1 Incorporate site specific rules and procedures in force at site as provided by Harbour Authority through the Departmental Representative.

.2 Clearly label the document as being the lockout procedures applicable to work of this contract.

.7 Use energy isolation lockout devices specifically designed and appropriate for type of facility or equipment being locked out.

.8 Use industry standard lockout tags.

.9 Provide appropriate safety grounding and guards as required.

1.9 CONFORMANCE

.1 Brief all workers and subcontractors on requirements of this section. Stringently enforce use and compliance.

.2 Failure to follow lockouts procedures specified herein may result in the issuance of a Non-Compliance notification as specified in section 01 35 29.06.

1.10 DOCUMENTS ONSITE

.1 Post Lockout Procedures on site in common location for viewing by workers.

.2 Keep copies of Request for Isolation forms and lockout permits and tags issued to workers on site for full duration of Work.

.3 Upon request, make available to Departmental Representative or to authorized safety Representative for inspection.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

.2 Government of Canada

.1 Canada Labour Code – Part II (entitled Occupational Health and Safety)

.2 Canada Occupational Health and Safety Regulations (COHS)

.3 Province of Prince Edward Island

.1 Occupational Health and Safety Act

.2 Occupational Health and Safety Regulations made pursuant to the Act

.4 Part 8 of the National Building Code

.5 Municipal by-laws and ordinances.

1.2 DEFINITIONS

.1 Competent Person: means a person who is:

.1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace;

.2 Knowledgeable about the provisions of occupational health and safety statues and regulations that apply to the Work; and

.3 Knowledgeable about potential or actual danger to health and safety associated with the Work.

.2 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.

.3 Work site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit site specific Health and Safety Plan: within 10 days of notification of Bid Acceptance and prior to commencement of work.

.3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments. Revise plan as appropriate and resubmit within ten (10) working days after receipt of comments.

.4 Submit revisions and updates made to the Contractor's Health and Safety plan during the course of the Work.

.5 Submit records of Contractor's Health and Safety meetings when requested.

.6 Submit Construction Safety Checklists after completion.

.7 Submit copies of reports of directions issued by Federal, Provincial and Territorial health and safety inspectors.

.8 Submit copies of incident and accident reports.

.9 Submit WHMIS MSDS – Material Safety Data Sheets.

.10 Submit proof of Workers' Compensation Coverage through submission of Letter of Good Standing. Contractor must maintain good standing throughout the duration of the contract.

.11 Submit Certificate of Recognition or Letter of Good Standing issued jointly by the Workers` Compensation Board of Prince Edward Island and an occupational health and safety organization approved by the Workers` Compensation Board of Prince Edward Island.

.12 Contractor's responsibility for Health and Safety is not relieved in any way by the Department Representative's review or lack of review of these submittals.

1.4 COMPLIANCE REQUIREMENTS

.1 Comply with the Occupational Health and Safety Act for the Province of Prince Edward Island and the Regulations made pursuant to the Act.

.2 Comply with Canada Labour Code Part II, and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.3 Observe and enforce construction safety measures required by:

- .1 2015 National Building Code of Canada, Part 8;
- .2 Provincial Worker's Compensation Board;
- .3 Municipal by-laws and ordinances.

.4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

.5 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Departmental Representative upon request.

.6 Medical Surveillance: Where prescribed by legislation or regulations, obtain and maintain worker medical surveillance documentation.

1.5 RESPONSIBILITY

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

.2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable federal, provincial, and local statues, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 SITE CONTROL AND ACCESS

.1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop non-authorized persons from circulating within construction areas and remove from site.

.2 Implement procedures for granting permission to enter onto work site to all persons who require access. Procedures to include the provision of a site safety orientation session.

.3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, boarding and temporary lighting as required. See Section 01 56 00 – Temporary Barriers and Enclosures for minimum type of barriers acceptable.

.4 Erect signage at entry points and at other strategic locations indicating restricted access and conditions of access. Signage must be professionally made in both official languages or by use of well understood graphic symbols.

.5 Secure work site against entry when inactive or unoccupied and to protect persons against harm. Provide security guard as deemed necessary to protect site against entry.

.6 Ensure persons granted access is fitted and wear appropriate personnel protective equipment (PPE). Be responsible for the provision of such PPE to persons who require access to conduct work or perform inspections.

1.7 PROTECTION

.1 Provide temporary facilities for protection and safe passage of vehicular traffic around and adjacent to work site.

.2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.

.3 Carry out work placing emphasis on health and safety of public, site personnel and protection of the environment over cost and schedule consideration for work.

.4 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.8 FILING OF NOTICE

.1 File Notice of Project and other Notices with Provincial authorities prior to commencement of work.

1.9 PERMITS

.1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.

.2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain Departmental Representative’s approval to proceed prior to carrying out that portion of work.

.3 Post all permits on site. Submit copies to Departmental Representative.

1.10 HAZARD ASSESSMENTS

.1 Implement and carry out a health and safety hazard assessment program as part of the work. Program to include:

- .1 Initial hazard assessment carried out immediately upon notification of contract award and prior to commencement of work.
- .2 On-going hazard assessments performed during the progress of work identifying new or potential health risks and safety hazards not previously known. As a minimum hazard assessments shall be carried out when:
  - .1 New sub-trade work, new subcontractor(s) or new workers arrive at the site to commence another portion of the work.
  - .2 The scope of work has been changed by Change Order.
  - .3 Potential hazard or weakness in current health and safety practices are identified by Departmental Representative or by an authorized safety representative.
- .3 Hazard assessments to be project and site-specific, based on review of contract documents, site and weather conditions.
- .4 Each hazard assessment to be made in writing. Keep copies of all assessments on site for duration of work. Upon request, make available to Departmental Representative for inspection.

1.11 PROJECT/SITE CONDITIONS

.1 The following are known or potential project related safety hazards at site:

- .1 Tidal water.
- .2 Working over water.
- .3 Electrical Lines overhead.
- .4 Harbour user vessel and vehicle and other commercial traffic
- .5 Heavy equipment.
- .6 Stability of existing structures.
- .7 Working at heights.
- .8 Working overhead.
- .9 Demolition.
- .10 Exposure.
- .11 Remote site.
- .12 Possible night-time work under artificial lighting.

.2 Above lists shall not be construed as being complete and inclusive of safety and health hazards encountered as a result of Contractor’s operations during the course of work.

.3 Include above items into the hazard assessment program specified herein.

1.12 SAFETY MEETINGS

.1 Prior to commencement of work attend health and safety meeting conducted by Departmental Representative. Departmental Representative will advise of time and location. Ensure attendance of:

.1 Superintendent of Work.

.2 Designated Health and Safety Site Representative

.3 Subcontractors.

.2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.

.3 Keep documents on site.

1.13 HEALTH AND SAFETY PLAN

.1 Develop written site-specific Project Health and Safety Plan, based on hazard assessments, prior to commencement of work. Submit plan to Departmental Representative within 10calendar days of Contract Award date.

.2 Health and Safety Plan shall contain the following components:

.1 List of health risks and safety hazards identified by hazard assessments.

.2 Control measures used to mitigate risks and hazards identified.

.3 On-site Contingency and Emergency Response Plan as specified below.

.4 On-site Communications Plan as specified below.

.5 Name of Contractor's designated Health and Safety Site Representative and information showing proof of their competence and reporting relationship in Contractor's company.

.6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.

.7 On-site Contingency and Emergency Response Plan shall include:

.1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.

.2 Evacuation plan: site layouts showing escape routes, marshalling areas. Details of alarm notification methods, fire drills, location of firefighting equipment and other related data.

.3 Name, duties and responsibilities of persons designated ad Emergency Warden(s) and deputies.

.4 Emergency Contacts: name and telephone number of officials from Contractor, Sub-Contractors, federal and provincial departments having jurisdiction, local emergency resource organization.

.5 Harmonize plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PCA and Facility Management contacts.

.8 On-site Communications Plan:

.1 Procedures for sharing of work related safety information to workers and Sub-Contractors, including emergency and evacuation measures.

.2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.

.9 Address all activities of the Work including those of Sub-Contractors.

.10 Review and update Health and Safety Plan regularly during the Work. Update as conditions warrant addressing additional health risks and safety hazards, such as whenever new trade or Sub-Contractors arrive at Work site.

.11 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Health and Safety Plan with correction of deficiencies or concerns.

.12 Post copy of the Health and Safety Plan, and updates, prominently at Work site.

1.14 SAFETY SUPERVISION AND INSPECTIONS

.1 Designate Health and Safety Site Representative to be present on site at all times during work, responsible for supervising health and safety and conducting safety inspections of work site.

.2 Health and Safety Representative shall be assigned the responsibility and authority to:

.1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work.

.2 Conduct site safety orientation session to persons granted access to the Work site.

.3 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work site.

.4 Authority to stop and start work as deemed necessary for reasons of health and safety.

.3 Conduct regularly scheduled safety inspections of work site as follows:

.1 Informal Inspections: carry out a minimum bi-weekly basis. Note deficiencies and remedial action taken in a log book or diary.

.2 Formal Inspections: carry out on a minimum monthly basis. Use standardized safety checklist forms. Prepare written report for each formal inspection. Document deficiencies, remedial action needed and assign responsibility for rectification to appropriate subcontractor or worker.

.4 Cooperate with Facility's Health and Safety Site Coordinator responsible for the entire site or facility, should one be designated by Departmental Representative.

.5 Maintain safety inspection documentation on site

1.15 TRAINING

.1 Ensure that workers, subcontractors and other authorized persons granted access to site are effectively trained in occupational health and safety and practices pertinent to their assigned tasks.

.2 Maintain employee records and evidence of training received.

.3 Make training records readily available for review by Departmental Representative upon request.

.4 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of Work immediately stop work and advise Department Representative verbally and in writing.

.5 Follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative.

1.16 MINIMUM SITE SAFETY RULES

.1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons granted access:

.1 Wear personal protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear (and eye protection where appropriate).

.2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.

.3 Maintain site and storage areas in tidy condition free of hazards causing injury.

.4 Obey warning signs and safety tags.

.2 Brief workers on site safety rules, and on the disciplinary measures to be taken for violation or non-compliance of such rules. Post such information on site.

1.17 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction of by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative will stop Work if non-compliance of health and safety regulations is not corrected in a timely manner.

1.18 INCIDENT REPORTING

.1 Investigate and immediately report to Departmental Representative incidents that:

.1 Require reporting to Provincial Department of Occupational Safety and Health, Workers' Compensation Board or to other regulatory agency.

.2 Medical aid injuries.

.3 Property damage in excess of $10,000.00,

.4 Interruption to Facility operations resulting in an operational loss to a Federal department or client in excess of $5,000.00,

.5 Required notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable regulations.

.2 Submit report in writing.

1.19 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information Systems (WHMIS).

.2 Keep MSDS data sheets on site. Provide copies of all data sheets to Departmental Representative upon receipt of materials on site.

.3 Post all MSDS data sheets on site, in a common area, visible to workers.

1.20 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.21 POWDER ACTUATED DEVICES

.1 Use power actuated fastening devices only after receipt of written permission from Departmental Representative.

1.22 CONFINED SPACES

.1 Abide by occupational health and safety regulations regarding work in confined spaces.

.2 Safely for Inspectors:

.1 Provide PPE and training to Departmental Representative and other persons who require entry into confined spaces to perform inspections.

.2 Be responsible for efficacy of equipment and safety of persons during their entry and occupancy in the confined space.

1.23 POSTING OF DOCUMENTS

.1 Post documents indicated herein and as required by Authority having jurisdiction.

1.24 RECORDS ON SITE

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

.2 Post other documents as specified herein, including:

.1 Site specific Health and Safety Plan.

.2 WHMIS data sheets.

.3 Incident reports.

.4 Tool box and safety meeting minutes.

.3 Make available to Departmental Representative, or authorized safety representative, for inspection upon request.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Waste Management and Disposal: Section 01 74 21

1.2 REFERENCES

.1 WHMIS: Workplace Hazardous Materials Information System, Health Canada.

.2 Transportation of Dangerous Goods Act. Transport Canada, amended 2011-11-09.

.3 Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters, Department of Fisheries and Oceans Canada, 1998.

.4 MBCA: Migratory Birds Convention Act, Environment Canada, 1994.

.5 Canadian Coast Guard Regulations, Department of Fisheries and Oceans Canada.

.6 Canadian Shipping Act, Transport Canada, 2001.

.7 AWPA: American Wood Preserver Association

1.3 DEFINITIONS

.1 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

.2 Watercourse: refers to the bed and shore of a river, stream, lake, creek, pond, marsh, estuary or salt-water body that contains water for at least part of each year.

.3 Alien species: refers to a species or subspecies introduced outside its normal distribution whose establishment and spread threaten ecosystems, habitats or species with economic or environmental harm.

1.4 TRANSPORTATION

.1 Transport hazardous materials and hazardous waste in compliance with Federal Transportation of Dangerous Goods Act.

.2 Do not overload trucks when hauling material. Secure contents against spillage.

.3 Maintain trucks clean and free of mud, dirt and other foreign matter.

.4 Avoid potential release of contents and of any foreign matter onto highways, roads and access routes used for the Work. Take extra care when hauling materials. Immediately clean any spillage and soils.

.5 Before commencement of work, advise the Departmental Representative of the existing roads and temporary routes proposed to be used to access work areas and to haul material to and from the site.

.6 Machinery is not allowed in water. Refer to 1.6 for equipment requirements that may come in contact with water.

1.5 HAZARDOUS MATERIAL HANDLING

.1 Handle and store hazardous materials on site in accordance with WHMIS procedures and requirements.

.2 Store all hazardous liquids in location and manner to prevent their spillage into the environment.

.3 Maintain written inventory of all hazardous materials kept on site. List product name, quantity and storage date.

.4 Keep MSDS data sheets on site for all items.

1.6 PETROLEUM, OIL, AND LUBRICANTS

.1 Comply with Federal and Provincial laws, regulations, codes and guidelines for the storage of fuel and petroleum products on site.

.2 Do not place fuel storage tanks and store fuel or other petroleum products within a 30 meter buffer zone of watercourses and wetlands. Do not fuel or lubricate equipment within this 30 meter buffer zone. Obtain approval from Departmental Representative of acceptable location on site for fuel storage and equipment service.

.3 Do not dump petroleum products or any other deleterious substances on ground or in the water.

.4 Be diligent and take all necessary precautions to avoid spills and contaminate the soil and water (both surface and subsurface) when handling petroleum products on site and during fueling and servicing of vehicles and equipment.

.5 Maintain on site appropriate emergency spill response equipment consisting of at least one 250-litre (55 gallon) overpack spill kit for containment and cleanup of spills.

.6 Maintain vehicles and equipment in good working order to prevent leaks on site.

.7 In the event of a petroleum spill, immediately notify the Departmental Representative and the Canadian Coast Guard (CCG) at 1-800-565-1633 (24 hour report line). Perform clean-up in accordance with all regulations and procedures stipulated by authority having jurisdiction.

.8 If using a floating barge, the following mitigation measures should be adhered to:

.1 Vessels should be compliant with all Canada Shipping Act, 2001, requirements for inspection, which includes certification of the vessel and adequate training and appropriate certification of competency for the operator.

.2 Ensure that all vessels will have procedures in place to ensure safeguards against marine pollution: awareness training of all employees, means of retention of waste oil on board and discharge to shore based reception facilities, capacity of responding to and clean-up of accidental spill caused by vessels involved in any particular part of the project.

.3 Onsite crews must have emergency spill clean-up equipment, adequate for the activity involved, on-site. Spill equipment will include, as a minimum, at least one 250 L (i.e. 55 gallon) overpak spill kit containing items to prevent a spill from spreading; absorbent booms, pillows, and mats; rubber gloves; and plastic disposal bags. All spills or leaks must be promptly contained, cleaned up, and

reported to the 24-Hour Environment Emergencies Report System (1-800-565-1633).

1.7 DISPOSAL OF WASTES

.1 Do not bury rubbish, demolition debris and waste materials on site.

.2 Dispose and recycle demolition debris and waste materials in accordance with project waste management requirements specified in section 01 74 21.

.3 Do not dispose of hazardous waste, volatile materials (such as mineral spirits, paints, thinners etc...) and petroleum products into waterways, storm or sanitary sewers or in waste landfill sites.

.4 Dispose of hazardous waste in accordance with applicable federal and provincial laws, regulations, codes and guidelines.

.5 Concrete waste:

.1 Do not discharge residual or rejected concrete on site.

.2 Immediately clean any accidental release of concrete on site prior to solidification.

.3 Do not wash and clean concrete vehicles on site.

.4 Perform dumping of residual material and truck cleaning operations only at the concrete plant. Follow environmental regulations and good practices as approved by the Provincial Department of the Environment and other authorities having jurisdiction.

1.8 EXCAVATED MATERIAL

.1 All stockpiled soil must be dyked (complete with silt fencing) to prevent erosion and release of sediment laden water.

.2 If any material is excavated during the proposed project activities then the Departmental Representative must be consulted to identify an appropriate stockpile location for the excavated material to ensure the material, or any part of the material, does not re-enter any waterbody.

.3 Excavated material shall be tested if it is to leave DFO-SCH property. If testing of material is required the cost will be the responsibility of the Crown.

1.9 WATER QUALITY

.1 During construction activities, a floating silt curtain and/or silt boom must be installed around the work site to prevent any suspended solids and/or debris from entering into the adjacent water body. The floating silt curtain must be installed before the commencement of any work activity.

.1 The silt curtains will be measured for payment as per Section 01 10 10.

.2 The silt curtain must be marked at 10m intervals with 0.4m yellow buoys.

.3 The silt curtain is not to be in the path of any vessels.

.2 Water contamination by preservative treated wood:

.1 Preservative treated lumber and timber, whether plant or site treated, shall be cured for a minimum of 30 days from date of the treatment application before their installation in areas which will be in contact with the water.

.2 Do not cut treated wood lumber over the surface of a watercourse or wetland.

.3 Do not use liquid applied preservative products over the surface of a watercourse or wetland.

.4 Wood treated with Chromate Copper Arsenate (CCA) or Ammoniac Copper Zinc Arsenate (ACZA) must be CSA or AWPA approved.

.5 Do not use timber and lumber treated with creosote, petroleum and pentachlorophenol for any part of the Work.

.3 Visually monitor the water turbidity of the surrounding areas adjacent to the work and up to 200 meters.

.1 Should excessive change occur in the turbidity beyond the 200 meters which differs from existing conditions of the surrounding water bodies, such as a distinct colour difference; stop the work and notify the Departmental Representative to obtain appropriate mitigation measures to be followed.

.4 Any construction debris entering the marine environment will be immediately retrieved when it is safe to do so.

.5 The construction material used must be clean and non-toxic (free of fuel, oil, grease, and/or any contaminants).

1.10 SOCIOECONOMIC RESTRICTIONS

.1 Must abide by municipal and provincial regulations for any restrictions on work performed during the night time and on flood lighting of the site. Obtain applicable permits.

.2 Place flood lights in opposite direction of adjacent residential and business areas.

.3 Equip equipment and machinery with purposely designed mufflers to reduce noise on site to lowest possible level. Maintain mufflers in good operating condition at all times.

.4 Adequate signage and safety measures must be supplied during transportation of materials and equipment to the harbour.

1.11 BIRD AND BIRD HABITAT

.1 Become knowledgeable with and abide by the Migratory Birds Convention Act (MBCA) in regards to the protection of migratory birds, their eggs, nests and their young encountered on site and in the vicinity.

.2 Minimize disturbance to all birds on site and adjacent areas during the entire course of the Work.

.3 Do not approach concentrations of seabirds, waterfowl and shorebirds when anchoring equipment, accessing wharves or ferrying supplies.

.4 During night time work, position flood lights in opposite direction of nearby bird nesting habitat.

.5 Do not use beaches, dunes and other natural previously undisturbed areas of the site to conduct work unless specifically approved by the Departmental Representative.

.6 Should nests of migratory birds in wetlands be encountered during work, immediately notify Departmental Representative for directives to be followed.

.1 Do not disturb nest site and neighboring vegetation until nesting is completed.

.2 Minimize work immediately adjacent to such areas until nesting is completed.

.3 Protect these areas by following recommendations of Canadian Wildlife Service.

.7 Ensure that food scraps and garbage are not left at the work site.

.8 Project vehicles will keep to designated project transportation routes and stay within DFO-SCH property boundaries.

.9 No staging of vehicles or equipment/material storage will take place on any beaches, wetlands or dunes, unless otherwise advised, via permit, by Departmental Representative. The project footprint will not encroach/impact these abovementioned areas.

1.12 FISH AND FISH HABITAT

.1 Be aware of the risk for contamination of the fish habitat at the site as a result of alien species being introduced in the water.

.2 To minimize the possibility of fish habitat contamination, all construction equipment which will be immersed into the water of a watercourse, or has the possibility of coming into contact with such water during the course of the work, must be cleaned and washed to ensure that they are free of marine growth and alien species.

.1 Equipment shall include boats, barges, cranes, excavators, haul trucks, pumps, pipe lines and other all miscellaneous tools and equipment previously used in a marine environment.

.3 Cleaning and washing of equipment shall be performed immediately upon their arrival at the site and before use in or over the body of water.

.4 Conduct cleaning and washing operations as follows:

.1 Scrape and remove heavy accumulation of mud and dispose appropriately.

.2 Wash all surfaces of equipment by use of a pressurized fresh water, supplied by contractor.

.3 Immediately follow with application of a heavy sprayed coating of undiluted vinegar or other environmentally approved cleaning agent to thoroughly remove all plant matter, animals and sediments.

.4 Checks and remove all plant, animal and sediment matter from the all bilges and filters.

.5 Drain standing water from equipment and let fully dry before use.

.6 Upon removal from the water, drain standing water from equipment and let fully dry before removal off the site.

.5 Do not perform cleaning and wash down within a 30 meter buffer zone of a wetland, watercourse or other identified environmentally sensitive area.

.6 Record of Assurance Logbook:

.1 Maintain an on-going log of past and present usage and wash down of all equipment to illustrate mitigation measures undertaken against fish habitat contamination by alien species.

.2 Include the following:

.1 Date and location where equipment was previously used in a watercourse or wetland;

.2 Type of work performed.

.3 Dates of wash down for each piece of equipment;

.4 Cleaning method and cleaning agent(s) used.

.7 Keep Record of Assurance Logbook updated from project to project. Upon request, submit logbook to Departmental Representative for review.

.8 Abide by requirements and recommendations of the Federal Department of Environment and the Department of Fisheries and Oceans - Habitat Protection and Sustainable Development Branch in cleaning and wash down of equipment.

1.13 AIR QUALITY

.1 Keep airborne dust and dirt resulting from the work on site to an absolute minimum.

.2 Apply dust control measures to roads, parking lots and work areas.

.3 Spray surfaces with water or other environmentally approved product. Use purposely suited equipment or machinery and apply in sufficient quantity and frequency to provide effective result and continued dust control during the entire course of the work.

.4 Do not use oil or any other petroleum products for dust control.

1.14 FIRES

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 77 00 – Closeout Procedures

.3 Section 01 78 00 – Closeout Submittals

1.2 DEFINITIONS

.1 Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed.

.2 Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

1.3 INSPECTION

.1 Allow Departmental Representative adequate time and access to Work. If part of Work is in preparation at locations other than Place of Work, allow time and access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

.5 The Departmental Representative shall participate in the taking of survey of all quantities with the Contractor responsible to complete the surveys in the presence of the Departmental Representative.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged and coordinated by Departmental Representative for purpose of inspecting and/or testing portions of Work. These agencies include, but are not limited to, concrete testing, coating testing and

inspection, aggregate tests, compaction tests. Cost of such services will be borne by Departmental Representative. The Contractor remains responsible for:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Mill tests and certificates of compliance.

.4 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.

.2 Provide equipment and materials required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility of Contractor to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no additional cost to Contract. Contractor shall pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

.1 Allow inspection/testing agencies access and required time to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

.3 Make good work disturbed by inspections and tests.

1.6 PROCEDURES

.1 Notify appropriate agency and Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such agency directly.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Deliver in required quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

1.7 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good damages to existing or new work, including work of other Contracts, resulting from removal or replacement of defective work.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.8 TESTING BY CONTRACTOR

.1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents. Contractor is to perform Axial Compression Performance Test Loading to confirm design pile capacity has been achieved.

1.9 REPORTS

.1 Submit the original and electronic copy of inspection and test reports to Departmental Representative.

.2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.10 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested and as specified in relevant Technical Specification section.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.11 MILL TESTS

.1 Submit mill test certificates as required of specification Sections or as requested by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SITE ACCESS AND PARKING

.1 Contractor's access to project site as well as parking facilities for equipment and workers will be by arrangement with the Harbour Authority.

.2 The Contractor is advised that while parking facilities for workers and subcontractors will be on DFO-SCH property, such parking facilities may be removed from the actual site of the work. In any case, follow all instructions from the Harbour Authority in regards to parking facilities.

.3 Parking facilities at site are limited. Make arrangements elsewhere for Contractor's vehicles including those of subcontractors and workers by consultation with the Harbour Authority.

.4 Build and maintain temporary access roads and provide snow removal and dust control during period of work.

.5 Maintain existing roads and parking areas at site, where used by Contractor, for duration of contract.

.1 Keep clean and free of mud and dirt by washing on a regular basis.

.2 Provide snow removal in areas located within construction site or enclosed by work.

.3 Make good and repair damage resulting from Contractor's use of existing roads, asphalted areas and lawns on site. This will be strictly enforced.

1.2 CONTRACTOR’S SITE OFFICE

.1 Be responsible for and provide own site office, if required, including electricity, heat, lights and telephone. Locate site office within laydown area identified on the contract drawings.

1.3 MATERIAL STORAGE

.1 Material storage space on site is limited. Coordinate delivery to minimize storage period on site before being needed for incorporation into work.

1.4 SITE ENCLOSURES

.1 Provide temporary fence to enclose various construction areas of work site.

.2 Erect plastic mesh fence constructed as follows:

.1 1200 mm height, constructed of high density polyethylene mesh fence fabric, orange in color.

.2 Supported by steel T-bar posts or other similar framing, of sufficient quantity, adequate spacing and set firmly in ground to secure fence against sags.

.3 Inspect fence regularly, repairing sags and damaged sections.

.4 Incorporate within fence one operable truck gate and one pedestrian gate.

.3 Make all gates lockable and provide keyed padlocks.

.4 Obtain Departmental Representative's approval beforehand of location and layout of all temporary fence enclosures.

.5 Provide battery powered lanterns around the perimeter of the site enclosure to clearly mark its location at night.

.6 Provide warning signs affixed to all fenced areas, identifying those enclosed areas as "Construction Zones" with access restricted to only those persons so authorized by General Contractor.

1.5 SANITARY FACILITIES

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

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

1.6 ENCLOSURE OF STRUCTURE

.1 Design enclosures to withstand wind pressure, tides, ice and snow loading.

1.7 POWER AND LIGHTING

.1 Power supply may be available and may be provided for construction usage, pending negotiation for same with the Harbour Authority.

.1 Make arrangements for the use of such services through the Harbour Authority and negotiate fee to use the service prior to commencing the work.

.2 DFO/SCH and the Harbour Authority will designate and approve each location of existing power source to which connections can be made to obtain temporary power service.

.3 Connect to existing power supply in accordance with Canadian Electrical Code.

.2 Provide and maintain temporary lighting to conduct work and to provide temporary lighting for the structures between April 1st and November 1st of any year (between 4:00 AM and 9:00 PM) during the construction period between the time whenever the current lighting system is disconnected and the new lighting system is connected. This may include areas outside of work areas if the lighting in those areas has been compromised. Ensure illumination level is not less than 162 lx in all locations. Temporary lighting shall be considered incidental to the work.

.3 Power used for heating and hoarding will require self-contained power supply units supplied by the contractor. No connection will be available from Harbour Authority services for this power requirement.

1.8 WATER SUPPLY

.1 Water supply may be available on site and may be provided for construction usage, pending negotiation for same with the Harbour Authority. Make arrangements for the use and transportation of such services to work area through the Harbour Authority.

1.9 CONSTRUCTION SIGNS AND NOTICES

.1 Contractor or subcontractor advertisement signboards are not permitted on site.

.2 Safety and Instruction Signs and Notices:

.1 Signs and notices for safety and instruction shall be in both official languages or commonly understood graphic symbols conforming to CAN3-Z321-96(R2006).

.3 Maintenance and Disposal of Site Signs:

.1 Maintain approved signs and notices in good condition for duration of project and dispose of offsite upon completion of project or earlier if directed by Departmental Representative.

1.10 REMOVAL OF TEMPORARY FACILITIES

.1 Remove temporary facilities from site when directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety

.3 Section 01 35 43 – Environmental Procedures

.4 Section 01 55 26 – Traffic Regulation

.5 Section 01 56 00 – Temporary Barriers and Enclosures

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.

.3 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.

.4 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for all temporary structures which are required to be engineered. Shop drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs as required.

1.6 HOISTING

.1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists and cranes to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees to an area agreed to by the Departmental Representative. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted in the identified Lay-Down area (as shown on the drawing) only

.2 Provide and maintain adequate access to project site.

.3 Keep parking areas clean and maintain during period of Contract.

1.9 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.12 SANITARY FACILITIES

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

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

1.13 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

Not Used.

Part 3 Execution

3.1 GENERAL

.1 Construct and maintain construction facilities in accordance with applicable Sections contained in these specifications.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, watercourses, and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 35 29.06 – Health and Safety

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 02 41 16 – Structure Demolition

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

.1 Nova Scotia Temporary Workplace Traffic Control Manual (TWTCM)

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 HOARDING

.1 Erect temporary site enclosures when and where required using 38 x 89mm construction grade lumber framing at 600mm centres and 1200 x 2400 x 13mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically as indicated flush and butt jointed.

.3 Provide one or two lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.

.6 Erect temporary site enclosure where and when required using new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one lockable truck gate. Maintain fence in good repair.

1.5 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, and open edges of structures or as indicated in Contract Documents. Provide as required by governing authorities and as indicated.

1.6 WEATHER ENCLOSURES

.1 Provide weather tight closures where and when required to facilitate construction operations.

.2 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens to localize and control dust generating activities, and for protection of workers and the environment.

.2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

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

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

.1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 REFERENCES

.1 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.4 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date of issue is specifically noted.

1.3 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations.

1.4 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

1.7 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.8 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.9 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.12 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of new and existing bridges. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.13 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

1.2 REFERENCES

.1 Owner's identification of existing survey control points and property limits.

1.3 SURVEY REFERENCE POINTS

.1 Locate, confirm and protect working/datum points prior to starting site work.

.2 Make no changes or relocations without prior written notice to Departmental Representative.

.3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

1.4 SURVEY REQUIREMENTS

.1 Establish lines and levels, locate and lay out, by instrumentation.

.2 Establish SSP tip elevations, as installed.

1.5 EXISTING SERVICES

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

1.6 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.3 Clear snow and ice from access to site, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

.8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.9 Provide adequate ventilation during use of volatile or noxious substances.

1.3 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Prior to final review remove surplus products, tools, construction machinery and equipment.

.3 Remove waste products and debris including that caused by Owner or other Contractors, and leave Work clean and suitable for occupancy.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Inspect finishes and ensure specified workmanship and operation.

.7 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.8 Remove dirt and other disfiguration from exterior surfaces.

.9 Sweep and wash clean finished paved areas within the work site.

.10 Clean downspouts and drainage systems.

.11 Remove debris and surplus materials from site.

.12 Remove snow and ice from access to site.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss DFO-SCH Waste Management Plan and Goals.

.2 Accomplish maximum control of solid construction waste.

.3 Preserve environment and prevent pollution and environmental damage.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 02 41 13 – Selective Site Demolition

1.3 REFERENCES

.1 Nova Scotia Solid Waste Resource Strategy.

.2 PEI Environmental ProtectionAct, Materials Stewardship and Recycling Regulations

1.4 DEFINITIONS

.1 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.2 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.3 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.4 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.5 Salvage: removal of structural and non-structural structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.6 Separate Condition: refers to waste sorted into individual types.

.7 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

.8 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.6 Separate and store materials produced during project in designated areas.

.7 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.

- .1 On-site source separation is required.
- .2 Remove co-mingled materials to off-site processing facility for separation.
- .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

1.6 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner and the like into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

- .1 Number and size of bins.
- .2 Waste type of each bin.
- .3 Total tonnage generated.
- .4 Tonnage reused or recycled.
- .5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

.6 All creosote or other treated timbers removed from the work to be disposed of in Provincially approved manner.

1.7 USE OF SITE FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by DFO-SCH and The Harbour Authority

1.8 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Clean up Work area as work progresses.

.2 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.3 Source separate materials to be reused/ recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 78 00 - Closeout Submittals.

1.2 INSPECTION AND DECLARATION

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Departmental Representative's Inspection.

.2 Departmental Representative Inspection:

.1 Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies.

.2 Contractor to correct Work accordingly.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative and Contractor.

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

.7 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment. Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with applicable sections of these specifications.

.2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 01 71 00 – Examination and Preparation

.4 Section 01 77 00 – Closeout Procedures

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide As-built documents and samples.

.3 Provide final site survey certificate.

1.3 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in “.dwg” format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of opaque drawings.

.2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface features.

.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.3 Field changes of dimension and detail.

.4 Changes made by change orders.

.5 Details not on original Contract Drawings.

.6 References to related shop drawings and modifications.

.4 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 WARRANTIES AND BONDS

.1 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.2 Except for items put into use with Department Representative’s permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF WORK

.1 This Section includes but is not limited to the following:

.1 All sitework, demolition and removals as required to complete the work. All items to be verified prior to submission of a tender. All available plans of the existing structure are available for viewing at PSPC Office in Charlottetown, PEI.

1.2 RELATED SECTIONS

.1 Refer to Section 01 33 00 for Submittal Procedures.

1.3 SUBMISSIONS

.1 Methodology:

.1 Provide methodology for carrying out the major components of the work.

.2 Provide submissions in accordance with Section 01 33 00.

1.4 PROTECTION

.1 Prevent movement, settlement or damage of adjacent structures. Provided bracing and shoring as required. In event of damage, immediately replace such items or make repairs to approval of a Departmental Representative and at no additional cost.

.2 Prevent debris from entering harbour and creating navigational hazards.

.3 All damage to existing structures, roadways, etc., not specified for removal to be repaired at the Contractor's cost to the satisfaction of the Departmental Representative.

.4 Do not load or travel on any structures other than those designated for replacement. Capacity of existing structures is unknown.

1.5 MEASUREMENT FOR PAYMENT

.1 Refer to Section 01 10 10 General Instructions for measurement for payment.

.2 Item shall include demolitions, selective demolitions, removals, transportation, disposal, environmental protective measures, and site cleanup.

.3 Disposal of creosote timber will be a separate Unit Price item in accordance with Section 01 10 10.

Part 2 Products

2.1 Not Used

Part 3 Execution

3.1 PREPARATION

.1 Inspect site and verify with a Departmental Representative items designated for removal and items to be preserved.

.2 Do not disturb adjacent structures designated to remain in place.

3.2 REMOVAL

.1 Remove items indicated.

.2 At end of each day's work, leave work in safe condition so no part is in danger of toppling or failing.

.3 Excavate to extents and dimensions indicated on the drawings.

.4 Do not leave existing or new structure open or exposed to the elements at the end of each day. This is of particular importance with regard to wave exposure.

3.3 DISPOSAL OF MATERIAL

.1 Treated timber materials to be disposed of at Provincially operated land fill facility. It is the contractor's responsibility to verify the location of the facility.

3.4 RESTORATION

.1 Upon completion of work, remove debris, trim surfaces and leave work site clean.

.2 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work. Match condition of adjacent, undisturbed areas.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 03 20 00 – Concrete Reinforcing

.4 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A23.4, Precast Concrete – Materials and Construction

.3 CSA-O86-14, Engineering Design in Wood.

.4 CSA O121-08(R2013), Douglas Fir Plywood.

.5 CSA O151-09 (R2014), Canadian Softwood Plywood.

.6 CSA O153-13, Poplar Plywood.

.7 CAN/CSA-O325-07(R2012), Construction Sheathing.

.8 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.

.9 CAN/CSA-S269.1-1975 (R2003), Falsework for Construction Purposes

.10 CAN/CSA-S269.3-M92(R2013), Concrete Formwork, National Standard of Canada

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings and calculations stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada at least four (4) weeks before construction. The submission is intended for information purposes only and shall in no way relieve the Contractor of full responsibility to carry out work related in accordance with CSA S269.3 for Concrete Formwork and CSA S269.1 for Falsework.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork/falsework as directed by formwork Engineer.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with jurisdictional requirements.

.2 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.

.3 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign material. Handle and erect the fabricated formwork so as to prevent damage.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC's).

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA O121, CAN/CSA-O86.

.2 Formwork shall be constructed from lumber devoid of warped defects in order to achieve a face alignment free of distortion. This shall apply to all panel forms including prefabricated boards, plywood and steel panels.

.3 Formwork on exposed concrete surfaces shall be new or like new to achieve a quality aesthetically pleasing finish.

.2 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Holes to be filled with non-shrink grout.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs (applied before concrete sealers and coatings are applied).

.3 Form tie components which remain embedded in concrete are to be galvanized or non-metallic. Dissimilar metals which are in contact must be separated by denso tape barrier.

.3 Form release agent: non-toxic, biodegradable, low VOC. Form release agents must be compatible with waterproofing systems where applicable.

.4 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Fabricate and erect falsework in accordance with CSA S269.1.

.3 Refer to structural drawings and Item 2.1.2 for concrete members requiring architectural exposed finishes.

.4 Do not place shores and mud sills on frozen ground.

.5 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.6 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.7 Align form joints and make watertight.

.1 Keep form joints to minimum.

.8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Construct forms for architectural concrete as indicated.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.11 Built in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including concrete texturing.

.2 Anchors and inserts cast into the concrete shall be non-metallic or galvanized metal and either be isolated from dissimilar metals by either a 30 mm clear spacing or ‘Denso’ tape barrier on the formwork anchors / inserts.

.12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Notify Departmental Representative prior to form removal.

.2 Form removal times are dependent on proper curing in accordance with CAN/CSA-A23.1 and CAN/CSA-S269.3. Provide written evidence of concrete strength to the Departmental Representative 24 hours prior to form removal to show the suitable strength has been achieved. Contractor shall pay for the concrete cylinder strength tests to demonstrate concrete strength prior to form removal.

.3 Leave formwork in place for following minimum periods of time after placing concrete.

.1 Two (2) days for walls.

.2 Two (2) days for footings and abutments.

.4 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring. No vehicle loading or backfilling of abutments shall take place until concrete reaches design strength, unless otherwise approved in writing by Departmental Representative.

.5 If formwork is used to aid curing, it shall not be removed until seven days after the concrete placement.

.6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 03 10 00 – Concrete Forming and Accessories

.4 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A143/A143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A780 / A780M 09 (2015), Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA-A23.3-14, Design of Concrete Structures.

.3 CSA-A23.4, Precast Concrete – Materials and Construction

.4 CAN/CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.5 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.6 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

.7 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.8 CSA S6-14, Canadian Highway Bridge Design Code

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315, except as noted herein. Shop drawings are to be submitted at least four (4) weeks prior to commencing fabrication for review and approval. The Contractor retains responsibility for correctly detailing reinforcement, but the shop drawings must be approved for conformity with the design. Fabrication shall not proceed until the final approval of shop drawings. Shop drawings shall be stamped by a Professional Engineer licensed to practice in the Province of Prince Edward Island.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details (Reference Table 3.3.1, Minimum Bend Diameter for Reinforcing Steel (400W)).

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices as specified / if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-S23.3, unless otherwise indicated.

.1 Provide Class B tension lap splices unless otherwise indicated.

1.4 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2.3 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.6 MEASUREMENT FOR PAYMENT

.1 Refer to Section 01 10 10 General Instructions for measurement for payment.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Departmental Representative.

.2 Reinforcing steel: billet steel, grade 400W (weldable), deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.3 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.4 Mechanical splices:

.1 The use of mechanical rebar splices shall be subject to approval of Departmental Representative.

.5 Wire ties: to CSA G30.3 plain, cold drawn annealed steel wire.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, except as noted herein (see Table 3.3.1).

.2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.5 Do not weld reinforcing steel.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

.1 All steel reinforcing bars shall have the necessary net sectional area, and shall be cut to the exact lengths, and bent cold to the exact forms and dimensions, shown on the approved plans, or otherwise required, before being placed in position. Bending shall be accurately done, in a bending machine and no welding or heating of any bars shall be allowed, except with written approval from the Departmental Representative. All stirrups and hoops shall accurately fit the rods, and all bends shall be taken out of bars to be used as straight members.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.3 CLEANING

.1 Clean reinforcing before placement.

3.4 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings.

.2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete placement.

.4 All reinforcing bars shall be placed and held rigidly in the exact positions in the forms as shown on the approved plans, or otherwise required, and there shall be no displacement of the same by the placing and tamping of the concrete. Adjusting or moving the bars, while the concrete is being placed, shall not be permitted, unless specified on the plans. Concrete protection required for reinforcing steel shall be in accordance with the Contract Documents, or as directed by the Departmental Representative. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the reinforcement, after being cleaned and placed in position, has been examined and approved by the Departmental Representative. The minimum bend diameter shall conform to the Table 3.3.1, below.

Table 3.3.1

Minimum Bend Diameter for Reinforcing Steel (400W)

Bar Size (mm)	Bend Diameter (mm)
10	70
15	90
20	150
25	200
30	250
35	300
45	450
55	600

3.5 SURFACE CONDITION

.1 Reinforcement (at time concrete is placed) to be free from mud, oil or other nonmetallic coatings that adversely affect bonding capacity.

.2 Reinforcement with rust, mill scale, or combination of both to be considered as satisfactory provided minimum dimensions, including height of deformations, and mass

of hand wire brushed test specimen are not less than specified requirements in applicable CSA Standards.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29.06 – Health and Safety Requirements

.3 Section 01 45 00 – Quality Control

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.5 Section 03 10 00 – Concrete Forming and Accessories

.6 Section 03 20 00 – Concrete Reinforcing

1.2 REFERENCES

.1 ANSI/ACI 117-06, Specifications for Tolerances for Concrete Construction and Materials and Commentary.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C457-08, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.

.4 ASTM C494/C 494M-13, Standard Specification for Chemical Admixtures for Concrete.

.5 ASTM C1017/C 1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM C1202-07, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A23.5, Supplementary Cementing Materials

.3 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.

.4 CSA S269.3-M92(R2008), Concrete Formwork.

.5 CAN/CSA-A3000-13, Cementitious Materials Compendium.

.1 CSA-A3001-13, Cementitious Materials for Use in Concrete.

.6 CSA S6-14, Canadian Highway Bridge Design Code

1.3 DESIGN REQUIREMENTS

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

.1 Concrete mixture designs shall be proportioned as normal density concrete in accordance with CSA-A23.1 latest edition, Alternative #1. Concrete shall be proportioned using Portland cement, Type SF silica fume, fly ash, fine and coarse aggregates, air entraining, water reducing, and superplasticizing and / or set retarding admixtures. Other supplementary cementing materials may include Class F fly ash. Set retarding admixtures may be used as ambient and site conditions warrant.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit the following at least four (4) weeks prior to the commencing concrete work:

.1 Certification from the qualified independent inspection and testing company that plant, equipment and materials to be used in the concrete comply with requirements of CSA-A23.1/A23.2.

.2 Manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:

.1 Portland cement

.2 Blended hydraulic cement

.3 Supplementary cementing materials

.4 Admixtures

.5 Water

.6 Aggregates

.3 Mix designs for concrete, mix proportions and aggregate sources, which will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.4 Certification for the concrete supplier from the Atlantic Provinces Ready Mixed Concrete Association – APRMCA Concrete Production Facilities Certification Program.

.3 Include in the submission of the mix designs, test results for each mix containing the following information:

.1 Plastic Concrete Tests

.2 Slump (CSA A23.2-5C)

.3 Air Content of Plastic Concrete by Pressure Method (CSA A23.2-4C)

.4 Mass Density and Yield (CSA A23.2-6C)

.5 Compressive Strength Testing (CSA A23.2-9C)

.6 2 cylinders to be tested at 28 days

.7 Air Void Analysis on Hardened Concrete (ASTM C457) tested at 7 days

.8 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (ASTM C1202) tested at 56 days

.9 Alkali Reactivity Test Results

.4 Submit four (4) weeks in advance of concrete placement, relevant test data for all aggregate materials indicating conformance to the requirements of CSA-A23.1 and this specification. The test results required, but not be limited to, shall include:

.1 Sieve Analysis of Fine and Coarse aggregate

.2 Amount of Material Finer than 80 μm in Aggregate

.3 Bulk Relative Density and Absorption of Fine and Coarse Aggregate (SSD basis)

.4 Fineness Modulus of Fine Aggregate

.5 Clay Lumps and Light Weight Pieces

.6 Test for Organic Impurities in Fine Aggregate

.7 Flat and Elongated Particles in Coarse Aggregates

.8 Petrographic Analysis of Coarse Aggregate (PN-NSTIR Test Method-2)

.9 Resistance to Degradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles machine

.10 Micro-Deval test for Coarse and Fine Aggregate

.11 Soundness of Coarse and Fine Aggregate by Use of Magnesium Sulphate

.12 Test for Detection of Alkali-Aggregate Reactivity (AAR) on Coarse and Fine Aggregate

.13 Unconfined Freeze and Thaw test

.5 Submit two (2) weeks prior to commencement of the project adequate details of all equipment to be used. Equipment shall include that required for transporting, handling, placement and curing of all concrete.

.6 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 – FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

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

.2 Submit to Departmental Representative, minimum of four weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.3 Minimum four weeks prior to starting concrete work, submit proposed quality assurance procedures for review by the Departmental Representative on the following items:

.1 Falsework erection

.2 Hot weather concrete

.3 Cold weather concrete

.1 Departmental Representative can provide expected provisions for cold weather concreting prior to submitting a procedure.

.4 Placement method(s)

.5 Curing

.6 Finishes

.7 Formwork Removal

.4 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 – PRODUCTS.

.5 Health and Safety Requirements: undertake occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to by Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

.2 The concrete materials shall be mixed and transported in a manner which will not segregate or damage the mix in any fashion. Concrete shall be mixed using stationary or truck mixers. The mixer shall carry the Manufacturer's rating plate in a prominent position that indicates the following:

.1 The gross volume of the mixer

.2 The rated maximum mixing capacity

.3 The minimum and maximum speeds for mixing and agitating of the mixer

.3 The mixer shall be capable of combining the concrete ingredients into a thoroughly mixed and uniform mass and shall not exceed the capabilities of the mixer.

.4 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.5 Where ready mix trucks are used to transport the concrete, the Departmental Representative reserves the right to subject any truck suspected of poor mixing to a uniformity test as outlined in CSA A23. If the truck fails the test, then the concrete and the truck shall be rejected at the sole cost of the Contractor unless otherwise directed by the Departmental Representative.

.6 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Use trigger operated spray nozzles for water hoses.

.3 Carefully coordinate the specified concrete work with weather conditions.

.4 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.

.5 Refer to Section 01 35 44 for requirements associated with the cleaning of concrete trucks and tools.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions collect liquid or solidify liquid

with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, provincial and national regulations.

.7 Choose least harmful, appropriate cleaning method which will perform adequately.

1.7 MEASUREMENT FOR PAYMENT

.1 Refer to Section 01 10 10 General Instructions for measurement for payment.

.2 Costs associated with cold and/or hot weather concreting shall be considered incidental to the work.

Part 2 Products

2.1 MATERIALS

.1 All cementing materials to CSA A3001.

.2 Cementing material to be a blended Portland cement, fly ash, silica fume cement. The minimum proportion by mass of the total cementing materials for silica fume shall be 6% and a maximum of 10%. The maximum proportion by mass of the total cementing material for fly ash is 20%.

.3 Water: to CSA A23.1 and to be free from injurious amounts of oil, acid, alkali soluble chloride, organic matter, sedimentation and other deleterious substances.

.4 Aggregates: to CSA A23.1/A23.2 for Class C-1 exposure, with a minimum 28 day compressive strength of 35 mPa..

.5 Coarse aggregates shall consist of washed crushed stone having a nominal size of 20 mm.

.6 Fine aggregate shall be washed and classified for conform to the gradation limits specified in CSA A23.1.

.7 The use of Alkali-Silica Reactive Aggregates shall not be permitted.

.8 Curing compound: to ASTM C309, Type 2.

.9 Joint sealer: self-leveling, two component sealant capable of remaining resilient over temperatures ranging from - 25° C to 35° C. Material will be capable of an elongation of 300%, have tensile recovery of 90% ASTM D412-75 (or latest edition), hardness of 25-35 Shore A and have a high bond strength to the concrete faces.

.10 Silane Sealer: self-penetrating, 100% silane, clear, breathable. Master Protect H 1000 or equal.

2.2 MIXES

.1 Prior to starting concrete work, submit to the Departmental Representative the proposed mix design(s) for approval. Mix design(s) to be in accordance with Alternative 1 of Table 11 in CSA A23.1-14 (or latest edition). Comply with additional requirements of CSA A23.1-14 (or latest edition), Section 15 for concrete placed near sea water.

.2 Use concrete mix (for both precast and cast-in-place) designed to produce air entrained concrete meeting the requirements for a Class C-1 exposure, with a minimum 28 day

compressive strength of 35 mPa, maximum water to cement ratio of 0.4 and air entrainment of 5-8%.

.3 Do not use calcium chloride or compounds containing calcium chloride.

.4 Weigh aggregates, cement, water and admixtures separately when batching. Inspect and test scales for accuracy as directed. Accuracy to be such that successive quantities can be measured to within one percent of desired amounts. Test certificates to be submitted to Departmental Representative upon request.

.5 Where seven day strength is less than 70% of specified 28 day strength, provide additional protection curing and make changes to mix proportions to the satisfactions of the Departmental Representative.

.6 Provide certification that plant, equipment and all materials to be used in concrete comply with the requirements of CSA A23.1-14 (or latest edition).

.7 Provide certification from independent testing and inspection company that mix proportions selected will produce concrete of specified quality and can be effectively placed and finished for all work under this contract.

2.3 FINISHES

.1 Provide uniform broom finish on top surface of concrete deck.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete. Provide 24 hours minimum notice prior to placing concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after review of equipment and mix by Departmental Representative.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application of concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 Remove all debris including sawdust, chips and any other deleterious materials from the interior of the forms.

.11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 CONSTRUCTION

.1 Perform cast-in-place concrete work to CSA A23.1/A23.2.

.2 Concrete shall not be placed when the air temperature exceeds 25°C or is likely predicted to rise above this temperature during placement. The temperature of the formwork, reinforcing steel or other material on which the concrete is placed shall not exceed 25°C.

.3 When there is a probability of the air temperature falling below 5 °C within 24 h of placing (as forecast by the nearest official meteorological office), all materials and equipment needed for adequate protection and curing shall be on hand and ready for use before concrete placement is started. If the temperature of the concrete is expected to drop below 5 °C then protection is required. All snow and ice shall be removed before concrete is deposited on any surface. Calcium chloride or other de-icing salts shall not be used as a de-icing agent in the forms.

.4 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through structural members, except where indicated or approved by Departmental Representative.

.2 Place electrical conduits and conduit expansion joints in slab at indicated locations. Ensure conduit expansion joints are cast in such a way that they are free to move longitudinally after the slabs on each side of the expansion joint are cast.

.3 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.4 Sleeves and openings greater than 100 x 100 mm not indicated must be reviewed by Departmental Representative.

.5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.

.6 Check locations and sizes of sleeves and openings shown on drawings.

.7 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.5 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 When setting anchor bolts, care shall be taken to not only ensure that the anchor bolts are set in the correct position and orientation, but also that sufficient thread extension is provided to facilitate bolting the assembly to the concrete, complete with compatible nuts and washers (plate washers where specified), as per the detailed on the Contract Drawings.

.6 Placing of concrete:

.1 Contractor is responsible for the placing method used.

.2 Concrete shall be delivered to the point of final deposit in a manner satisfactory to the Departmental Representative using means and equipment which will prevent segregation or loss of materials.

.3 The size of section to be placed in one continuous operation shall be as detailed on the drawings or as directed by the Departmental Representative.

.4 Unless otherwise authorized by the Departmental Representative, forms shall be kept dry during the placing of the concrete until the concrete has reached initial set.

.5 Concrete shall be deposited in the forms in maximum lifts of 500 mm and in layers that are approximately horizontal and as close as practicable to its final position.

.6 Concrete shall not be moved horizontally with vibrators or by other methods which could cause segregation.

.7 Under adverse weather conditions the Contractor shall be prepared to provide suitable protection in order to prevent damage to concrete.

.8 Consolidation:

.1 All methods of consolidation shall be subject to the approval of the Departmental Representative.

.2 Concrete shall be consolidated thoroughly and uniformly by means of hand tamping, vibrators or finishing machines to obtain a dense, homogeneous structure, free from cold joints, voids and honeycomb.

.3 A sufficient number of vibrators shall be employed to adequately handle the anticipated rate of placement. The size and frequency of vibrators shall be as specified in CSA A23.1. A stand-by vibrator shall be available on the site at all times.

.4 Internal vibrators shall be used wherever practicable. External type vibrators may be used where surfaces cannot be properly consolidated with the internal type alone.

.5 Insertion of internal vibrators shall be made systematically at intervals such that the zones of influence of the vibrator overlap.

.6 Extreme care shall be taken to ensure that the internal type vibrators do not displace the reinforcing steel or the forms. Vibrators shall have rubber or non-metallic vibrating heads.

.9 Curing concrete:

.1 Concrete shall be protected from freezing, premature drying, high temperature and moisture loss for a period of time necessary to develop the desired properties of the concrete.

.2 Curing shall be applied to concrete as soon as possible without damaging or marring the surface.

.3 Curing compounds shall conform to ASTM C309 Type 2.

.4 All fresh placed and consolidated concrete shall be suitably protected from the elements and from defacement due to construction activities, traffic and vandals. The effects of direct sunshine, drying winds, cold, excessive heat and running water are particularly harmful. The concrete shall be protected by the use of adequate tarpaulins or other suitable material to completely cover, or enclose, all freshly finished surfaces.

.5 The curing time and methods shall be as indicated in CSA A23.1.

.6 Hot Weather Concreting (if approved by Departmental Representative):

.1 When the air temperature is at or above 25˚C, or is likely to rise above 25˚C within 24 hours, special measures, as detailed in CSA A23.1 shall be taken by the Contractor to protect the concrete from the effects of hot and /or drying weather conditions.

.2 The temperature of the formwork, reinforcing steel or the material on which the concrete is to be placed, shall not exceed 25˚C. Concrete temperatures shall not exceed those specified in CSA A23.1, Table 16.

.7 Cold Weather Concreting:

.1 When the mean air temperature is at or below 5˚C or when the temperature is likely to fall below 5˚C within 24 hours, the Contractor shall place, cure and protect concrete in accordance with CSA 23.1 section 7.1.2, Cold Weather Concreting and this specification.

.2 Concrete shall not be placed on or against any surface which is at a temperature less than 5˚C. Snow and ice shall be removed before concrete is deposited on any surface.

.3 Calcium chloride or other de-icing chemicals shall not be used as a de-icing agent in the forms.

.4 If heating of the mix water and/or aggregates is approved for use, the charging cycle shall be altered to prevent flash setting of the concrete.

.5 Aggregates and water shall not be heated above 80˚C. Water and/or aggregates heated to a temperature in excess of 40˚C, prior to the addition of the cementing materials shall be approved by the Departmental Representative.

.6 All frozen lumps of aggregate shall be excluded from the mix.

.10 Protection Classes:

.1 Protection and curing depends upon the outside temperature, the wind velocity, and the size of the concrete section.

.2 Under normal circumstances the following methods of protection may be required to maintain the protection necessary for the conditions described.

.3 Heating of the mixing water and/or aggregates shall be required for all classes of protection.

.4 When the outside temperature during placing or during the protection period may fall below 5˚C, adequate covering of all surfaces with tarpaulins or polyethylene sheets shall be provided.

.5 When the outside temperature during placing or during the protection period may fall below 0˚C, all surfaces shall be covered with an approved insulating material, over which tarpaulins or polyethylene sheets are placed.

.6 When the outside temperature during placing or during the protection period may fall below -5˚C, a complete housing of the concrete, together with supplementary heat, shall be provided. The Contractor shall ensure that heat is supplied uniformly around the concrete.

.7 For mass concrete, defined as minimum section dimension in excess of 2 m, the temperature gradient shall not exceed 20˚C/m from the interior of the element to the exterior face.

.8 In thin sections, less than 2 m, the temperature differential from the interior to the exterior shall not exceed 20˚C.

.7 Finishing of Concrete:

.1 Basic Treatment:

.1 Upon removal of the forms, all cavities, honeycomb, and other deficiencies shall be patched with sand cement mortar of the same composition as that used in the concrete.

.2 Mortar shall be composed of cement, fine aggregate and water, proportioned and mixed as specified.

.3 When the proportioning of cement and fine aggregate is not specified, the mortar shall consist of one (1) part by volume of cement and two (2) parts of fine aggregate.

.4 The quantity of water used in mixing the mortar shall be sufficient to make it capable of being freely spread with the trowel.

.5 Mortar shall be mixed in quantities which can be utilized within 60 minutes.

.6 Mortar shall not be re-tempered or re-mixed with water after initial set.

.7 All bolts, ties, nails, or other metal not specifically required for construction purposes, shall be removed or cut back to a depth of 25 mm from the surface of the concrete unless otherwise directed by the Departmental Representative.

.8 The cavity shall be kept saturated for 60 minutes prior to the application of latex bonding agent or neat cement paste.

.9 The mortar shall be pressed or packed into the depressions so as to completely fill the cavity and then finished to match the adjacent surface.

.10 Fins, unsightly ridges, or other imperfections shall be chipped or rubbed off flush with the surface.

.11 Mortar patches in excess of 25 mm shall be applied in layers not exceeding 25 mm with a 30 minute interval between the placing of layers.

.12 The surface of the patch shall be textured equivalent to the adjacent concrete.

.13 Honeycomb areas or cavities over 25 mm in diameter shall not be repaired until inspected by the Departmental Representative.

.14 Where honeycombing has occurred in non-structural elements, the affected area shall be removed and filled with mortar as previously described.

.15 Where honeycombing has occurred in structural elements, the corrective method of treatment shall be carried out as directed by the Departmental Representative.

.16 All concrete and mortar shall be cured and protected in accordance with CSA A23.1.

.2 Seal all concrete surfaces with a silane sealer.

.8 Concrete tolerance in accordance with CSA-A23.1/A23.2.

3.3 CRACKS

.1 Repair all cracks greater than 0.2mm in width with an epoxy injection grout. Repair methods and materials to be submitted to a Departmental Representative for approval.

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and Section 1.6, Quality Assurance, of this Section and submit report as described in PART 1 - SUBMITTALS.

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.

.2 Carry out tests for slump, air content, compressive strength and temperature in conformance with CAN/CSA A23.1 and CAN/CSA A23.2

.3 Frequency of testing as follows:

.1 Air, Slump and Temperature: one test for each load of concrete until satisfactory control is established daily and rate of placement > 35 m^3 per hour; then one (1) test for each three (3) loads of concrete. Satisfactory control is considered to have been established when tests on five consecutive loads or batches or concrete are within specification requirements.

.2 Concrete shall be tested for slump, air content and temperature prior to and after the addition of superplasticizer (if added on site). Testing shall be carried out at the point of discharge from the truck and as close as possible to the final deposit into the forms. Sufficient superplasticizer shall be added to produce the desired consistency and if added on site, the superplasticizer shall be mixed into the load a minimum of five minutes prior to retesting.

.3 A set of three regular compressive strength cylinders shall be made for every 50 m^3 of concrete placed, or fraction thereof, or as directed by the Departmental Representative. In addition, for every regular set of three cylinders, two additional cylinders will be cast to be tested only if requested by the Departmental Representative for appeal purposes.

.4 The responsibility for casting any additional cylinders required for interim testing lies with the Contractor.

.5 Ensure there is no accelerated curing of concrete cylinders

.2 The Departmental Representative shall have the right to sample and test all materials used in the mixture design and given access to the production facilities of the ready mix supplier. Materials failing to meet requirements to be immediately rejected.

.3 Ensure test results are distributed to all parties.

.4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

.5 Departmental Representative may take additional test cylinders as required. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.7 Inspection or testing by Departmental Representative will not relieve Contractor of their contractual responsibility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 03 30 00 – Cast-in-Place and Precast Concrete

.4 Section 05 12 23 – Structural Steel

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A 36/A36M-01, Specification for Structural Steel.

.2 ASTM A 193/A193M-01b, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

.3 ASTM A 325-02, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.4 ASTM A 325M-00, Specification for High Strength Bolts, for Structural Steel Joints Metric.

.5 ASTM A 490M-00, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).

.6 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.7 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).

.1 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2-75, Quick-Drying, Primer for use on Structural Steel.

.4 Canadian Standards Association (CSA International)

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA-S16-14, Design of Steel Structures.

.4 CAN/CSA-S136-94 (R2001), Cold Formed Steel Structural Members.

.5 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.6 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.7 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.8 CSA S6-14, CSA S6 Canadian Highway Bridge Design Code (CHBDC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Prince Edward Island, Canada.

.3 Indicate materials, all necessary geometric details, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.

.2 Provide mill test reports certified by metallurgists qualified to practice in Province of Prince Edward Island, Canada.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer’s installation instructions and manufacturer’s warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials from damage.

.2 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations.

.2 Replace defective or damaged materials with new.

.3 Packaging Waste Management: as much as possible, remove for reuse by manufacturer any pallets, crates, padding and packaging materials.

1.6 WASTE MANAGEMENT DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.7 MEASUREMENT FOR PAYMENT

.1 Structural Steel, Galvanized Structural Steel, Tie rods, Mooring Cleats, Ladders and holdfasts will be measured in accordance with Section 01 10 10.

Part 2 Products

2.1 MATERIALS

.1 Refer to Section 31 62 13.16 Steel Sheet Piles for steel sheet pile specifications.

.2 Steel plates and rolled sections: to CSA G40.20/G40.21, Grade 350W.

.3 HSS: to ASTM A500, Grade C.

.4 Tie-Rods:

.1 Rods to ASTM A615, Grade 517 mPa continuously threaded bar. Size as indicated on the drawings.

.2 Turnbuckles and heavy hex nuts shall be capable of developing the full yield capacity of the threaded bar.

.3 Preassemble, mark and test tie rod assemblies in shop. Align threaded connection to following tolerances at sleeve nut or connector sleeve: 1/80 of normal rod diameter, deviation of centre line, 1 in 160.

.5 Reuse existing metal fabrications where indicated on the drawings.

.6 Welding: in accordance with CSA W59, latest edition.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Where possible, fit and shop assemble work, ready for erection.

.3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Existing metal fabrications indicated to be reused shall be cleaned of surface rust using hand tools only. Care shall be taken to maintain the structural integrity of the parts while cleaning. Coat all reused fabrications using a rust inhibiting acrylic resin spray paint prior to re-installation. Colour to be flat black and shall be installed as per manufacturer's recommendations.

.2 All metal fabrications shall have the following finishes (unless noted otherwise):

.1 Curb assemblies including fastening hardware (any required shims) and any attachments to the rail: Hot dip galvanizing to CAN/CSA G164, minimum zinc coating of 760 g/m2.

.3 The following structural steel elements shall be un-coated:

.1 Walers, cap plates, ladders, fabrications for transition ramps, and tie-rods.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 MARKING

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.3 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with approved shop drawings.

.2 Field cutting or altering structural members: to approval of the Departmental Representative.

.3 Supply components for work by other trades in accordance with shop drawings and schedule.

.4 Touch-up damaged galvanized surfaces with a minimum of 2 coats zinc rich primer.

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship may be carried out by testing laboratory designated by the Departmental Representative.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by the Departmental Representative.

.3 Submit test reports to the Departmental Representative within 2 weeks of completion of inspection.

.4 The Departmental Representative will pay costs of tests as specified in Section 01 45 00.

3.5 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt. Cleaning shall meet the approval requirements of the Departmental Representative. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction. Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 61 00 Common Product Requirements

1.2 REFERENCES

.1 ASTM International

.1 ASTM A123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-[11], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.

.3 ASTM D1761-[06], Standard Test Methods for Mechanical Fasteners in Wood.

.2 CSA International

.1 CSA B111-[1974(R2003)], Wire Nails, Spikes and Staples.

.2 CSA O141-[05(R2009)], Softwood Lumber.

.3 CAN/CSA-Z809-[08], Sustainable Forest Management.

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber [2010].

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Prince Edward Island, Canada.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FENDERS, STRUCTURE 405 ACCESS RAMP

.1 Description:

.1 Sustainability Characteristics:

.1 Lumber, CAN/CSA-Z809 or FSC or SFI certified.

.2 Heavy Timber Framing and Decking:

.1 Lumber required for ramp construction shall be salvaged from the existing Structure 403.

2.2 WOOD TREATMENT

.1 Preservative: in accordance with manufacturer's recommendations for surface conditions:

.1 Preservative: VOC limit [350] g/L maximum to [SCAQMD Rule 1113].

.2 All timber shall be treated with CCA (chromated copper arsenate) preservatives in accordance with CSA O80 Series 15, water borne salt preservative (24 kg/m^3).

.3 Use of creosote oil not permitted.

.4 Apply a liberal coat of wood preservative in the field to all cut ends and bored holes.

2.3 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111.

.2 Bolts and lag screws: 19 mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Fastener Finishes:

.1 Galvanizing: to ASTM A123/A123M, use galvanized fasteners for all connections.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 REMOVAL OF EXISTING TIMBER FOR REUSE

.1 Where indicated, carefully remove existing timber by extracting connections by hand.

.2 Handle removed materials carefully. Repair any damaged coatings resulting from the removal process.

3.3 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Re-treat surfaces exposed by field cutting, trimming or boring with liberal brush application of preservative before installation.

.3 Treat all new wood components with preservative.

3.4 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with "crown-edge" up.

.4 Select exposed framing for appearance. Install lumber materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.5 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.6 Countersink bolts where necessary to provide clearance for other work.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse, recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 Reference Standards:

.1 CSA Group

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical equipment and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Submit for review single line electrical diagrams under plexiglass and locate on wall of electrical building.

.1 Electrical distribution system in main electrical room.

.4 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.4 If changes are required, notify Departmental Representative of these changes before they are made.

.5 Certificates:

.1 Provide CSA certified equipment.

.2 Where CSA certified equipment is not available, submit such equipment to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.6 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in a clean, dry and well-ventilated area.

.2 Store and protect equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates, labels for control items in English.

.4 Use one nameplate for each language.

2.2 MATERIALS AND EQUIPMENT

.1 Provide equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment to be CSA certified. Where CSA certified equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 DECAL signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. _____" as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Prime	Auxiliary	
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue

Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to consist of:

- .1 Connector body and stud clamp for stranded copper conductors.
- .2 Clamp for stranded copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Bolts for aluminum conductors.
- .6 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable aluminum sheathed cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductor cables and:

- .1 Apply coat of zinc joint compound on conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
- .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with NEMA.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets crates padding packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE, Non Jacketted.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TWU rated at 600 V.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper as indicated.

.2 Circuit conductors: copper as indicated, size as indicated.

.3 Insulation:

.1 Ethylene propylene rubber EP.

.2 Cross-linked polyethylene XLPE.

.3 Rating: 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 600 mm centers.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90 - lead sheath over cable assembly and under armour.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.

.5 Connectors: anti short connectors.

2.4 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: cross linked polyethylene type RA90 rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated seamless sheath.

.4 Outer jacket: none.

.5 Fastenings for aluminum sheathed cable:

.1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at 600 mm centers.

.3 Threaded rods: 6 mm diameter to support suspended channels.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by straps.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.6 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA Group

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from Departmental Representative and include it with maintenance manuals.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2No.41.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, size as required.

.3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.

.4 Plate electrodes: copper, surface area 0.2 m^2, minimum 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.6 Insulated grounding conductors: green, copper conductors, size as indicated.

.7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.11 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.12 Ground secondary service pedestals.

3.3 MAINTENANCE HOLES

.1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each maintenance hole.

.2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.4 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod electrodes and make grounding connections as indicated.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0 AWG copper conductors for connections to electrodes.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.5 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 240 V system.

3.6 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.7 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.2 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.3 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.4 For surface mounting of two or more conduits use channels at 1 m on centre spacing.

.5 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.6 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.7 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.9 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on turned edge covers.

2.3 CABINETS

.1 Construction: welded stainless steel as indicated hinged door, handle, latch lock 2 keys and catch.

.2 Type E Empty: surface return flange mounting as indicated.

.3 Type T Terminal: surface return flange mounting as indicated containing 19 mm G1S fir plywood backboard.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating system name and voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

.1 Cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-05, Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Epoxy coated conduit: CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.

.3 Surface mount conduits except where indicated.

.4 Use epoxy coated conduit where indicated.

.5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.

.6 Use rigid pvc conduit underground.

.7 Use flexible metal conduit for connection to surface or recessed fixtures.

.8 Minimum conduit size for lighting and power circuits: 19 mm.

.9 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.10 Mechanically bend steel conduit over 19 mm diameter.

.11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.12 Install fish cord in empty conduits.

.13 Run 2- 25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.14 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for service equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect service equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 EQUIPMENT

.1 Cabinet type 'A' for utility revenue metering: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets, size as indicated.

.2 Ground fault equipment: in accordance with Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for service equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Install ground fault equipment.

.5 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.6 Make provision for power supply authority's metering.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA Group

.1 CSA C22.2 No.31-10, Switchgear Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for service entrance board and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Floor anchoring method and foundation template.

.2 Dimensioned cable entry and exit locations.

.3 Dimensioned position and size of bus.

.4 Overall length, height and depth.

.5 Dimensioned layout of internal and front panel mounted components.

.2 Include time-current characteristic curves for circuit breakers and fuses.

.4 Test and Evaluation Reports:

.1 Submit six (6) copies of certified test results.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for service entrance board for incorporation into manual.

.3 Submit 6 copies of operation and maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect service entrance board from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service Entrance Board: to CSA C22.2 No.31.

.2 Rating: 600 V, 3 phase, 4wire, 400 A, short circuit current 25 kA (rms symmetrical).

.3 Cubicles: free standing, dead front, size as indicated.

.4 Barrier metering section from adjoining Sections.

.5 Provision for installation of power supply authority metering in barriered Section.

.6 Distribution section.

.7 Hinged access panels with captive knurled thumb screws.

.8 Bus bars and main connections: 99.3% copper.

.9 Bus from load terminals of main breaker via metering section to main lugs of distribution section.

.10 Cable from load terminals of main breaker to metering section and bus from metering section to lugs of distribution section.

.11 Identify phases with colour coding.

2.2 MOULDED CASE CIRCUIT BREAKERS

.1 _____.

2.3 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for size 1/0 grounding cable.

2.4 POWER SUPPLY AUTHORITY METERING

.1 Separate compartment and metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by power supply authority:

.1 Current transformers.

2.5 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.

.1 Service entrance board exterior: gray.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplates:

.1 White plate, black letters, size 7.

.2 Complete board labelled: "120/240 V."

.3 Main disconnect labelled: "Main Breaker ".

.4 Branch disconnects labelled: "Feeder No. 1", "Feeder No. 2", "Feeder No. 3", as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for service entrance board installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate service entrance board and fasten to wall.

.2 Connect main secondary service to line terminals of main breaker.

.3 Connect load terminals of distribution breakers to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run one grounding conductor 4/0 AWG bare copper in 25 mm conduit from ground bus to building ground.

.6 Check trip unit settings fuse sizes against co-ordination study to ensure proper working and protection of components.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environmental Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum stainless steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Cover: tamperproof, bolt-on, domed to shed water.

.5 Door: 3 point latching, with padlocking means.

.6 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.

.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V single pole switches, to: CSA C22.2 No.55 CSA C22.2 No.111.

.2 Manually operated general purpose AC switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle.

.3 Toggle operated fully rated for tungsten filament and LED lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

- .1 White urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

- .1 White urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

- .1 Marine grade receptacles for all receptacles located on the wharf deck surface.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.4 Weatherproof "while in use" heavy duty cover plates, complete with gaskets for duplex receptacles as indicated.

.5 Weatherproof "while in use" cover plates complete with gaskets for single receptacles or.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height as indicated.

.3 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.144-M91(R2006), Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2-1999(R2009), Application Guide for Ground Fault Protection Devices for Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No.144 NEMA PG 2.2.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

.1 Solid state ground sensing device.

.2 Facility for testing and reset.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Pass phase conductors including neutral through zero sequence transformers.

.3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.

.2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.

.3 Demonstrate simulated ground fault tests.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.3 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International)

.5 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by the Consultant.

.3 Photometric data to include spacing criterion.

.3 Quality assurance submittals: provide following in accordance with Section01 45 00 - Quality Control.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Products

2.1 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.2 OPTICAL CONTROL DEVICES

.1 As indicated on the drawings.

2.3 LUMINAIRES

.1 As indicated on the drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, AC.

.3 Output voltage: 12 V DC.

.4 Operating time: 60 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 2.5 W.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: White.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA Group

.1 CSA C22.2 No.206-13, Lighting Poles.

.2 CAN/CSA-O15-05(R2009), Wood Utility Poles and Reinforcing Stubs.

.3 CAN/CSA-O80 Series-08(R2012), Consolidated - Wood Preservation.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for roadway lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect roadway lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 ALUMINUM POLES

.1 Aluminum poles: to CSA C22.2 No.206 designed for underground wiring and:

.1 Mounting on concrete anchor base without transformer base.

.2 Style: monotube, round tapered G063-T6 aluminum, wall thickness 6 mm.

.3 Straight for 1 luminaire mounting brackets.

.4 Tapered davit for 1 luminaire.

.5 Access handhole 610 mm above pole base for wiring connections, with welded-on reinforcing frames bolted-on cover.

.6 Size: 208 mm x 150 mm x 5.48 m.

.7 Anchor bolts: 27 mm x 914 mm steel with shims, nuts, washers and covers.

.8 Finish: semi-lustrous satin by rotary sand process.

.9 Grounding lug.

2.2 LUMINAIRE MOUNTING BRACKETS

.1 Mounting brackets aluminum for specified luminaires:

.1 Arm extension length: 2.4 m.

.2 Single tapered davit type.

2.3 LUMINAIRES

.1 Luminaire with cast aluminum weatherproof housing and:

.1 Lamp type: LED wattage: 75watt.

.2 Color Temperature: 4000K

.3 IP67 rated.

.4 Driver: 120 V, 1 lamp, in accordance with Section 26 50 00 - Lighting.

.5 Light Distribution:

.1 IES distribution Type III.

.6 Self-locking latches of stainless steel and aluminum.

.7 Factory wired terminated at terminal block.

.8 Complete with integral photocell.

.9 Complete with bird spikes.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roadway lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install poles true and plumb, complete with brackets in accordance with manufacturer's instructions.

.2 Install luminaires on single or double pole davits and indicated on the drawings.

.3 Check luminaire orientation, level and tilt.

.4 Connect luminaire to lighting circuit.

.5 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 31 61 13 – Pile Foundations, General Requirements

.3 Section 31 62 16.13 – Steel Sheet Piles

1.2 MEASUREMENT AND PAYMENT

.1 Payment for this item shall be as per Section 01 10 10.

1.3 REFERENCES

.1 All reference standards in this section shall be current issue or latest revision at the first date of project tender advertisement.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A252-98 (2002), Standard Specification for Welded and Seamless Steel Pipe Piles.

.2 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.

.3 ASTM A325M-05, Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength Metric.

.4 ASTM A490M-04a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.2 CAN/CSA-S16-14, Design of Steel Structures.

.3 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.

.4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) (metric version).

.6 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC).

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.

.2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.

.5 The Master Painters Institute (MPI)/Architectural Painting Specification Manual, (ASM-[February 2004]).

.1 MPI #19, Inorganic Zinc Rich Primer.

.6 The Society of Protective Coatings (SSPC)

.1 SSPC-SP 5/NACE No.1-[2000], White Metal Blast Cleaning Joint Surface Preparation Standard.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements: design templates to safely withstand following loads:

.1 Gravity loads to which template are subjected.

.2 Lateral loads to firmly hold pile in position when driving.

1.5 SUBMITTALS

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

.2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.

.1 Include product characteristics, performance criteria, and limitations.

.3 Submit shop drawings and indicate following items:

.1 Material.

.2 Anchorage, field control and alignment methods.

.3 Design parameters.

.4 Tolerance for driving pile.

.5 Removal method.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21- Type 350W.

.2 Welding materials: to CSA W48 and CSA W59.

.3 Bolts, nuts and washers: to ASTM A325.

2.2 FABRICATION

.1 Fabricate structural steel for templates: to CAN/CSA-S16.

.2 Welding: to CSA W59.

.3 Use welding companies qualified under CSA W47.1.

Part 3 Execution

3.1 GENERAL

.1 The design of pile templates are the responsibility of the Contractor. All pile template designs shall be stamped by a Professional Engineer Licensed to Practice in the Province of Prince Edward Island, Canada.

3.2 POSITIONING

.1 Position and hold template in location to receive piles.

.1 Ensure pile positions are within tolerances specified.

.2 Secure templates to piles in accordance with shop drawings

3.3 REMOVAL OF TEMPLATES

.1 Avoid damage to piling when removing templates.

.2 When instructed by Departmental Representative, remove templates from Project site.

3.4 PROTECTION

.1 Protect templates from damage.

.2 Repair damage to templates, formwork or concrete arising from operations as reviewed by Departmental Representative at no extra cost.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 44 - Environmental Procedures.

.3 Section 01 50 00 - Temporary Facilities.

.4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.5 Section 02 41 13 – Selective Site Demolition.

.6 Section 31 32 19.01 – Geotextiles.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 117-[95], Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C 136-[96a], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D 422-[98], Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D 698-[00a], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ^{3}) (600 kN-m/m ^{3}).

.5 ASTM D 1557-[00], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ^{3}) (2,700 kN-m/m ^{3}).

.6 ASTM D 4318-[00], Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-A3000-[98]-A5-[98], Portland Cement.

.2 CAN/CSA-A23.1-[00], Concrete Materials and Methods of Concrete Construction.

1.3 SUBMITTALS

.1 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Inform a Departmental Representative at least 4 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.

.3 Upon Request, submit 70 kg samples of type of fill specified including representative samples of excavated material.

.4 Upon request, ship samples prepaid to an address specified by the Departmental Representative in tightly closed containers to prevent contamination.

1.4 MEASUREMENT FOR PAYMENT

.1 Excavation and disposal will be measured in accordance with Section 01 10 10.

Part 2 Products

2.1 MATERIALS

.1 See Section 31 37 00 for fill material specifications.

.2 See Section 31 32 19.01 for geotextile specifications.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 STOCKPILING

.1 Stockpile fill materials in the laydown area. Stockpile granular materials in a manner to prevent segregation.

.2 Protect fill materials from contamination.

3.3 VERIFICATION OF UNDERSIDE OF EXISTING CRIBS

.1 As indicated in the drawings, the elevation of the underside of the existing timber cribs is unknown. The contractor is responsible to identify the underside of each crib by any means necessary in order to ensure the stability of the existing crib during excavation.

3.4 EXCAVATING ADJACENT TO EXISTING STRUCTURES #404 AND #409

.1 Structures #404 and #409 are bulkhead structures. Do not excavate within 4.0m of the perimeter of the structures. Removal of the marine sediments adjacent to the structures must be achieved by displacement of the material from the placement of the new rock fill adjacent to the structure and working outward.

3.5 EXCAVATION

.1 Advise a Departmental Representative at least 7 days in advance of excavation operations.

.2 Excavate to lines, grades, elevations and dimensions as directed by a Departmental Representative. The excavation limit directly adjacent to the existing timber cribs shall be the elevation of the underside of the crib or the excavation limit, whichever is higher. If the underside of crib is above the excavation limit, maintain stable slopes adjacent to the crib down to the excavation limit indicated.

.3 Remove concrete and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.4 Excavation must not interfere with bearing capacity of adjacent foundations.

.5 Dispose of surplus and unsuitable excavated material in approved location.

.6 Do not obstruct flow of surface drainage or natural watercourses.

.7 Install geotextiles in accordance with Section 31 32 19.01 – Geotextiles.

3.6 FILL TYPES AND COMPACTION

.1 All fill materials will be in accordance with Section 31 37 00 – Fills. Compaction densities are percentages of maximum densities obtained from ASTM D 698. See Section 31 37 00 for compaction requirements for different fills.

3.7 BACKFILLING

.1 Do not proceed with backfilling operations until a Departmental Representative has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.25 m.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from a Departmental Representative.

.6 Install geotextiles in backfill in accordance with section 31 32 19.01 – Geotextiles as directed by a Departmental Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation of polymeric geotextiles, the purpose of which is to:

.1 Separate and prevent mixing of granular materials of different grading both within the wharf reconstruction and embankment, as detailed.

.2 Provide protection to the HDPE Geomembrane and reinforce the cap of the containment area.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 31 32 19.02 – Scrim-Reinforced HDPE Geomembrane

1.3 MEASUREMENT PROCEDURES

.1 Refer Sections 01 10 10 and 01 29 10.

1.4 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D 3786, Standard Test Method for Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method.

.2 ASTM D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.

.3 ASTM D 4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

.4 ASTM D 4632. Grab Tensile strength test.

.5 ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.6 ASTM D 4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

.7 ASTM D 6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products using 50-mm Probe.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2-M89, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Geomembranes.

.1 No. 2-M85, Mass per Unit Area.

.3 CAN/CSA G40.21, General Requirements for Rolled or Welded Structural Quality Steel

1.5 SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to a Departmental Representative following samples at least 4 weeks prior to beginning Work.

.1 Minimum length of 2 m of roll width of each geotextile or geomembrane.

1.6 DELIVERY, STORAGE AND HANDLING

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

1.7 MEASUREMENT FOR PAYMENT

.1 Refer to Section 01 10 10 General Instructions for measurement for payment.

Part 2 Products

2.1 MATERIAL

.1 Geotextile: Needle-punched non-woven synthetic fiber fabric, supplied in rolls.

.1 Width: 3.5 m minimum. Length: 150 m minimum.

.2 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 400 g/m².

.3 Apparent Opening Size to ASTM D4751.

.4 Grab Tensile Strength: to ASTM D4632, minimum 1300 N.

.5 Elongation: to ASTM D4632, 45-105 %.

.6 Puncture Resistance: to ASTM D4833, minimum 800 N.

.7 Mullen Burst: to ASTM D3786, minimum 400 N.

.8 UV Stability: to ASTM D4355, minimum 70% @ 500h.

.2 Geotextile: Woven synthetic polypropylene-yarn fiber fabric, supplied in rolls.

.1 Width: 3.5 m minimum. Length: 150 m minimum.

.2 Grab Tensile Strength: to ASTM D4632, minimum 1400 N (MD, CD)

.3 CBR Puncture Strength: to ASTM D6241, minimum 4000 N

.4 Trapezoid Tear Strength: to ASTM D4533, minimum 500 N (MD, CD)

.5 UV Stability: to ASTM D4355, minimum 70% @ 500h

.3 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164.

Part 3 Execution

3.1 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with pins or weights.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Cut geotextile around driven piles such that the material lays flat on the excavated surface.

.5 Overlap each successive strip of geotextile approximately 600 mm over previously laid strip.

.6 Pin successive strips of geotextile with securing pins at 600 mm interval at mid-point of lap.

.7 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.8 After installation, cover with overlying layer within 4 h of placement

.9 Replace damaged or deteriorated geotextile to approval of a Departmental Representative.

.10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

3.2 PROTECTION

.1 Vehicular traffic not permitted directly on geotextiles.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation of a scrim-reinforced geomembrane, the purpose of which is to:

.1 Act as a barrier to water from entering the containment area.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 31 32 19.01 – Geotextiles.

1.3 MEASUREMENT PROCEDURES

.1 Refer Sections 01 10 10 and 01 29 10.

1.4 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D413 – Standard Test Methods for Rubber Property – Adhesion to Flexible Substrate.

.2 ASTM D751 – Standard Test Methods for Coated Fabrics.

.3 ASTM D1777 – Standard Test Method for Thickness of Textile Materials.

.4 ASTM D4437 – Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

.5 ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

.6 ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

.7 ASTM D5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

.8 ASTM D5397 – Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembrane Using Notched Constant Tensile Load Test.

.9 ASTM D5641 – Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

.10 ASTM D5820 – Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

.11 ASTM D6392 – Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

.12 ASTM D7003 – Standard Test Method for Strip Tensile Properties of Reinforced Geomembranes.

.13 ASTM D7004 – Standard Test Method for Grab Tensile Properties of Reinforced Geomembranes.

.14 ASTM D7747 – Standard Test Method for Determining Integrity of Seams Produced Using Thermo-Fusion Methods for Reinforced Geomembranes by the Strip Tensile Method.

.15 ASTM D7749 – Standard Test Method for Determining Integrity of Seams Produced using Thermo-Fusion Methods for Reinforced Geomembranes by the Grab Method.

.16 ASTM G151 – Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources.

.17 ASTM G154 – Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

1.5 SUBMITTALS

.1 Submit samples and shop drawings in accordance with Section 01 33 00 - Submittal Procedures at least 4 weeks prior to the beginning of work.

.2 Submit to a Departmental Representative following samples at least 4 weeks prior to the beginning of work.

.1 Minimum length of 2 m of roll width

.2 Minimum of 1 m seam with at least 300 mm of each geomembrane on both sides of seam.

.3 Indicate installation layout, dimensions and details, including fabricated and field seams, anchor trenches, and protrusion details.

.4 Product Data:

.1 Provide specification sheets for geomembrane.

.2 Provide mill test reports for geomembrane roll stock used to make liner.

.3 Provide shop test reports for each fabricated panel produced.

.4 Provide field test reports for all welds completed in the field.

1.6 QUALITY ASSURANCE

.1 Submit copies of material index quality control tests at least four weeks prior to start of the work.

.1 Material index quality control tests shall be performed a minimum of every 18 000 kg, once per shift, or at the start of a new material run.

.2 Each roll of geomembrane shall be labeled with; roll identification, roll number, thickness, roll dimensions, resin type, and date of manufacture.

.2 Submit certificates that the material meets manufacturer’s specification at least two weeks prior to delivery of the materials to the job site.

.3 Follow documented installation plan and work procedures.

.4 The installation shall be supervised by an engineer licensed in the Province of Prince Edward Island. This engineer shall be engaged and compensated by the winning bidder and shall furnish a certificate of compliance stating that the selected geomembrane has been tested, meets the requirements of Section 2.1 and is:

.1 Free from pinholes, tears, and other defects that would cause leakage of liquids through the geomembrane.

1.7 DELIVERY, STORAGE AND HANDLING

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

1.8 MEASUREMENT FOR PAYMENT

.1 Refer to Section 01 10 10 General Instructions for measurement for payment.

Part 2 Products

2.1 MATERIAL

.1 Geomembrane:

.1 The geomembrane shall be puncture free and produced specifically for the purpose of hydraulic containment with inhibitors added to resist ultra-violet and chemical degradation and shall be capable of being sealed to itself using heat-sealing techniques.

.2 The geomembrane shall be comprised of a scrim-reinforced polyethylene material.

.3 Width: ≥3.0 m Length: ≥150 m

.4 The geomembrane shall meet the following physical and chemical requirements:

.1 Surface: The surface shall be free of pinholes or bubbles.

.2 Thickness (ASTM D5199 or ASTM D1777): Average thickness must exceed 1.00 mm (40 mil) with no individual reading lower than 10% below the average.

.3 Mass per unit area (ASTM D5261): ≥ 600 g/m^2.

.4 Grab tensile strength (ASTM D7004):

.1 Machine Direction: ≥2850 N.

.2 Transverse Direction: ≥2850 N.

.5 Strip Tensile Strength (ASTM D7003):

.1 Machine Direction: ≥3900 N/5cm.

.2 Transverse Direction: ≥3900 N/5cm.

.6 Hydraulic Conductivity (Calculated from MVTR): < $1x10^{-10}$ cm/s

.7 Puncture Resistance (ASTM D4833): ≥ 1500 N.

.8 Mullen Burst (ASTM D751): ≥ 8500 kPa.

.9 UV Stability (ASTM G151/G154)

.5 Minimum 90% strength retained after 2000h exposure 0.77 W/m^2/nm or 1200 h exposure at 1.35 W/m^2/nm.

.6 Seam strength (shear) (ASTM D7747): ≥80% of strip tensile value in direction perpendicular to seam.

.7 Seam strength (peel) (ASTM D413): ≥ 35N/5cm

Part 3 Execution

3.1 ACCESSORIES

.1 Welding rod shall be manufactured from the same formulation as the geomembrane.

3.2 INSTALLER

.1 Geomembrane Installer shall be approved by the geomembrane manufacturer and follow manufacturer's installation specifications.

3.3 INSTALLATION

.1 Installation of the geomembrane shall be performed in a logical sequence and in accordance with the lining installer's documented instructions.

.2 Geomembrane shall be placed in accordance with the project drawings.

.3 Sufficient thermal slack shall be incorporated during placement to ensure that harmful stresses do not occur in service. Wrinkles due to slack in the liner should be minimized and distributed evenly.

.4 Weather conditions at time of installation:

.1 Site welding may proceed at any temperature providing a suitable qualification weld can be prepared at site conditions using the operator, equipment, and materials intended for the project.

.2 Installation of membrane in winds above 20 km/h can proceed only if the installer can demonstrate that the liner will not be at risk of damage.

.3 Installation shall not occur in conditions that may be detrimental to the function of the membrane.

.5 Personnel working on geomembrane shall not use damaging footwear.

.6 Completed panels shall be protected from damage and handled carefully to avoid damaging the liner.

.7 Ballast used to prevent uplift by wind must not damage the geomembrane. A continuous load is recommended along the edges of panels to eliminate the risk of wind uplift.

.8 Field Seams

.1 Field seams shall be tightly bonded using heat welding techniques. Extrusion welding shall only be used for repairs, detail work, and in areas where the use of other equipment is not practical. All personnel performing seaming operations shall be trained in the operation of the specific seaming equipment being used.

.2 Field seams shall be sampled for testing in a way that does not compromise the installed liner.

.1 One sample shall be tested for every 100 m of field seam.

.2 Test samples shall be removed from the ends of seams, or other location that does not introduce a defect into the liner of otherwise affect its performance.

.3 Samples to be approximately 100 mm long to permit testing of one shear and two peel specimens (ASTM D7749).

.4 Samples shall be tested immediately after seaming.

.5 Samples shall be tested on a field tensiometer in accordance with ASTM D7749.

.3 A written record shall be maintained for all field seam tests.

.4 All completed field seams will be 100 percent non-destructively tested using an air lance test (ASTM D4437) or a dual-seam air pressure test (ASTM D5820) as applicable.

.5 Field seams shall meet the specified requirements in peel and shear for the material. All discontinuities detected by any test method shall be repaired. All testing, repairs, and re-tests are to be recorded.

.9 Qualification Seams

.1 Qualification seams shall be prepared at the beginning of each seaming period, when the operator is changed, and when the equipment is adjusted.

.2 A qualification seam will be run prior to any field seams.

.3 A qualification seam is made with separate pieces of geomembrane using the same material and equipment that will be used for production welding.

.4 Machine conditions, and operator used for welding must be the same as those used for the qualification weld.

.5 Qualification seams shall be tested in shear and peel, and meet the specified requirements for the material as stated in the materials section.

3.4 TOLERANCES

.1 Seam destructive tests:

.1 Follow the procedure in ASTM D7749.

.2 Test three specimens per sampling point, one in shear and two in peel.

.1 All specimens must meet seam strength requirements

.3 Procedures for case of failure of destructive testing.

.1 Cut out seam and re-weld; or,

.2 Retrace welding path to 3 m (in each direction) from location of failed test and take an additional sample for testing. If passed - cap strip or extrusion weld between re-tested location and original failed location.

3.5 PROTECTION

.1 Protect finished work from damage.

.2 Vehicular traffic not permitted directly on geomembranes.

.3 Use water and rags for all cleaning. If soap is used for cleaning, rinse with clean water and dry before welding.

.4 Cleaning solvents shall not be used unless the product is approved by the membrane manufacturer.

3.6 REPAIR

.1 Inspect seams and non-seam areas for defects, holes, blisters, and undispersed raw materials.

.2 Identify any sign of foreign matter contamination.

.3 Repair all through-thickness defects.

.4 Repairs shall utilize the same material as the geomembrane and shall extend a minimum of 100 mm beyond the defect. Patches shall be secured by extrusion welding, hot air welding, or other approved technique.

.5 Verification of repairs: All repairs are to be non-destructively tested using

.1 Air Lance Test, ASTM D4437 Method 7.2, or,

.2 Vacuum Box Test ASTM D5641

.6 Redo failed repairs and re-test.

.7 Keep records of all repairs and the results of repair testing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Refer to Section 01 33 00 for submittal requirements.

1.2 REFERENCE STANDARDS

.1 ASTM C127-88(2001) el (or latest edition) Specific Gravity and Absorption or Coarse Aggregate.

.2 AASHTO T85-88 (or latest edition) Specific Gravity and Absorption of Coarse Aggregate.

1.3 SUBMISSIONS

.1 Product Data/Samples:

.1 Provide samples of materials proposed for the work.

.2 Methodology:

.1 Provide methodologies for carrying out the work

.3 Provide submissions in accordance with Section 01 33 00.

1.4 MEASUREMENT FOR PAYMENT

.1 Class “A” gravel, structural fill, sandstone fill, rock fill, armourstone (500 kg to 750 kg), filterstone (50 kg to 75 kg) will be measured in accordance with Section 01 10 10.

.2 Prices will include the entire cost of supplying and placing the material in the work, rough grading as necessary, the leveling and finish grading of the listed materials, taking soundings, diving inspections, shoring, bracing, underpinning, all as shown on the drawings, and as specified.

.3 Departmental Representative will only pay for incorporated fills used in the work. Contractor must coordinate quantities required with anticipated road closures (during winter work) and will be required to remove from site any surplus of material.

Part 2 Products

2.1 MATERIALS

.1 Class “A” Gravel

.1 Gravels shall be sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances. The material shall be approved by a Departmental Representative prior to utilization.

.2 The gravel shall meet the gradation requirements detailed in Table 1. Gradation to be within the following limits when tested to ASTM C136 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 Los Angeles Abrasion to ASTM C131 maximum percent loss by mass: 35.

.4 Petrographic number (max): 150.

.5 Class "A" gravel to be placed and compacted to 100% Standard Proctor maximum dry density.

.6 Class A Gravel shall meet the following gradation:

ASTM Sieve Designation	% Passing by Mass
31.5 mm	100
25.0 mm	95-100
12.5 mm	50-83
4.75 mm	30-60
1.18 mm	15-40

.2 Structural Fill

.1 Structural fill (Premium borrow) shall consist of an approved soil (preferable granular) which is free of organics and deleterious materials such as a pit run sandstone or other approved inorganic soil. Fill material meeting the current Prince Edward Island Infrastructure and Energy (PEITIE) Premium Borrow specification. Premium borrow shall be non-plastic well graded and composed of clean, uncoated particles free from lumps or other deleterious materials with a maximum particle size of 100 mm and a maximum of 20% of the material passing the 4.75 mm sieve shall pass the 75 µm sieve. Structural fills to be placed and compacted to 100% Standard Proctor maximum dry density. Max lift thickness should not exceed 300 mm and must be compatible with the compaction equipment used.

.3 Sandstone Fill

.1 Sandstone fill (Common borrow) shall consist of an approved soil (preferable granular) which is free of organics and deleterious materials such as a pit run sandstone or other approved inorganic soil. Fill material meeting the current Prince Edward Island Infrastructure and Energy (PEITIE) Common Borrow specification. Common Borrow shall be non-plastic well graded and composed of clean, uncoated particles free from lumps or other deleterious materials. Max lift thickness should not exceed 300 mm and must be compatible with the compaction equipment used.

.4 Rock Fill

.1 Rock Fill to be hard durable crushed quarried rock, free from silt, clay, organic matter and other foreign substances and free from splits, seams or defects likely to impair its soundness during handling or under action of water. Rock Fill shall be imported, well graded and free from fines. The following materials will not be considered acceptable for use as rock fill: slate, siltstone, sandstone, shale, conglomerate, and mudstone. The material is to be blended to ensure a homogeneous mix of smaller and larger stone sizes will be obtained. Rock Fill to be placed and compacted to 100% Standard Proctor maximum dry density.

.2 Rock fill shall meet the following gradation:

ASTM Sieve Designation	% Passing by Mass
220 mm	100
190 mm	70-90
150 mm	40-55
75 mm	0-3

.5 Armourstone and Filterstone

.3 Inform Departmental Representative of proposed source of materials and provide access for sampling at least 4 weeks prior to commencing the work. Provide test results from quarry supporting the specified requirements.

.4 Material shall be hard durable crushed quarried rock, free from excessive fines, silt, clay, organic matter and other foreign substances and free from splits, seams or defects likely to impair its soundness during handling or under action of water. Conglomerates will not be permitted for use in the work.

.5 Specific gravity of not less than 2.65 when tested to ASTM C127 or AASHTO T85. Max absorption shall be 3.5% for filterstone, and 2.0% for armour stone. Actual specific gravity and absorption will be determined by testing selected samples of material being incorporated into the work. Materials with a specific gravity less than the specified minimum or an absorption rate in excess of the specified maximum will be rejected.

.6 ArmourStone (500 kg to 750 kg): Dimension of each rock shall not exceed two times the least dimension. Armour stone shall consist of 500 – 750 kg stones (mean weight of 625 kg).

.7 Filterstone: Dimension of each rock shall not exceed two times the least dimension. Filter stone shall consist of 50-75 kg stones (mean weight of 62.5kg).

.8 Actual specific gravity and absorption will be determined by testing selected samples of material being incorporated into the work. Materials with a specific gravity less than the specified minimum or an absorption rate in excess of the specified maximum will be rejected.

Part 3 Execution

3.1 PREPARATION

.1 Prior to placing fills in the positions indicated on the drawings, ensure all construction debris is removed and Geotextile/Geomembranes are installed as per Section 31 32 19.01 and 31 32 19.02.

.2 Prior to placing structural fill, ensure sub base is free from debris and if it had been disturbed, compact the sub base material to 98% of its standard proctor density.

.3 Prior to placing Class “A” gravel, ensure structural fill is installed as per this specification and is to the proper grade as indicated on the contract documents.

3.2 PLACEMENT

.1 Ensure the placement method for Class A gravel, structural fill, sandstone fill, rock fill, armourstone and filterstone is reviewed and approved by a Departmental Representative before commencing the work.

.2 Place sub-base material to avoid segregation of material sizes.

.3 Level top surface of sub-base to specified grade.

3.3 TOLERANCES

.1 Surface of bearing layer to be within 50 mm of elevation indicated and variation in elevation over whole area of bearing layer not to exceed 75mm.

.2 Other layers to be within 100 mm of lines shown.

3.4 PROTECTION

.1 Take into account anticipated weather conditions and degree of exposure of site in setting requirements for protection.

.2 Schedule and carry out construction so that each phase of work is not left exposed longer than necessary.

.3 The Contractor should note that the work site is subject to water level variations due to tidal action.

.4 The Contractor will be responsible to replace any materials lost due to storms, tidal erosion or by their own activities.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 31 62 16.13 – Steel Sheet Piles

.3 Section 31 09 16.01 Pile Driving Template

1.2 REFERENCES

.1 Joose Environmental Geotechnical Report, Project Number JE0295 dated May 17th 2018: The entire report can be accessed through the Departmental Representative.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Sub-surface investigation reports: when site conditions differ from those indicated, submit written notification to a Departmental Representative and await further instructions.

.3 Submit schedule of planned sequence of driving to a Departmental Representative for review, as specified.

.4 Equipment:

.1 Submit prior to sheet pile installation for review by a Departmental Representative, list and details of equipment for use in installation of sheet piles.

.2 Impact hammers: submit manufacturer's written data as specified.

.3 Non-impact methods; submit characteristics to evaluate performance.

.5 Submit drivability analyses as specified, to a Departmental Representative for approval of hammers.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s instructions.

.2 Protect sheet piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.

.3 Replace damaged sheet piles as directed by a Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Material requirements for piles are specified in Section 31 62 13.16.

.2 Supply or fabricate full length sheet piles as indicated and provide equipment to handle full length sheet piles without cutting or splicing.

2.2 EQUIPMENT

.1 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.

.2 Non-impact methods of installation such as auguring, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.

.3 Hammer:

.1 Hammers to be selected on basis of drivability analysis using wave equation theory, performed to show that sheet piles can be driven to levels indicated.

.2 Drivability analysis to include, but not be limited to, following: hammer, cushion, and cap block details; static soil parameters; quake and damping factors, total soil resistance, blow count, sheet pile stresses and energy throughput at representative penetrations.

.3 When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.

.4 Recommended rated hammer energy equal to 450J/cm2 of steel cross-sectional area.

Part 3 Execution

3.1 PREPARATION

.1 Protection:

.1 Protect adjacent structures, services and work of other sections from hazards due to sheet pile driving operations.

.2 Arrange sequencing of sheet pile driving operations and methods to avoid damages to adjacent existing structures.

.3 When damages occur, remedy damaged items to restore to original or better condition at own expense.

.2 Ensure that conditions at sheet pile locations are adequate to support sheet pile driving operation. Make provision for access and support of sheet piling equipment during performance of Work.

3.2 INSTALLATION

.1 Leads: construct pile driver leads to provide free movement of hammer.

.1 Hold leads in position at top and bottom, with guides, stiff braces, or other means reviewed by Departmental Representative, to ensure support to sheet pile while being driven.

.2 Lengths: provide sufficient length of leads to ensure that use of follower is unnecessary.

.3 Swing leads:

.1 Not permitted.

.2 Installation of each sheet pile will be subject to review of Departmental Representative.

.1 Departmental Representative will be the sole judge of acceptability of each sheet pile with respect to final driving resistance, depth of penetration or other criteria used to determine load capacity.

.2 A Departmental Representative to review final driving of all sheet piles prior to removal of pile driving rig from site.

.3 Drive each sheet pile to elevation indicated on the project drawings.

.1 Do not overdrive to cause damage to sheet piles in bedrock.

3.3 APPLICATION/DRIVING

.1 Use driving caps and cushions to protect sheet piles.

.1 Reinforce pile heads as required by Departmental Representative.

.2 Sheet piles with damaged heads as determined by Departmental Representative will be rejected.

.2 Hold sheet piles securely and accurately in position while driving.

.3 Deliver hammer blows along axis of sheet pile.

.4 Ensure no contact between sheet pile and existing structure takes place.

.5 Re-strike already driven sheet piles lifted during driving of adjacent sheet piles to confirm set.

.6 Cut off sheet piles neatly and squarely at elevations as indicated to tolerance of plus or minus 5 mm.

.1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.

.7 Remove cut-off lengths from site on completion of work.

3.4 OBSTRUCTIONS

.1 Where an obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, notify the Departmental Representative.

3.5 FIELD QUALITY CONTROL

.1 Required Sheet Pile Testing

.1 Each sheet pile shall be driven to elevations outlined on the drawings.

.2 The depth to refusal of each sheet pile shall be monitored and recorded to ensure sheet piles are not obstructed during driving.

.2 Measurement:

.1 Maintain accurate records of driving for each sheet pile, including:

.1 Types and make of hammer, stroke or related energy.

.2 Other driving equipment including water jet, driving cap, cushion.

.3 Sheet pile size and length, location of sheet pile.

.4 Numbers of blows per meter for entire length of sheet pile and number of blows per 25 mm for last 300 mm.

.5 Final tip and cut-off elevations.

.6 Record pertinent information such as interruption of continuous driving or sheet pile damage.

.7 Record elevations taken on adjacent sheet piles before and after driving of each sheet pile.

.2 Provide Departmental Representative with three copies of any records.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 09 16.01 – Pile Driving Templates

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A 6/A 6M-[02b], Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

.2 ASTM A 307-[02], Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA G40.20/G40.21-[98(June 2000)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W47.1-[92(R2001)], Certification of Companies for Fusion Welding of Steel Structures.

.3 CSA W47.1S1-[M1989(R1998)], Supplement No.1-1989 to W47.1-1983, Certification of Companies for Fusion Welding of Steel Structures.

.4 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Metric Version).

.5 CSA W59S1-[M1989(R1998)], Supplement No.1-M1989, Steel Fixed Offshore Structures, to W59-M1989, Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for following items:

.1 Tie rods, bearing plates and nuts.

.2 Wales including splices, spacers and washers.

.3 Bolts.

.3 At least 2 weeks prior to fabrication, submit to Departmental Representative two copies of steel producer certificates in accordance with mill test reports in accordance with CAN/CSA-G40.20/G40.21.

.4 Provide Departmental Representative with copy of certification for fusion welding in accordance with CSA W47.1 and CSA W47.1S1.

.5 Submittals shall be stamped and signed by an engineer licensed to practice in the province of Prince Edward Island.

1.4 QUALITY ASSURANCE

.1 Materials inspected or tested by Departmental Representative which fail to meet contract requirements will be rejected.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Contractor to pay costs for additional tests or inspections. Departmental Representative to approve corrected work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Use slings for lifting sheet piling so that mass is evenly distributed and sheet piling is not subjected to excessive bending stresses.

.2 Store sheet piling on level ground or provide supports so that sheet piling is level when stored.

- .1 Provide blocking at spacing not exceeding 5m so that there is no excessive sagging in sheet piling.
- .2 Overhand at ends not to exceed 0.5m.
- .3 Block between lifts directly above blocking in lower lift.

.3 If material is stock-piled on structure, ensure that structure is not overloaded.

1.6 MEASUREMENT FOR PAYMENT

.1 Measure supply and installation of sheet piling as per Section 01 10 10.

.2 Nuts, turnbuckles, pipe sleeves, washers, transfer bolts, and other associated hardware supplied and incorporated in Work will be considered incidental to the Work.

.3 Square meter measurement for installation of SSP to be based on final tip to cutoff length.

Part 2 Products

2.1 MATERIALS

.1 Steel sheet Z-profile piles:

- .1 Grade: 350W.
- .2 Minimum flange thickness: 15.5mm
- .3 Minimum web thickness: 12.0mm
- .4 Minimum cross section area: 225 cm^2/m.
- .5 Minimum elastic section modulus (S_x): 3700 cm^3/m

.2 Refer to Section 05 50 00 Metal Fabrications for specifications on structural steel for wales, bearing plates, wales splices, capping plates, support angles and miscellaneous steel.

2.2 COATINGS

.1 Steel sheet piles shall be un-coated (black steel).

Part 3 Execution

3.1 ERECTION

.1 Do welding in accordance with [CSA W59] [and] [CSA W59S1], except where specified otherwise.

.2 Do not begin sheet pile installation until approved by Departmental Representative.

.3 Do sheet pile installation Work in accordance with Section 31 61 13 - Pile Foundations, General Requirements except where otherwise specified.

.4 Submit full details of method and sequence of installation of sheet piling to Departmental Representative for approval prior to start of sheet pile installation work. Details must include templates, bracing, setting and driving sequence and number of sheet piles in panels for driving.

.5 When installing sheet piles in bulkhead wall, standard industry installations procedure are acceptable. An example of such a procedure is as follows:

.1 Provide temporary templates or bracing to hold piles in alignment during setting and driving.

.2 Drive piles two at a time. Drive first double pile to full depth, then place panel of five to eight double sheet piles in templates and secure last (end) double pile in location to prevent spreading of piles in panel.

.3 Drive end double pile in panel sufficiently deep into ground to ensure that it will remain plumb, then, drive remaining double piles in panel to full depth beginning with double pile next to end double pile and finishing with double pile next to double pile first driven.

.4 After one panel has been driven, place and drive succeeding panels in similar manner. Complete the driving of end double pile of first panel after double piles of second panel have been driven.

.6 When installation is complete, face of wall at top of sheet piles to be within 75 mm of location as indicated and deviation from vertical not to exceed 1 in 100.

3.2 OBSTRUCTIONS

.1 If obstruction encountered during driving, leave obstructed pile and proceed to drive remaining piles. Return and attempt to complete driving of obstructed pile later.

.2 Advise Departmental Representative immediately if impossible to drive pile to full penetration, and obtain direction from Departmental Representative on further steps required to complete Work.

3.3 HOLES

.1 Patch holes in sheet pile wall, except where permanent holes are indicated.

.1 Use 12mm thick plate of material equal to that of piling to patch holes and overlap not less than hole diameter.

.2 Weld to develop full strength of plate.

.2 Drill any required holes in piling. Do not use flame cutting without permission of Departmental Representative.

3.4 CUTTING

.1 When flame cutting tops of piles, and flame cutting holes in piles approved by Departmental Representative, use following procedure:

.1 When air temperature is above 0 degrees C, no pre-heat is necessary.

.2 When air temperature is below 0 degrees C, pre-heat until steel 25 mm on each side of line of cut has reached a temperature very warm to hand (approximately 35 degrees C). Temperature indicating crayon marks may be used to measure temperature.

.3 Use torch guiding device to ensure smooth round holes or straight edges.

.4 Make cut smooth and free from notches throughout thickness. If grinding is employed to remove notch or crack, finished radius to be minimum 5 mm.

3.5 SPLICING

.1 Use full length piles. Splicing is not permitted

3.6 TIE-ROD ANCHORAGE SYSTEM

.1 Do not place backfill behind anchored bulkhead until piles have been completely driven, adjusted and secured in final position by anchorage system.

.2 Support tie rods at intervals along their length as indicated.

.3 Fit and adjust tie rod systems so that connections at waling and anchor end of tie rods are tight before backfilling.

3.7 BACKFILLING

.1 Install tie-rods prior to backfilling to maintain a vertical wall during backfilling operations.

.2 Protect piling tie rods and anchorage systems from damage or displacement during backfilling operations. This will necessarily require temporary vertical bracing for the tie-rods.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section covers asphalt paving on the approach to the reconstructed wharf structures 403 and 409.

1.2 REFERENCES

.1 ASTM C88-90, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.

.2 ASTM C117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.3 ASTM C123-92, Test Method for Lightweight Pieces in Aggregate.

.4 ASTM C127-88, Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.5 ASTM C128-93, Test Method for Specific Gravity and Absorption of Fine Aggregate.

.6 ASTM C131-89, Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 ASTM C136-92, Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM D995-88, Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.9 ASTM D1559-89, Test Method for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.10 ASTM D2419-79, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.11 ASTM D2041-90, Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

.12 ASTM D2950-91, Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.

.13 ASTM D3203-88, Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.14 ASTM D3515-89, Standard Specifications for Hot Mixed, Hot Laid Bituminous Paving Mixtures.

.15 ASTM D4460-85, Standard Method for Calculating Percent Asphalt Absorption by the Aggregate in an Asphalt Pavement Mixture.

.16 CAN/CGSB-8.2-M88 (R10/3 Series), Sieves Testing, Woven Wire, Metric.

.17 CAN/CGSB-16.3-M90, Asphalt Cements for Road Purposes.

.18 AASHTO T-283 with Lottman Conditioning.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 Submittal Procedures.

.2 Upon request and at least 4 weeks prior to commencing work submit samples of following materials proposed for use:

.1 One 4 L container of asphalt cement.

1.4 MATERIAL CERTIFICATION

.1 Upon request and at least 4 weeks prior to commencing work submit viscosity-temperature chart for asphalt cement to be supplied showing kinematic viscosity in mm2/s versus temperature range from 105° to 175°.

.2 Upon request and at least 4 weeks before commencing work, submit refinery's test data and certification that asphalt cement meets requirements of this section which also includes the specific gravity of the asphalt cement.

1.5 DELIVERY AND STORAGE

.1 Coarse aggregate stockpile shall contain no more than 15% passing 5000 sieve.

.2 Fine aggregate stockpile shall contain no more than 15% retained on 5000 sieve.

.3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.4 When dryer drum mixing plant is used, stockpile fine aggregate separately from coarse aggregate.

.5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.

1.6 MEASUREMENT FOR PAYMENT

.1 Refer to Section 01 10 10 General Instructions for measurement for payment.

Part 2 Products

2.1 MATERIALS

.1 Asphalt concrete: hot mixed, hot- laid combination of mineral aggregates, uniformly coated and mixed with an asphaltic binder in a suitable mixing plant. Asphalt materials and aggregates must meet the requirements of Item 603 of the “General Provisions And Contract Specifications For Highway Construction” as released by the PEI Department Of Transportation, Infrastructure and Energy (PEITIE), latest edition, mix type "A -Base" and type "B-Seal" for all paving surfaces.

.2 Bituminous Prime and Tack coats to be in accordance with the PEITIE Standard Specification.

Part 3 Execution

3.1 EQUIPMENT

.1 Pavers: Mechanical grade controlled self powered pavers capable of spreading asphalt concrete within specified tolerances, true to line, grade and crown indicated.

.1 Pavers to be equipped with automatic screed controls, as recommended by manufacturer for control of longitudinal grade and transverse slope.

.2 Pavers to be equipped with joint matching shoe to operate with longitudinal grade control.

.3 Transverse slope control shall be capable of operating from either side of paver.

.4 Pavers to be equipped with an approved 12 m ski. Where such ski is a flexible unit, it shall be equipped with a spring tensioned wire extending between brackets fitted on and slightly above each end of ski. Sensing grid shall ride on wire and not on ski.

.2 Rollers: sufficient number of rollers of type and mass to obtain specified density of compacted mix.

.3 Haul trucks: of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers (tarps) of sufficient size and weight to completely cover and protect asphalt concrete when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Trucks which cannot be weighed in a single operation on scales supplied will not be accepted.

.5 Truck tailgate assemblies must be such that they do not strike paver hopper when emptying into the hopper.

.4 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass not less than 12 kg and a bearing area not exceeding 310 cm2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by the Departmental Representative, may be used instead of tamping irons.

.3 Straight edges, 3 m in length, to test finished surface.

3.2 PREPARATION

.1 Apply asphalt prime to granular base.

.2 Apply tack coat.

.3 Pavement sites indicated by the Departmental Representative for overlay and skin patching shall be free of loose and foreign material and tack coat shall be applied.

3.3 TRANSPORTATION OF ASPHALT CONCRETE

.1 Transport asphalt concrete to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted. Diesel fuel is not permitted.

.3 Schedule delivery of asphalt concrete for placing in daylight, unless the Departmental Representative approves artificial light.

.4 Deliver asphalt concrete to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.

.5 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place asphalt concrete at temperature within range as directed by the Departmental Representative, but not less than 135°.

.6 Tarpaulins or other coverings for trucks must be of sufficient mass to prevent rapid cooling of asphalt concrete surface.

3.4 PLACING

.1 Obtain the Departmental Representative's approval of base surface and tack coat prior to placing asphalt.

.2 Place asphalt paving to thicknesses, grades and lines as indicated or as directed by the Departmental Representative.

.3 Placing conditions:

.1 Place asphalt paving only when air temperature is above 5°.

.2 When temperature of surface on which asphalt concrete is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.

.3 Do not place asphalt paving when pools of standing water exist on surface to be paved, or during rain, or when surface is damp, or if ambient temperature is below 5°C.

.4 Place asphalt paving in compacted lifts as indicated on the project drawings:

.1 A base course and a finish course in two separate lifts.

.5 Spread and strike off asphalt concrete overlay with self-propelled mechanical finisher.

.1 Place individual strips no longer than 500 m.

.2 Construct longitudinal joints and edges true to line markings. Lines for paver to follow will be established by the Departmental Representative parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.

.3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.4 Correct irregularities in alignment left by paver by trimming directly behind machine.

.5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute access asphalt concrete forming high posts. Fill and smooth dips with asphalt concrete.

.6 Do not broadcast asphalt concrete over surface.

.7 The forward speed of the paver shall be regulated by capacity of the plant and the rollers but shall not exceed a forward speed of 10 m/min.

.6 When hand spreading is used:

.1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.2 Distribute material uniformly. Do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute asphalt concrete by lutes or covered rakes. Reject asphalt concrete that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn asphalt concrete. Do not use tools at a higher temperature than temperature of asphalt concrete being placed.

3.5 COMPACTING

.1 Compact asphalt concrete continuously using established rolling pattern.

.2 Do not change rolling pattern unless asphalt concrete changes or lift thickness changes. Change rolling pattern only as directed by the Departmental Representative.

.3 General:

.1 Provide as many additional rollers as necessary to achieve specified pavement density.

.2 Start rolling operations as soon as asphalt concrete can bear mass of roller without undue displacement of asphalt concrete or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of asphalt concrete. For subsequent rolling do not exceed 5 km/h for static steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.

.4 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per metre of travel.

.5 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.

.6 Keep wheels of roller slightly moistened with water to prevent pick-up of asphalt concrete but do not over-water and do not use diesel fuel.

.7 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.8 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.9 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

.10 Where rolling causes displacement of asphalt concrete, loosen affected areas at once with lutes or shovels and restore to original grade of loose asphalt concrete before re-rolling.

.11 Do not refuel rollers on fresh asphalt concrete.

.4 Breakdown rolling:

.1 Commence breakdown rolling with static steel wheeled roller vibratory roller immediately following rolling of transverse and longitudinal joint and edges.

.2 Operate rollers as close to paver as necessary to obtain the specified density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. Exceptions may be made when working on steep slopes or super-elevated sections.

.4 Use only experienced roller operators for this work.

.5 Second rolling:

.1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving asphalt concrete temperature allows maximum density from this operation.

.2 Rolling shall be continuous after initial rolling until asphalt concrete placed has been thoroughly compacted.

.6 All asphalt concrete shall be compacted to meet the requirements of the PEITIE Standard Specification.

.7 The Contractor will supply additional compaction equipment if required density is not achieved.

3.6 JOINTS

.1 General:

.1 Trim vertical face to provide true surface and cross section against which new pavement may be laid. Remove loose particles.

.2 Paint joint face with coat of tack coat emulsified asphalt cement or preheat joint face with approved heater, prior to placing of fresh asphalt concrete.

.3 Overlap previously laid strip with spreader by 100 mm.

.4 Rake fresh asphalt concrete against joint and thoroughly tamp and roll.

.5 Remove surplus material from surface of previously laid strip. Dispose of surplus material as directed by the Departmental Representative.

.6 Do not throw surplus material on freshly screened mat surface.

.2 Transverse Joints:

.1 Carefully construct and thoroughly compact transverse joints to provide a smooth riding surface.

.2 Hold transverse joints to a minimum

.3 Stagger joint locations 1.5 to 3.0 meters. Schedule each day’s paving operation to terminate adjacent lanes in any one area to within above specified joint location.

.4 Offset transverse joint in succeeding course by at least 600 mm.

.3 Longitudinal Joints:

.1 Before rolling, carefully remove with a lute or rake and discard coarse aggregate in asphalt concrete overlapping joint.

.2 Roll longitudinal joints directly behind paving operation

.3 When rolling with static roller, shift roller over onto previously placed lane in order that no more than 150 mm of roll rides on edge of newly laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until a thoroughly compacted neat joint is obtained.

.4 When rolling with vibratory roller, have most of drum width ride on newly placed lane with remaining 100 to 150 mm extending onto previously placed and compacted lane.

.4 When abutting lane is not placed in same day, or when joint is distorted during day's work by traffic or other means, carefully trim edge of lane to line and paint with a thin coating of asphalt before abutting lane is placed.

.5 Ensure joints are offset at least 150 to 200 mm from those in lower layers.

3.7 FINISH TOLERANCES

.1 Finished asphalt concrete to be within 6 mm of design elevation but not uniformly high or low.

.2 Finished asphalt concrete not to have irregularities exceeding 6 mm when checked with a 3 m straight edge placed in any direction.

3.8 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.

.2 Repair areas showing checking or rippling

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

END OF SECTION

Appendix

Geotechnical Report

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

GEOTECHNICAL INVESTIGATION
PROPOSED PIER REPLACEMENT AND BREAKWATER CONSTRUCTION
GEORGETOWN SMALL CRAFT HARBOUR
KINGS COUNTY, PEI

JOOSE ENVIRONMENTAL PROJECT NO. JE0295

GEO SERVICES
GEOTECHNICAL DIVISION OF
JOOSE ENVIRONMENTAL

GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL
Consulting Inc.
North Wiltshire PE C0A 1Y0

May 17, 2018

Joose Environmental Project No. JE0295

Ms. Katie McCarthy, P. Eng.
Small Craft Harbours, Fisheries and Oceans Canada
165 John Yeo Drive
Charlottetown, PE C1E 3J3

Dear Ms. McCarthy:

Reference: Geotechnical Investigation - Pier Replacement and Breakwater Construction, Georgetown Small Craft Harbour, Kings County, PEI

This report presents the results of the geotechnical investigation carried out for the above-noted project, in accordance with your request. The purpose of the investigation was to establish the subsurface conditions within the area of the proposed pier replacement and breakwater construction and, based on the conditions encountered, to provide geotechnical engineering recommendations pertaining to design and construction.

PROCEDURE

The field work for the present investigation was carried out on four separate dates/periods as follows:

- February 26, 2018 - performance of eleven (11) sediment probes using fiberglass rods;
- February 28, 2018 - drilling of a single borehole (BH 1-18) with a CME 55 auger drill rig mounted on a tracked carrier;
- March 1, 2018 - drilling of three (3) dynamic cone penetration tests (CPTs) with a small walk-behind Dando drill; and
- May 1 to 4, 2018 - drilling of nine (9) marine-based boreholes (BH M1 to BH M9) with a barge-mounted CME 55 auger drill rig.

The smaller/lighter Dando drill was used on the pier deck due to the present condition and reduced load carrying capability of this structure.

The probes were advanced (i.e., pushed) to practical refusal, to depths into the harbour bottom ranging from 50 to 750 mm. The CPTs were advanced to refusal, to depths below the pier deck ranging from 7.5 to 12.2 m. BH 1-18 was advanced to a depth of 12.3 m below the deck. BH M1 to BH M9 were advanced to depths ranging from 7.3 to 10.1 m below harbour bottom.

The locations of the probes, boreholes, and CPTs are shown on the appended drawings (DWG. No. 1, DWG. No. 2, and DWG. No. 3).

Samples of the overburden soils encountered at the borehole and CPTs (surficial samples only) were taken at regular intervals by means of a conventional split spoon sampler during the performance of Standard Penetration Tests. Bedrock was proven at all borehole locations by rotary core drilling in NQ-size (i.e., 48 mm core diameter).

All soil samples recovered were placed in moisture-proof containers and were delivered, with the rock core, to our office for classification and testing. All soil and rock core samples remaining after testing will be stored for a period of 60 days from the date of issue of this report after which they will be discarded unless directions to the contrary are received.

Detailed logs of the strata encountered at the site and of the sampling and testing carried out are shown on the appended Borehole and CPT Records.

The locations and elevations of the boreholes and CPTs were established in the field by our personnel, with assistance as required provided by ISE Engineering Ltd. The borehole locations were established relative to the existing pier and with a handheld Garmin GPS unit set to NAD 83 UTM Zone 20 as follows:

Location	Northing, m	Easting, m
BH 1-18	5114033	536165
CPT 1-18	5114016	536169
CPT 2-18	5114001	536173
CPT 3-18	5113986	536176
BH M1	5114028	536151
BH M2	5114032	536170
BH M3	5114004	536161
BH M4	5114014	536175
BH M5	5113982	536166
BH M6	5113988	536183
BH M7	5113998	536232
BH M8	5114012	536270
BH M9	5114024	536322

The ground surface/harbour bottom elevations at BH 1-18, BH M1 to BH M6, and the CPTs were determined with respect to Low Normal Tide (Chart) Datum based on the existing site benchmark (CHS BM M14P9000, el. 3.26 m) shown on appended drawings. The harbour bottom elevations at BH M7 to BH M9 were determined using available bathymetry and tidal chart information.

SEDIMENT PROBES

The sediment probes were undertaken with relatively flexible, 1.5 m long, fiberglass rods with threaded couplings. The probes were advanced to practical refusal by manual means. The depth to refusal at each probe location is presented in the following table.

Probe No.	Depth to Probe Refusal, mm
P1	250
P2	100
P3	725
P4	675
P5	375
P6	625
P7	50
P8	225
P9	750
P10	500
P11	450

Based on the conditions encountered at the borehole and CPT locations, it may be concluded that the depths to probe refusal do not represent the full depth of the marine deposit, but rather the depth of a very loose to loose/very soft to soft surficial layer.

SUBSURFACE CONDITIONS

The subsurface conditions encountered at the boreholes and CPTs (inferred) are shown in detail on the appended Borehole and CPT Records, are summarized on Table 1 and Table 2 (also appended), and are described below. The results of all laboratory testing carried out for soil classification purposes are presented on Table 3 (appended).

Fill Materials

A layer of dark grey to brown fill materials, ranging in thickness from 0.9 to 3.0 m, was encountered at the surface of BH 1-18, CPT 1-18, and CPT 2-18. The fill varies in composition from a *sand* to a *sand and gravel* with some silt, traces of shell fragments, and occasional cobbles and wood. The fill has likely been intermixed with some of the underlying marine soil.

Standard Penetration Test N-values obtained within fill were found to range from 1 to 30 indicating highly variable, very loose to compact, relative density.

A grain size test (curve appended) performed on a sample of the fill recovered from CPT 2-18 shows it to contain 37 percent gravel, 50 percent sand, and 13 percent fines (i.e., silt and clay sizes). The test sample was found to have a moisture content of 40 percent.

The following geotechnical parameters may be assigned to the existing fill materials:

Total Unit Weight	18 kN/m^3
Submerged Unit Weight	8 kN/m^3
Effective Friction Angle	30 degrees

Marine Deposit

A layer of marine deposited soil, ranging in thickness from 450 mm to 3.2 m, was encountered below the fill at BH 1-18 and CPT 2-18, and at the surface of CPT 3-18 and BH M1 to BH M9, inclusive.

The marine soil around the perimeter of the existing pier (i.e., BH M1 to BH M6) was found to consist of very soft (N = 0 to 1) black organic silt containing traces of sand and shell fragments. An N-value of 0 indicates the sampler sunk under the weight of drill rods. Total and submerged unit weights or 14.5 kN/m^3 and 4.5 kN/m^3, respectively, may be assigned to the organic silt

Below the existing pier deck (i.e., BH 1-18, CPT 2-18 and CPT 3-18), the marine deposit includes a layer of very loose to loose (N = 0 to 8) dark grey to brown sand containing some silt, gravel and traces of shell

fragments. A sample of the sand recovered from BH 1-18 was found to contain 10 percent gravel, 80 percent sand, and 10 percent fines. The test sample was found to have a moisture content of 27 percent.

The marine deposit encountered along the proposed breakwater alignment (i.e., BH M7 to BH M9) includes layers of very loose (N = 0 to 1) olive grey *silt and sand* and very loose to loose (N = 3 to 7) mottled brown/grey *sand*. Grain size testing (curves appended) shows the *silt and sand* to contain 13 percent gravel, 44 percent sand, and 43 percent fines and the *sand* to contain 91 percent sand and 9 percent fines. The *silt and sand* and *sand* samples were found to have moisture contents of 56 percent and 32 percent, respectively.

The following geotechnical parameters may be assigned to the very loose to loose marine sand/silt and sand deposits:

Total Unit Weight	17 kN/m^3
Submerged Unit Weight	7 kN/m^3
Effective Friction Angle	28 degrees

Glacial Till

A glacially derived, reddish brown, till stratum was encountered directly below the marine deposit (or below the fill in the case of CPT 1-18) at all borehole and CPT (inferred based on N-values) locations. In the vicinity of the existing pier, the thickness of the till layer was found to range from 1.8 to 5.6 m with an average of 3.9 m. The till surface elevation was found to range from el. -2.60 m to el. -5.42 m in this area. The thickness of the till layer along the proposed breakwater alignment ranges from 3.6 to 4.4 m with an average of 4.0 m. The till surface elevation along the alignment ranges from el. -3.95 m to el. -5.25 m.

Although the till varies in composition from a sandy silt to a gravelly sand, the predominant soil type is a silt and sand, with trace to some gravel, trace clay, and occasional sandstone cobbles.

N-values obtained within the till were typically found to range from 10 to 30 indicating an overall compact relative density. Higher N-values may be attributed to the occasional presence of sandstone cobbles/boulders within the till, particularly near the bedrock surface.

Grain size analyses (curves appended) performed on nine (9) split spoon samples of the till show it to contain 8 to 45 percent gravel, 29 to 56 percent sand, and 16 to 57 percent fines. Two Atterberg Limit determinations show the till to contain fines of low plasticity based on average liquid and plastic limits of 17 and 15 percent, respectively. The natural moisture content of the till samples was found to range from 9 to 16 percent, with an average of 14.

Geotechnical parameters for the glacial till are provided in the Design Parameters section of this report.

Bedrock

Sandstone bedrock was encountered directly below the till stratum at all borehole and CPT (inferred) locations as follows:

- Existing Pier - 4.9 to 8.7 m below harbour bottom (el. -4.90 m to el. -10.06 m); and
- Proposed Breakwater - 4.3 to 5.6 m below harbour bottom (el. -7.77 m to el. -9.37 m).

The rock core recovered consisted predominantly of fine to medium-grained, reddish brown sandstone with occasional stiff to hard mudstone partings/seams/layers (up to 250 mm in thickness).

The bedrock is horizontally bedded with extremely close (<20 mm) to moderately close (200 to 600 mm) joints which typically occur along the bedding planes. An average RQD (Rock Quality Designation) value of 68 indicates fair quality, fractured bedrock.

A total of five (5) Unconfined Compressive Strength (UCS) tests were carried out on selected core samples recovered from BH 1-18 and show the UCS to range from 37 to 45 MPa, indicating a medium strong (i.e. 25 to 50 MPa) strength classification. Since stronger, more intact samples are required for this testing, a very weak (i.e., <5 MPa) to medium strong classification is considered to be more representative of the overall rock mass at the site and is therefore used on the Borehole Records.

Geotechnical parameters for the sandstone bedrock are provided in the Design Parameters section of this report.

Groundwater

It may be assumed that the groundwater table at the site is directly governed by tidal variations within the Georgetown Harbour.

DISCUSSION AND RECOMMENDATIONS

Overview

It is understood that the present development plans for the subject site include:

- The replacement of a section of the existing pier (Structure 402 and 403) with a steel sheet pile (SSP) structure; and
- The construction of a new breakwater, with fixed structure and rubble mound sections, perpendicular to the main pier.

The subsurface conditions encountered in the immediate vicinity of the existing pier may be summarized as 0.9 to 3.2 m of very soft organic silt (marine deposit) that is underlain by a compact native till stratum and sandstone bedrock. Along the alignment of the proposed breakwater, the conditions may be summarized as a 450 mm to 1.1 m of layer very loose/loose marine deposited soils (silt and sand/sand) over till and sandstone bedrock.

The effects of the subsurface conditions encountered on the design and construction of the proposed pier replacement and breakwater are considered in the following sections.

Proposed Pier Replacement

The presence of compressible marine soils (very soft organic silt and very loose/loose sand/silt and sand) within the footprint of the proposed pier would result in excessive settlement of the pier deck and high internal lateral loads on the new structure if left in place. Consequently, the removal of these materials from within the proposed pier footprint is recommended prior to the placement of any new fill materials. The removal of any existing fill materials will also be necessary to access the underlying the marine soils.

Fill Placement and Settlement

It is understood that a total thickness of approximately 7.5 m of new fill is to be placed at the site, assuming that the existing marine deposit is removed in its entirety. It may be assumed that the initial 2.5 to 5.0 m of the fill will be placed below low tide level. To minimize settlement, a clean, relatively uniformly graded, coarse rockfill, such as PEITIE R-5, Class 1 Rip Rap, would be well suited for fill placement below water. Above this level, a local sandstone fill (e.g., PEITIE Select Borrow) could be utilized. Consideration could also be given to the use of an imported fill, such as 75 mm minus crushed rock, for placement in dry conditions. In either case, all fills utilized above low tide level should be placed and compacted in lifts to 100 percent of Standard Proctor maximum dry density (or to at least 80 percent relative density in the case of a rockfill). Lift thickness should be compatible with the compaction equipment selected for use.

The use of an intermediate filter layer and/or a geotextile may be required to prevent the downward movement of finer particles between fill layers, depending on the gradation of the fill materials selected for use.

Settlement resulting from the compression of the underlying till would occur primarily as the load (i.e., weight of new fills) is being applied and should not have any adverse effect of the new pier deck. Since compaction of the new fill placed below the water level is generally not practical, some settlement of this material will occur as a result of self-weight and the weight of the compacted fills above. Such settlement can be minimized by using a uniformly graded, coarse rockfill as recommended above. Total settlement of the rockfill placed without compaction below water level would be expected to be in the order of 3 to 5 percent of the corresponding fill thickness (i.e., 75 to 250 mm range for the expected conditions). 90 percent of this settlement should, however, occur within 6 months of placement, with most of this settlement occurring during placement/compaction of the above water fill.

It should be noted that the magnitude of the expected settlement for the fill placed below water level would be considerably higher, with a longer duration, if a local fill material (e.g., Select Borrow) was used for this application.

Compaction as soon as practical near the water level with a backhoe or excavator mounted plate tamper is recommended to consolidate the upper zone of the coarse rock fill and to reduce future settlements. This should be carried out during a low tide period for maximum effectiveness. Settlement of properly compacted fills placed above the water level would not be of a sufficient magnitude to adversely affect the performance of the pier deck.

For fill placement undertaken as outlined above, long-term (i.e., creep settlement) associated primarily with the non-compacted portion of the new fill placed below the water level would not be expected to exceed 25 mm. It would be prudent to delay placement of the pier deck for as long as practical following fill placement.

Steel Sheet Piling

The penetration of steel sheet piling into the sandstone bedrock is difficult to predict and may be variable. Based on the conditions encountered at the borehole and CPTs, the results of the UCS testing undertaken, and on the use of a pile driving hammer with a rated energy in the order of 450 joules per cm^2 of pile cross-sectional area, it is not expected that the sheet piling would penetrate more than 300 mm into the sandstone bedrock. Geotechnical parameters required for the design of a steel sheet pile structure are provided in the following section.

Design Parameters

The geotechnical design parameters provided in the table below may be assigned to the various strata encountered and to expected new fill materials, for steel sheet pile design purposes.

Design Parameters	Glacial Till	Sandstone Bedrock	Pit Run Sandstone /Select Borrow (compact)	R-5 Rip Rap; 75 mm to 220 mm (loose)	75 mm Minus Crushed Rockfill (compact)
Total Unit Weight, kN/m^3	22.0	23.5	21.5	18.0	20.0
Submerged Unit Weight, kN/m^3	12.0	13.5	11.5	11.5	13.0
Effective Friction Angle (Φ), degrees	32	36[4]	32	34	38
Active Earth Pressure Coefficient, K_a[5]	0.31	0.26	0.31	0.28	0.24
Passive Earth Pressure Coefficient, K_p[1,5]	3.25	3.86	-	-	-
Passive Earth Pressure Coefficient, K_p[5]	5.28[2]	7.46[3]	-	-	-

Notes:

[1] - neglecting the effects of wall friction
[2] - including the effects of wall friction for a steel sheet pile wall (based on δ ultimate = 14 degrees)
[3] - including the effects of wall friction for a steel sheet pile wall (based on δ ultimate = 17 degrees)
[4] - based on sandstone bedrock zone fragmented by pile penetration
[5] - earth pressure coefficients provided are for a vertical wall and a horizontal backfill

Proposed Breakwater

The subsurface conditions encountered along the proposed breakwater alignment, with the except of at BH M6 located near the existing pier, may be summarized as 450 mm to 1.1 m of marine soil that is underlain by 3.6 to 4.4 m of glacial till, that in turn is underlain by sandstone bedrock. The marine deposit is comprised of very loose to loose silt and sand, and sand layers.

As noted previously, the proposed breakwater is to include fixed structure and rubble mound sections. For the fixed structure section, steel sheet pile or Berlin Wall structures could be considered. For either structure type, the very soft organic silt encountered in the vicinity of the existing pier should be removed. Consideration could, however, be given to leaving the very loose/loose marine silt and sand/sand in place below the fixed structure and/or rubble mound portions of the proposed breakwater. These marine deposits

contain a relatively high percentage of sand, are essentially non-plastic, and are of somewhat limited thickness.

The following sections provide general comments and recommendations pertaining to breakwater design. We would be pleased to provide more specific geotechnical input as plans for the breakwater are developed.

Steel Sheet Pile Structure

The comments, recommendations, and geotechnical parameters provided in the previous section pertaining to the design, construction, and infilling of a steel sheet pile structure are applicable. The very soft organic silt should be removed from within the footprint of the proposed breakwater.

Berlin Wall

For a breakwater design incorporating steel H-piles, it is expected that the piles would be driven into bedrock. Steel piles should be driven to refusal using a hammer with a rated energy of at least 350 J/cm^2 of net steel cross sectional area. Refusal may be taken as 10 blows for the last 25 mm of pile penetration. Re-tapping of some piles (e.g., 20 percent) within a 48-hour period is recommended to assess relaxation effects, and the requirement to re-tap additional piles.

Actual penetration depths of steel H-piles into the sandstone bedrock will depend on the driving energy delivered and the bedrock condition/strength at the pile locations. Previous experience has shown that penetration depths can vary significantly from site to site or within the same site (depending on the rock quality and strength) and can range from less than 1 m to 2 m or more. For the conditions encountered at the boreholes (i.e., no apparent weathered zone at the bedrock surface and no significant mudstone layers), it is expected that penetration depths of more than 0.5 to 1 m would likely be difficult to achieve.

The vertical capacity of steel H-piles driven to refusal, as defined above, may be determined using an allowable contact stress of 50 MPa (based on net steel area). The settlement of piles installed as outlined above and proportioned for foundation loads would be negligible.

For driven steel, some uplift resistance will be obtained through shaft friction (typically 50 percent of the shaft friction available in compression is assumed for uplift). The actual magnitude of the uplift resistance would depend on the type/size of the pile selected for use and the depth driven. More details can be provided if requested.

For the analysis of lateral resistance, an effective pile width of 2.5 times the pile diameter may be used.

The geotechnical parameters provided in the Design Parameters section of the report would also be applicable for design purposes of a Berlin Wall structure. A slight increase in the wall friction values and corresponding K_p values provided for the till and bedrock could be considered (i.e., concrete versus steel contact surface).

CLOSING COMMENTS

A subsurface investigation is a limited sampling of a site. In the event that any conditions are encountered that differ from those encountered at the test locations, we request that we be notified immediately to permit a reassessment of our design assumptions. We trust this report contains all of the information required at this time, and we are available at your convenience should you have any questions.

Sincerely,

JOOSE ENVIRONMENTAL CONSULTING INC.

George Zafiris

George W. Zafiris, P. Eng.
Geotechnical Engineer
georgez@jooseenv.com

GWZ/gz

APPENDIX

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 28 FEB 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: 2.58 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	2.58	Wharf Deck									
	0.00										
1 /											
2 / 1											
3 /											
4 /											
5 /											
6 /											
7 / 2	0.45	Harbour Bottom									
	2.13	Compact to loose dark grey to brown gravelly sand, some silt, occasional cobbles, trace shell fragments: **FILL**			SS	1	150	10			
8 /											
9 /					SS	2	100	9			
10 / 3											
11 /	-1.07										
12 /	3.65	Very loose dark grey to brown sand, some silt, gravel, trace shell fragments: **MARINE DEPOSIT**			SS	3	450	2		27	S
13 / 4											
14 /											
15 /					SS	4	100	1			
16 /	-2.60										
17 / 5	5.18	Compact reddish brown silt and sand, trace gravel, clay: **TILL**			SS	5	350	11		14	S
18 /											
19 /											
20 / 6	-3.52										
	6.10	Compact to dense reddish brown sandy silt, some gravel, trace clay: **TILL**			SS	6	450	40			
21 /											
22 /					SS	7	300	28		14	S/A
23 / 7											
24 /											
25 /					SS	8	150	60		15	S
26 /	-5.34										
27 / 8	7.92	Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff mudstone partings/seams (up to 50 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	9	93%		37		
28 /											
29 /											
30 / 9											
31 /											

SPT N-Value
10 20 30 40 50 60 70 80 90

UCS = 37 MPa

UCS = 45 MPa

Joose Environmental

JOOSE ENVIRONMENTAL

Date Drilled: 28 FEB 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: 2.58 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests	SPT N-Value (10 20 30 40 50 60 70 80 90)
10					NQ	10	95%		92			UCS = 40 MPa
	-8.24											
11	10.82	Very weak to medium strong, reddish brown, fine to medium grained sandstone, occasional stiff mudstone partings/seams (up to 25 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	11	98%		73			UCS = 39 MPa
12	-9.76											UCS = 40 MPa
	12.34	End of Borehole										
13												
14												
15												
16												
17												
18												
19												

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

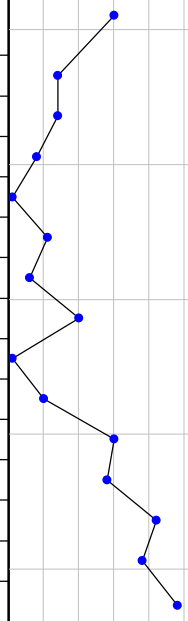
Date Drilled: 01 MAR 2018
Water Level: Tidal
Contractor/Equipment: Logan/Dando

Project No.: JE0295
Elevation: 2.56 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	2.56	Wharf Deck									
	0.00										
8 / 2	-0.03	Harbour Bottom									
	2.59	Compact dark grey sand and gravel, some silt: **FILL**			SS	1	50	30			
10 / 3	-0.63										
	3.19				CPT	2		14			
					CPT	3		14			
13 / 4					CPT	4		8			
		Inferred Fill; compact to very loose			CPT	5		1			
					CPT	6		11			
16 / 5					CPT	7		6			
					CPT	8		20			
18	-3.08				CPT	9		1			
	5.64				CPT	10		10			
20 / 6					CPT	11		30			
		Inferred Till; compact to dense			CPT	12		28			
22					CPT	13		42			
23 / 7					CPT	14		38			
24	-4.90				CPT	15		48			
	7.46	End of Borehole									
26 / 8		CPT refusal on inferred sandstone bedrock									
29 / 9											
31											

SPT N-Value
10 20 30 40 50 60 70 80 90



Joose Environmental

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 01 MAR 2018
Water Level: Tidal
Contractor/Equipment: Logan/Dando

Project No.: JE0295
Elevation: 2.55 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	2.55	Wharf Deck									
	0.00										
9 / 3	-0.35	Harbour Bottom									
	2.90	Very loose dark grey gravelly sand, some silt, trace to some wood, trace shell fragments: **FILL**			SS	1	200	3		40	S
12 / 4	-1.25										
	3.80				CPT	2		1			
					CPT	3		1			
					CPT	4		4			
		Inferred Marine Deposit; very loose			CPT	5		1			
					CPT	6		0			
					CPT	7		0			
19 / 6	-3.40				CPT	8		0			
	5.95				CPT	9		18			
					CPT	10		13			
					CPT	11		22			
					CPT	12		14			
					CPT	13		14			
					CPT	14		11			
					CPT	15		9			
26 / 8		**Inferred Till**; compact			CPT	16		11			
					CPT	17		11			
					CPT	18		12			
29 / 9					CPT	19		16			
					CPT	20		23			

SPT N-Value
10 20 30 40 50 60 70 80 90

Note - N-value of 0 indicates CPT sank under weight of rods

Joose Environmental

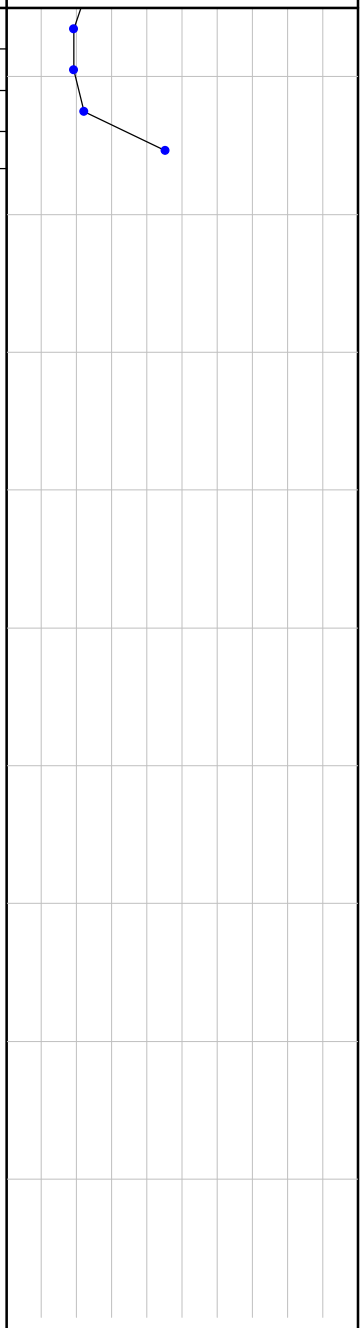
Date Drilled: 01 MAR 2018
Water Level: Tidal
Contractor/Equipment: Logan/Dando

Project No.: JE0295
Elevation: 2.55 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
10					CPT	21		19			
					CPT	22		19			
					CPT	23		22			
					CPT	24		45			
	-8.12										
11	10.67	End of Borehole SPT refusal on inferred sandstone bedrock									
12											
13											
14											
15											
16											
17											
18											
19											

SPT N-Value
10 20 30 40 50 60 70 80 90



Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 01 MAR 2018
Water Level: Tidal
Contractor/Equipment: Logan/Dando

Project No.: JE0295
Elevation: 2.76
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	2.76	Wharf Deck									
	0.00										
11 / 3	-0.74	Harbour Bottom									
	3.50	Very loose dark grey sand, some silt, trace gravel, shell fragments: **MARINE DEPOSIT**			SS	1	75	1			
	-1.64										
	4.40				CPT	2		0			
					CPT	3		4			
					CPT	4		8			
		Inferred Marine Deposit; very loose to loose			CPT	5		0			
					CPT	6		0			
					CPT	7		0			
	-3.79				CPT	8		6			
	6.55				CPT	9		22			
					CPT	10		30			
					CPT	11		41			
		Inferred Till; compact to dense			CPT	12		48			
					CPT	13		26			
					CPT	14		29			
					CPT	15		25			
					CPT	16		33			
					CPT	17		38			
					CPT	18		31			

SPT N-Value
10 20 30 40 50 60 70 80 90

Note - N-value of 0 indicates CPT sank under weight of rods

Joose Environmental

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

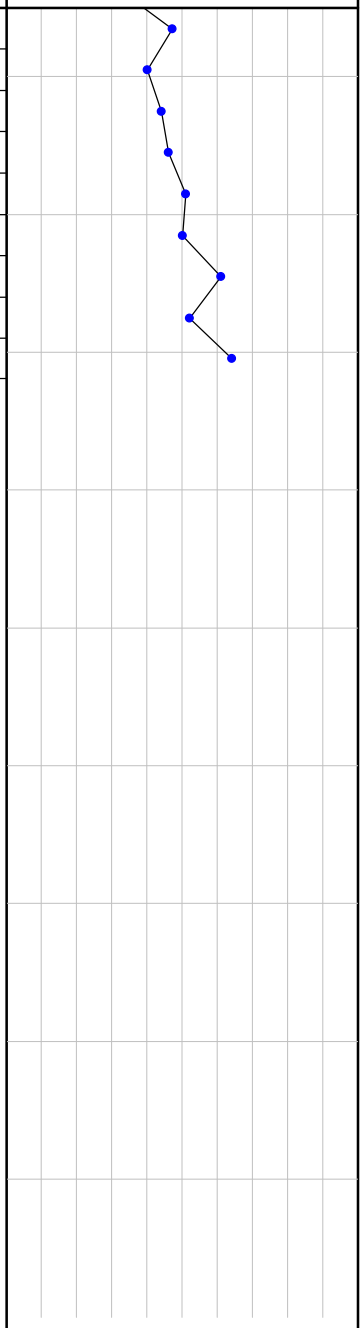
Date Drilled: 01 MAR 2018
Water Level: Tidal
Contractor/Equipment: Logan/Dando

Project No.: JE0295
Elevation: 2.76
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
					CPT	19		47			
					CPT	20		40			
					CPT	21		44			
					CPT	22		46			
					CPT	23		51			
					CPT	24		50			
					CPT	25		61			
					CPT	26		52			
	-9.43				CPT	27		64			
	12.19	End of Borehole SPT refusal on inferred sandstone bedrock									

SPT N-Value
10 20 30 40 50 60 70 80 90



Depth: 10 11 12 13 14 15 16 17 18 19

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Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 02 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.16 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.16	Harbour Bottom									
0 / 0	0.00	Very soft black organic silt, trace sand, shell fragments: **MARINE DEPOSIT**			SS	1	150	1			
3 / 1					SS	2	150	1			
5 / 1	-4.68				SS	3	100	1			
5 / 2	1.52	Compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**			SS	4	300	20			
10 / 3					SS	5	300	12			
13 / 4					SS	6	300	10			
15 / 4					SS	7	400	39			
16 / 5	-8.34				SS	8	50	75			
17 / 5	5.18	Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff to hard mudstone partings/seams/layers (up to 100 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	9	100%		54		
22 / 7					NQ	10	100%		77		
27 / 8					NQ	11	88%		50		
31 / 9	-12.76										
32 / 10	9.60	End of Borehole									

SPT N-Value
10 20 30 40 50 60 70 80 90

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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 04 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -1.80 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-1.80	Harbour Bottom									
	0.00	Very soft black organic silt, trace sand, shell fragments: **MARINE DEPOSIT**			SS	1	0	0			
	-2.71				SS	2	150	0			
1 /	0.91				SS	3	300	21			
2 /					SS	4	300	11			
3 /		Compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**			SS	5	450	13		16	Sieve
4 /					SS	6	300	11			
5 /					SS	7	300	24		15	Sieve
6 /	-7.90										
	6.10				NQ	8	100%		59		
7 /		Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff to hard mudstone partings/seams/layers (up to 100 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	9	100%		80		
8 /											
9 /					NQ	10	100%		60		
10 /	-11.86										
	10.06	End of Borehole									

SPT N-Value
10 20 30 40 50 60 70 80 90

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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

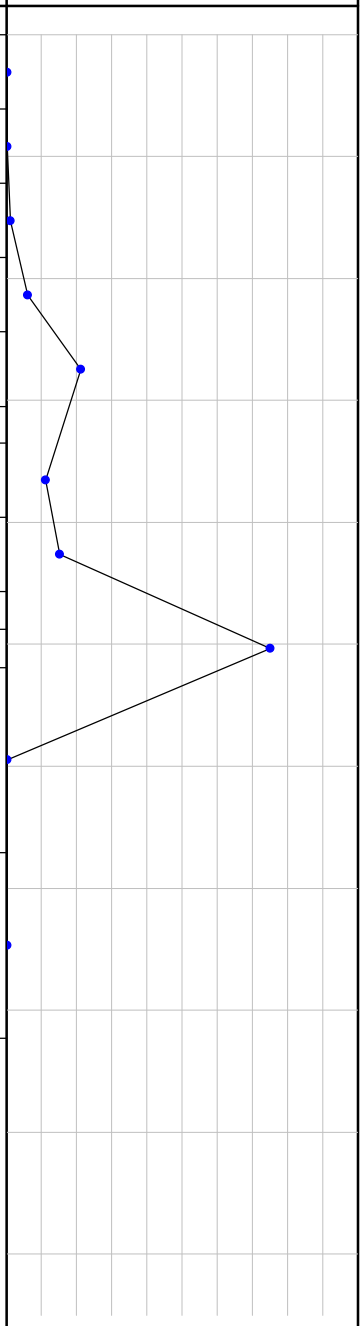
Date Drilled: 02 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.59
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.59	Harbour Bottom									
	0.00										
1		Very soft black organic silt, trace sand, shell fragments: **MARINE DEPOSIT**			SS	1	0	0			
2											
3 / 1					SS	2	75	0			
4											
5					SS	3	150	1			
6	-5.42										
	1.83										
7 / 2					SS	4	250	6			
8											
9					SS	5	250	21			
10 / 3		Loose to compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**									
11											
12					SS	6	300	11			
13 / 4											
14					SS	7	300	15		14	S/A
15											
16											
17 / 5					SS	8	150	75			
	-8.92										
18	5.33										
19											
20 / 6					NQ	9	80%		45		
21		Very weak to medium strong, reddish brown, medium grained sandstone: **BEDROCK**; extremely close to moderately close joint spacing									
22											
23 / 7											
24					NQ	10	100%		82		
25											
26 / 8											
	-11.82										
27	8.23	End of Borehole									
28											
29											
30 / 9											
31											
32											
33 / 10											
34											

SPT N-Value
10 20 30 40 50 60 70 80 90



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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 02 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -2.12
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-2.12	Harbour Bottom									
	0.00	Very soft black organic silt, trace sand, shell fragments: **MARINE DEPOSIT**			SS	1	450	1			
1 /					SS	2	0	0			
2 /											
					SS	3	0	1			
3 / 1											
	-5.32				ST	4	450	-			
	3.20	Loose to compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles and boulders (up to 500 mm): **TILL**			NQ	5	300		-		
4 /					NQ	6	950		-		
5 /											
					NQ	7	100%		100		
6 / 2	-8.22										
	6.10	Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff to hard mudstone partings/seams/layers (up to 250 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	8	97%		38		
7 /											
8 /	-10.35										
	8.23	End of Borehole									
9 / 3											
10 /											

SPT N-Value
10 20 30 40 50 60 70 80 90

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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 02 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.96 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.96	Harbour Bottom									
0 / 0	0.00	Very soft black organic silt, trace sand, shell fragments: **MARINE DEPOSIT**			SS	1	0	0			
3 / 1					SS	2	50	0			
4 / 1	-5.33										
5 / 2	1.37	Compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**			SS	3	150	10			
7 / 2					SS	4	300	16			
9 / 3					SS	5	450	16		13	Sieve
12 / 4					SS	6	300	15			
15 / 5					SS	7	150	75			
18 / 6					NQ	8	600		-		
20 / 6	-10.06										
23 / 7	6.10	Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff to hard mudstone partings/seams (up to 25 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	9	97%		77		
26 / 8					NQ	10	83%		83		
31 / 9	-13.41										
32 / 10	9.45	End of Borehole									

SPT N-Value
10 20 30 40 50 60 70 80 90

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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 02 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.73
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Pier Reconstruction
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.73	Harbour Bottom									
	0.00	Very soft black organic silt, trace sand, shell fragments: **MARINE DEPOSIT**			SS	1	0	0			
1 / 0					SS	2	300	0			
	-5.25				SS	3	300	2			
	1.52				SS	4	300	11			
2 / 1											
					SS	5	150	15			
3 / 1		Compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**			NQ	6	500		-		
4 / 2											
5 / 2					NQ	7	83%		70		
	-9.37										
	5.64	Very weak to medium strong, reddish brown, medium grained sandstone: **BEDROCK**; extremely close to moderately close joint spacing			NQ	8	100%		72		
6 / 3											
7 / 4											
	-11.65										
8 / 5	7.92	End of Borehole									
9 / 6											
10 / 7											

SPT N-Value
10 20 30 40 50 60 70 80 90

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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

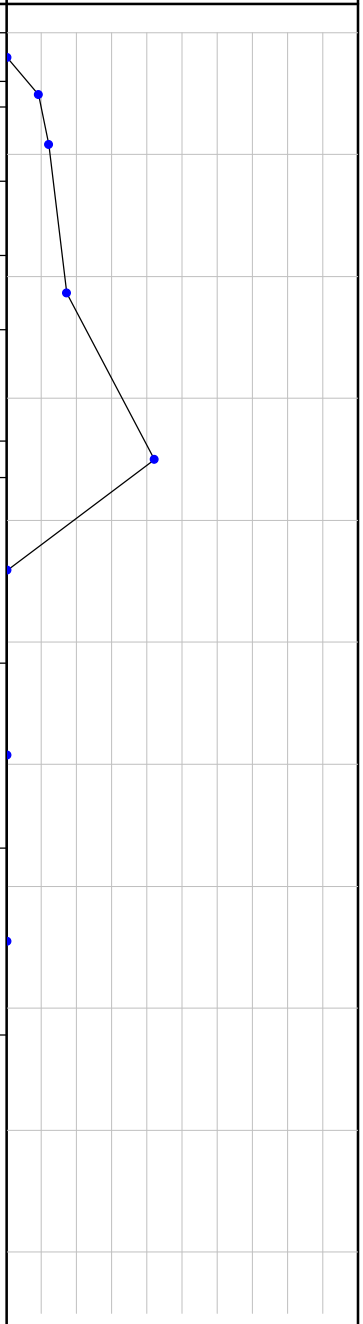
Date Drilled: 04 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.70
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Breakwater (L-Section)
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.70	Harbour Bottom									
0 / 0	0.00	Very loose olive grey silt and sand, trace to some gravel, trace organics, shell fragments: **MARINE DEPOSIT**			SS	1T	450	0		56	Sieve
1 /	-4.15				SS	1B	150	9			
2 /	0.45				SS	2	300	12		9	Sieve
3 / 1											
4 /											
5 /											
6 / 2					SS	3	350	17			
7 /		Compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**									
8 /											
9 /											
10 / 3					SS	4	300	42			
11 /											
12 /					NQ	5	600		-		
13 / 4											
14 /											
15 /											
16 /	-8.58										
17 / 5	4.88										
18 /											
19 /											
20 / 6		Very weak to medium strong, reddish brown, medium grained sandstone, occasional mudstone partings: **BEDROCK**; extremely close to moderately close joint spacing			NQ	6	100%		78		
21 /											
22 /											
23 / 7					NQ	7	100%		77		
24 /											
25 /											
26 / 8											
27 /	-11.93										
28 /	8.23	End of Borehole									
29 / 9											
30 /											
31 /											
32 / 10											
33 /											
34 /											

SPT N-Value
10 20 30 40 50 60 70 80 90



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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

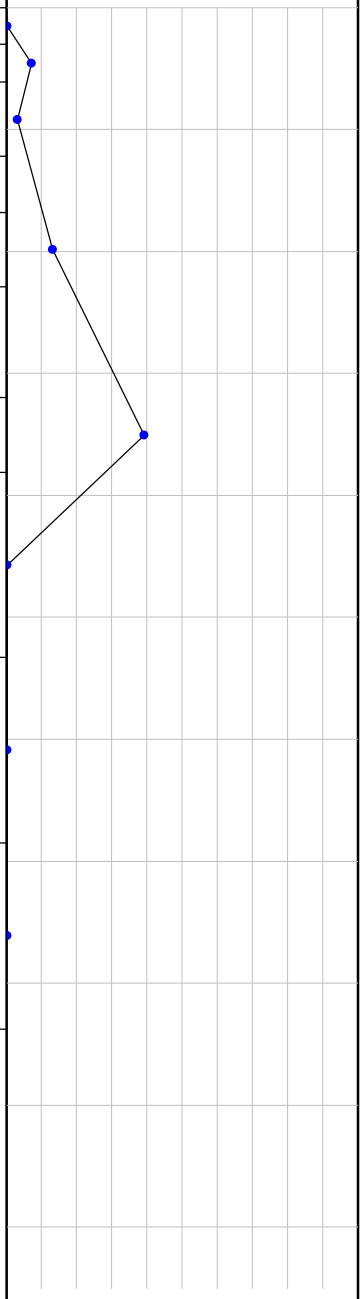
Date Drilled: 04 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.40 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Breakwater (L-Section)
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.40	Harbour Bottom									
	0.00	Very loose olive grey silt and sand, trace to some gravel: **MARINE DEPOSIT**			SS	1T	150	0			
1					SS	1B	150	7		32	Sieve
2		Loose mottled brown/grey sand, trace silt: **MARINE DEPOSIT**									
3 / 1	-4.47				SS	2	300	3			
	1.07										
4											
5											
6 / 2					SS	3	350	13		12	Sieve
7											
8											
9		Compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**									
10 / 3											
11					SS	4	300	39			
12											
13 / 4					NQ	5	900		-		
14											
15	-8.12										
	4.72										
16 / 5											
17											
18											
19											
20 / 6		Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff to hard mudstone partings/seams (up to 75 mm): **BEDROCK**; extremely close to moderately close joint spacing			NQ	6	100%		75		
21											
22											
23 / 7											
24											
25					NQ	7	100%		43		
26 / 8											
27	-11.78										
	8.38										
28		End of Borehole									
29											
30 / 9											
31											
32											
33 / 10											
34											

SPT N-Value
10 20 30 40 50 60 70 80 90



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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Date Drilled: 04 May 2018
Water Level: Tidal
Contractor/Equipment: Logan/CME 55

Project No.: JE0295
Elevation: -3.50 m
Datum: Low Normal Tide (Chart)

Location: Georgetown SCH, Kings County, PEI
Project: Proposed Breakwater (L-Section)
Client: Small Craft Harbours, Fisheries and Oceans Canada

Depth (ft / m)	Elevation, m	SOIL DESCRIPTION	Strata Plot	Water Level	Sample Type	Sample Number	Recovery, mm	SPT N-Value	RQD	Moisture Content, %	Other Tests
0 / 0	-3.50	Harbour Bottom									
	0.00	Very loose olive grey silt and sand, trace to some gravel, trace organics, shell fragments: **MARINE DEPOSIT**			SS	1	450	1			
	-3.95										
1	0.45				SS	2	225	6			
2					SS	3	300	12			
		Loose to compact reddish brown silt and sand, trace to some gravel, trace clay, occasional sandstone cobbles: **TILL**			SS	4	225	80			
3					NQ	5	450		-		
4	-7.77										
	4.27				NQ	6	100%		83		
5		Very weak to medium strong, reddish brown, medium grained sandstone, occasional stiff to hard mudstone partings/seams (up to 30 mm): **BEDROCK**; extremely close to moderately close joint spacing									
6					NQ	7	100%		68		
7	-10.82										
	7.32	End of Borehole									
8											
9											
10											

SPT N-Value
10 20 30 40 50 60 70 80 90

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GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Table 1 - Borehole and CPT Summary - Proposed Pier Replacement, Georgetown Small Craft Harbour

	Borehole/Cone Penetration Test (CPT) Number									
	BH 1-18	CPT 1-18	CPT 2-18	CPT 3-18	BH M1	BH M2	BH M3	BH M4	BH M5	BH M6
Wharf Deck el., m	2.58	2.56	2.55	2.76	-	-	-	-	-	-
Depth to Harbour Bottom, m	2.13	2.59	2.90	3.50	-	-	-	-	-	-
Harbour Bottom el., m	0.45	-0.03	-0.35	-0.74	-3.16	-1.80	-3.59	-2.12	-3.96	-3.73
Fill Thickness, m	1.52	3.05	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine Deposit Thickness, m	1.53	0.00	2.15	3.05	1.52	0.91	1.83	3.20	1.37	1.52
Depth to Till Surface, m	3.05	3.05	3.05	3.05	1.52	0.91	1.83	3.20	1.37	1.52
Till Surface el., m	-2.60	-3.08	-3.40	-3.79	-4.68	-2.71	-5.42	-5.32	-5.33	-5.25
Till Thickness, m	2.74	1.82	4.72	5.64	3.66	5.19	3.50	2.90	4.73	4.12
Depth to Bedrock, m	5.79	4.87	7.77	8.69	5.18	6.10	5.33	6.10	6.10	5.64
Bedrock Surface el., m	-5.34	-4.90	-8.12	-9.43	-8.34	-7.90	-8.92	-8.22	-10.06	-9.37
Depth of Borehole/CPT, m	12.34	7.46	10.67	12.19	9.60	10.06	8.23	8.23	9.45	7.92

NOTES:

- BH 1-18 was drilled at the site on February 28, 2018 using a track-mounted CME 55 auger drill rig
- the CPTS were carried out at the site on March 1, 2018 using a small track-mounted Dando drill rig
- BH M1 to BH M6 were drilled at the site during the period May 1 to 4, 2018 using a barge-mounted CME 55 auger drill rig
- elevations are referenced to Low Normal Tide (Chart) Datum based on CHS BM No. M14P9000
- fill, marine deposit, and till layer thicknesses at the CPT locations are inferred based on N-values
- bedrock was proven at the boreholes by rotary core drilling in NQ-size
- bedrock was inferred at the CPT locations based on penetration cone refusal

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Table 2 - Borehole Summary - Proposed Breakwater (L-Section), Georgetown Small Craft Harbour

	Borehole Number			
	BH M6	BH M7	BH M8	BH M9
Harbour Bottom el., m	-3.73	-3.70	-3.40	-3.50
Marine Deposit Thickness, m	1.52	0.45	1.07	0.45
Till Surface el., m	-5.25	-4.15	-4.47	-3.95
Till Thickness, m	4.12	4.43	3.65	3.82
Depth to Bedrock, m	5.64	4.88	4.72	4.27
Bedrock Surface el., m	-9.37	-8.58	-8.12	-7.77
Depth of Borehole/CPT, m	7.92	8.23	8.38	7.32

NOTES:

- the boreholes were drilled during the period May 1 to 3, 2018 using a barge-mounted CME 55 auger drill rig
- elevations are referenced to Low Normal Tide (Chart) Datum
- bedrock was proven at the boreholes by rotary core drilling in NQ-size

Table 3 - Laboratory Testing Summary - Georgetown Small Craft Harbour

			Grain Size Distribution, %			Atterberg Limits, %			Moisture Content, %	Soil Description
Borehole No.	Sample No.	Depth, m	Gravel	Sand	Silt/ Clay	LL	PL	PI		
BH 1-18	SS 3	1.5 to 2.1	10	80	10	-	-	-	27	Sand, some silt, gravel: Marine Deposit
BH 1-18	SS 5	3.1 to 3.7	8	45	47	-	-	-	14	Silt and sand, trace clay, gravel: Till
BH 1-18	SS 7	4.6 to 5.2	15	29	56	16	14	2	14	Sandy silt, some gravel, trace clay: Till
BH 1-18	SS 8	5.5 to 5.8	10	33	57	-	-	-	15	Sandy silt, some gravel, trace clay: Till
CPT 2-18	SS 1	0.0 to 0.9	37	50	13	-	-	-	40	Gravelly sand, some silt: Fill
BH M2	SS 5	2.7 to 3.0	22	40	38	-	-	-	16	Silt and sand, some gravel: Till
BH M2	SS 7	5.5 to 5.9	13	47	40	-	-	-	15	Silt and sand, some gravel: Till
BH M3	SS 7	4.0 to 4.6	45	38	17	18	16	2	14	Silty sand and gravel, trace clay: Till
BH M5	SS 5	2.4 to 3.0	5	56	39	-	-	-	13	Silt and sand, trace gravel: Till
BH M7	SS 1T	0.0 to 0.4	13	44	43	-	-	-	56	Silt and sand, some gravel: Marine Deposit
BH M7	SS 2	0.6 to 1.2	31	53	16	-	-	-	9	Gravelly sand, some silt: Till
BH M8	SS 1B	0.3 to 0.6	0	91	9	-	-	-	32	Sand, trace silt: Marine Deposit
BH M8	SS 3	1.7 to 2.3	18	47	35	-	-	-	12	Silt and sand, some gravel: Till

Notes:

- Depths shown above are below harbour bottom
- LL denotes liquid limit
- PL denotes liquid limit
- PI denotes plasticity index

GEO SERVICES
GEOTECHNICAL DIVISION OF JOOSE ENVIRONMENTAL

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

The foll[illegible]ıe interpretation of terms and symbols used on the borehole logs, te[illegible]

Soils Description

Terminology describing common soil genesis:

Topsoil	-	mixture of soil and humus capable of supporting vegetative growth
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating successions of different soil types, e.g. silt and sand
Layer	-	> 75 mm in thickness
Seam	-	2 mm to 75 mm in thickness
Parting	-	< 2 mm in thickness

Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Modified Unified Soil Classification System (MUSCS) and in accordance with the Canadian Foundation Engineering Manual Fourth Edition (Canadian Geotechnical Society, 2006). The classification excludes particles larger than 75 mm (3 inches). The MUSCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Consised using simple field tests, or described in terms of a strengt**h**ength (s_u) can be assessed using a simple field tool appropriate for cohesive soils, in conjunction with the relevant calibration. Refer to AS 1726-1993, Table A4.

Consistency - Essentially Cohesive Soils					
Term	**Field Guide**	**Symbol**	**SPT "N" Value**	**Undrained Shear Strength su (kPa)**	**Unconfined Compressive Strength qu (kPa)**
Very soft	Oozes between fingers when	VS	0-2	<12	<25
Soft	Easily moulded with fingers.	S	2-4	12-25	25-50
Firm	Can be moulded by strong pressure of fingers.	F	4-8	25-50	50-100
Stiff	Not possible to mould with fingers.	St	8-15	50-100	100-200
Very stiff		VSt	15-30	100-200	200-400
Hard	Can be indented with difficulty by thumb nail.	H	>30	>200	>400

Note: SPT - N to q_u correlation from Terzaghi and Peck, 1967. (General guide only).

Soil Particle Sizes	
Term	**Size Range**
BOULDERS	>200 mm
COBBLES	63-200 mm
Coarse GRAVEL	20-63 mm
Medium GRAVEL	6-20 mm
Fine GRAVEL	2.36-6 mm
Coarse SAND	0.6-2.36 mm
Medium SAND	0.2-0.6 mm
Fine SAND	0.075-0.2 mm
SILT	0.002-0.075 mm
CLAY	<0.002 mm

Consistency of Non-Cohesive Soils: Is described in terms of the density index, as defined in AS 1289.0-2000. This can be assessed using a field tool appropriate for non-cohesive soils, in conjunction with the relevant calibration. Refer to AS 1726-1993, Table A5; BS5930-1999, p117.

Consistency - Essentially Non-Cohesive Soils				
Term	**Symbol**	**SPT N Value**	**Field Guide**	**Density Index (%)**
Very loose	VL	0-4	Foot imprints readily	0-15
Loose	L	4-10	Shovels Easily	15-35
Medium dense	MD	10-30	Shovelling difficult	35-65
Dense	D	30-50	Pick required	65-85
Very dense	VD	>50	Picking difficult	85-100

Standard Penetration Test (SPT): Refer to. AS 1289.6.3.1-2004. Example report formats for SPT results are shown below:

Test Report	Penetration Resistance (N)	Explanation / Comment
4, 7, 11	N=18	Full penetration; N is reported on engineering borehole log
18, 27, 32	N=59	Full penetration; N is reported on engineering borehole log
4, 18, 30/15 mm	N is not reported	30 blows causes less than 100 mm penetration (3rd interval) - test discontinued
30/80 mm	N is not reported	30 blows causes less than 100 mm penetration (1st interval) - test discontinued
rw	N<1	Rod weight only causes full penetration
hw	N<1	Hammer and rod weight only causes full penetration
hb	N is not reported	Hammer bouncing for 5 consecutive blows with no measurable penetration - test discontinued

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Rock D

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology Describing Rock Quality:

RQD	Rock Mass Quality
0 - 25	*Very Poor Quality*
25 - 50	*Poor Quality*
50 - 75	*Fair Quality*
75 - 90	*Good Quality*
90 - 100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 inches) long are summed up and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved forma borehole of any orientation. All pieces of the solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of the natural occurring fractures.

Refer to AS 1726-1993 (Appendix A3.3) for the description and classification of rock material composition, including:

(a) Rock type (Table A6, (a) and (b))
(b) Grain size
(c) Texture and fabric
(d) Colour (describe as per soil).

The condition of a rock material refers to its weathering characteristics, strength characteristics and rock mass properties. Refer to AS 1726-1993 (Appendix A3 Tables A8, A9 and A10).

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Weathe

The de[illegible]sh rock to soil. Boundaries between weathering grades may be abrupt or gradational.

Rock Material Weathering		
Weathering Grade	**Symbol**	**Definitio**
Residual Soil	RS	Soil-like material developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the material has not been significantly transported.
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded in water, but substance fabric and rock structure still recognizable.
Highly Weathered Rock	HW	Strong discolouration is evident throughout the rock mass, often with significant change in the constituent minerals. The intact rock strength is generally much weaker than that of the fresh rock.
Moderately Weathered Rock	MW	Modest discolouration is evident throughout the rock fabric, often with some change in the constituent minerals. The intact rock strength is usually noticeably weaker than that of the fresh rock.
Slightly Weathered	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

Notes:

1. Minor variations within broader weathering grade zones will be noted on the engineering borehole logs.
2. Extremely weathered rock is described in terms of soil engineering properties.
3. Weathering may be pervasive throughout the rock mass, or may penetrate inwards from discontinuities to some extent.
4. The 'Distinctly Weathered (DW)' class as defined in AS 1726-1993 is divided to incorporate HW and MW in the above table. The symbol DW should not be used.

Strength Condition (Intact Rock Strength):

Terminology Describing Rock Strength

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	< 1
Very Weak	R1	1 - 5
Weak	R2	5 - 25
Medium Strong	R3	25 - 50
Strong Very	R4	50 - 100
Strong Extremely	R5	100 - 250
Strong	R6	> 250

Discontinuity Spacing: On the geotechnical borehole log, a graphical representation of defect spacing vs depth is shown. This representation takes into account all the natural rock defects occurring within a given depth interval, excluding breaks induced by the drilling / handling of core. Refer to AS 1726-1993, BS5930-1999.

Defect Spacing			Bedding Thickness (Sedimentary Rock Stratification)	
Spacing/Width (mm)	**Descriptor**	**Symbol**	**Descriptor**	**Spacing /Width (mm)**
			Thinly Laminated	<6
<20	Extremely Close	EC	Thickly Laminated	6 - 20
20 - 60	Very Close	VC	Very Thinly Bedded	20 - 60
60 - 200	Close	C	Thinly Bedded	60 -200
200 - 600	Medium	M	Medium Bedded	200 - 600
600 - 2000	Wide	W	Thickly Bedded	600 - 2000
2000 - 6000	Very Wide	VW	Very Thickly Bedded	>2000
>6000	Extremely Wide	EW		

Defect Spacing in 3D	
Term	**Description**
Blocky	Equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

Direct Persistence (areal extent)
Trace length of defect given in metres

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

The list [illegible]tion of terms and symbols used on the geotechnical borehole, test pit and penetrometer logs.

Test Results					Test Symbols	
PI	Plasticity Index	c′	Effective Cohesion		DCP	Dynamic Cone Penetrometer
LL	Liquid Limit	c_u	Undrained Cohesion		SPT	Standard Penetration Test
LI	Liquidity Index	c'_R	Residual Cohesion		CPTu	Cone Penetrometer (Piezocone) Test
DD	Dry Density	φ′	Effective Angle of Internal Friction		PANDA	Variable Energy DCP
WD	Wet Density	φ_u	Undrained Angle of Internal Friction		PP	Pocket Penetrometer Test
LS	Linear Shrinkage	φ'_R	Residual Angle of Internal Friction		U50	Undisturbed Sample 50 mm (nominal diameter)
MC	Moisture Content	c_v	Coefficient of Consolidation		U100	Undisturbed Sample 100mm (nominal diameter)
OC	Organic Content	m_v	Coefficient of Volume Compressibility		UCS	Uniaxial Compressive Strength
WPI	Weighted Plasticity Index	$c_{\alpha\varepsilon}$	Coefficient of Secondary Compression		Pm	Pressuremeter

Test Results					Test Symbols	
WLS	Weighted Linear Shrinkage	e	Voids Ratio		FSV	Field Shear Vane
DoS	Degree of Saturation	φ'_{cv}	Constant Volume Friction Angle		DST	Direct Shear Test
APD	Apparent Particle Density	q_t / q_c	Piezocone Tip Resistance (corrected / uncorrected)		PR	Penetration Rate
s_u	Undrained Shear Strength	q_d	PANDA Cone Resistance		A	Point Load Test (axial)
q_u	Unconfined Compressive Strength	$I_{s(50)}$	Point Load Strength Index		D	Point Load Test (diametral)
R	Total Core Recovery	*RQD*	Rock Quality Designation		L	Point Load Test (irregular lump)

Sample Type

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameters tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ,NQ, BQ, etc	Rock core samples obtained with the use of standard size diamond coring bits.

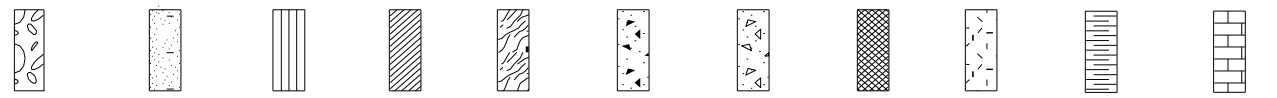
Water Level Measurement

Measurement in standpipe, piezometer, or well

Inferred

Strata Plot

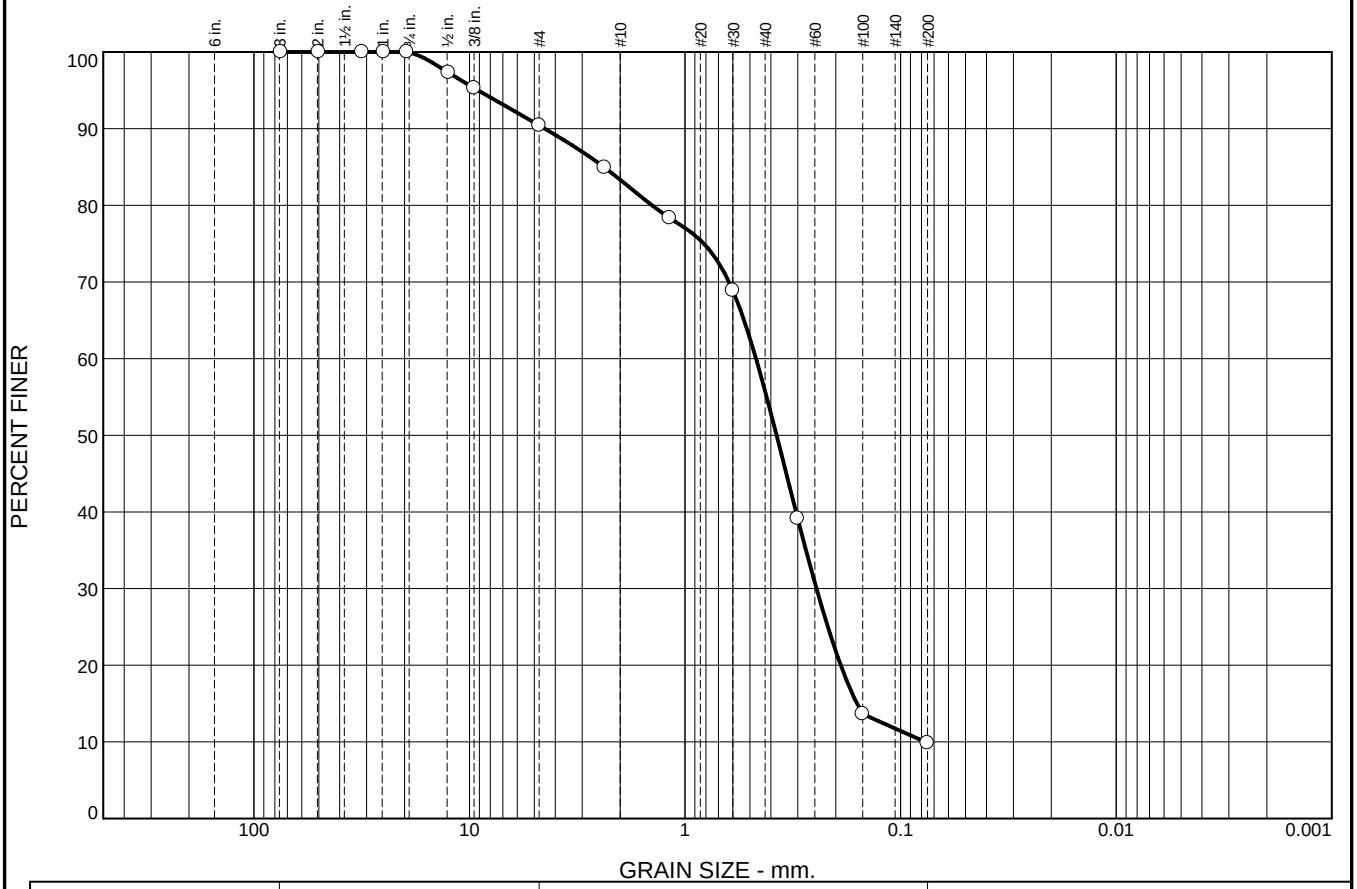
Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	10	7	27	46	10	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			2.3816	0.4687	0.3760	0.2456	0.1595	0.0770	1.67	6.09

Material Description	USCS	AASHTO
○ Insitu March 2, 2018		

Project No. 18-12973 **Client:** Joose Environmental
Project: QC Soils Analysis Georgetown Small Craft Harbours

○ **Location:** BH-1-18 - SS#3 **Depth:** 12'-14' **Sample Number:** 2

FUNDY Engineering

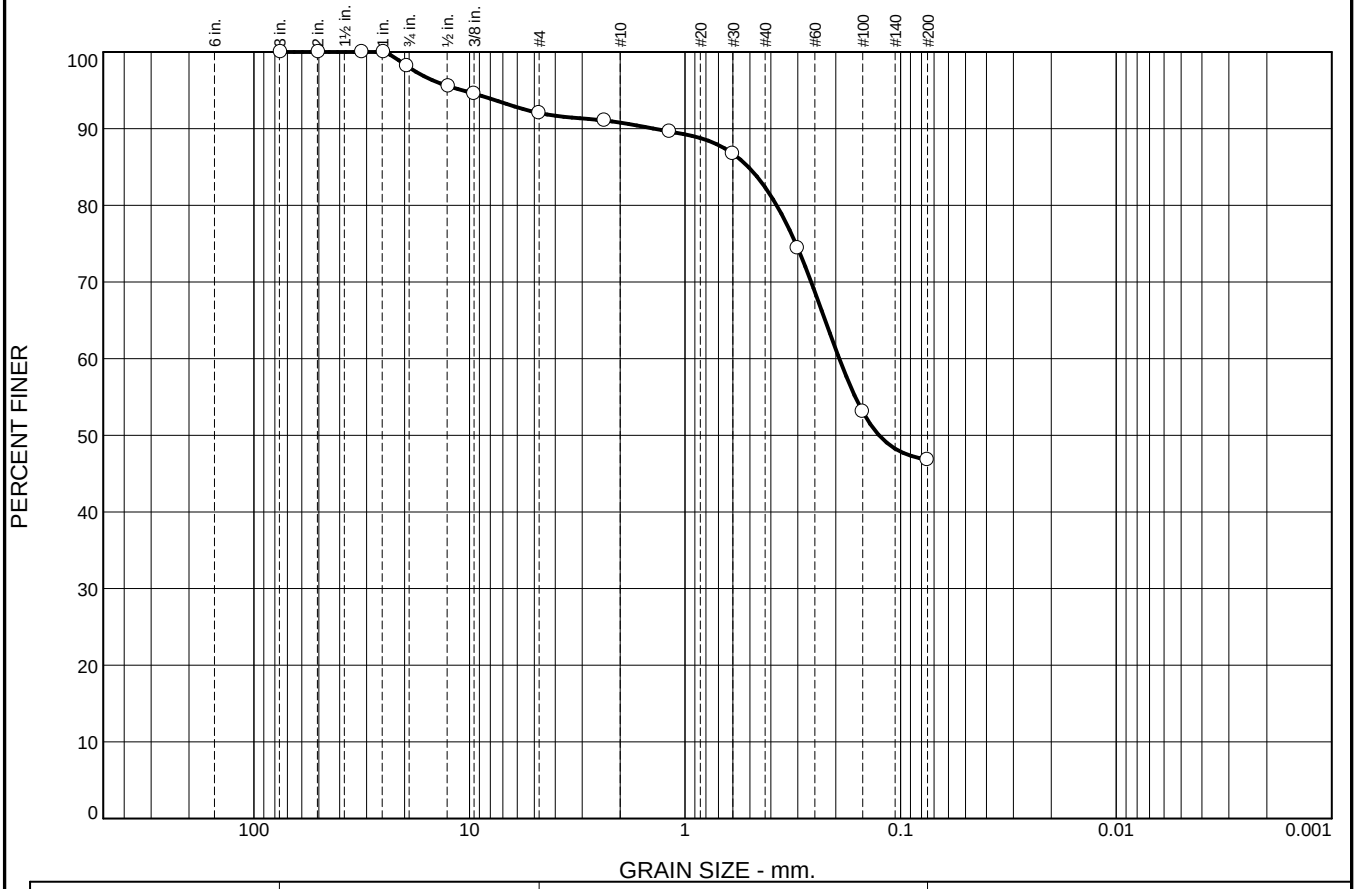
Remarks:
○Moisture content on sample was 26.9%

Figure

Tested By: T. Pineau **Checked By:** D. Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	2	6	1	9	35	47	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5086	0.1926	0.1259					

Material Description	USCS	AASHTO
○ Insitu March 2, 2018		

Project No. 18-12973 **Client:** Joose Environmental
Project: QC Soils Analysis Georgetown Small Craft Harbours

○ **Location:** BH-1-18 - SS#5 **Depth:** 17'-19' **Sample Number:** 3

FUNDY Engineering

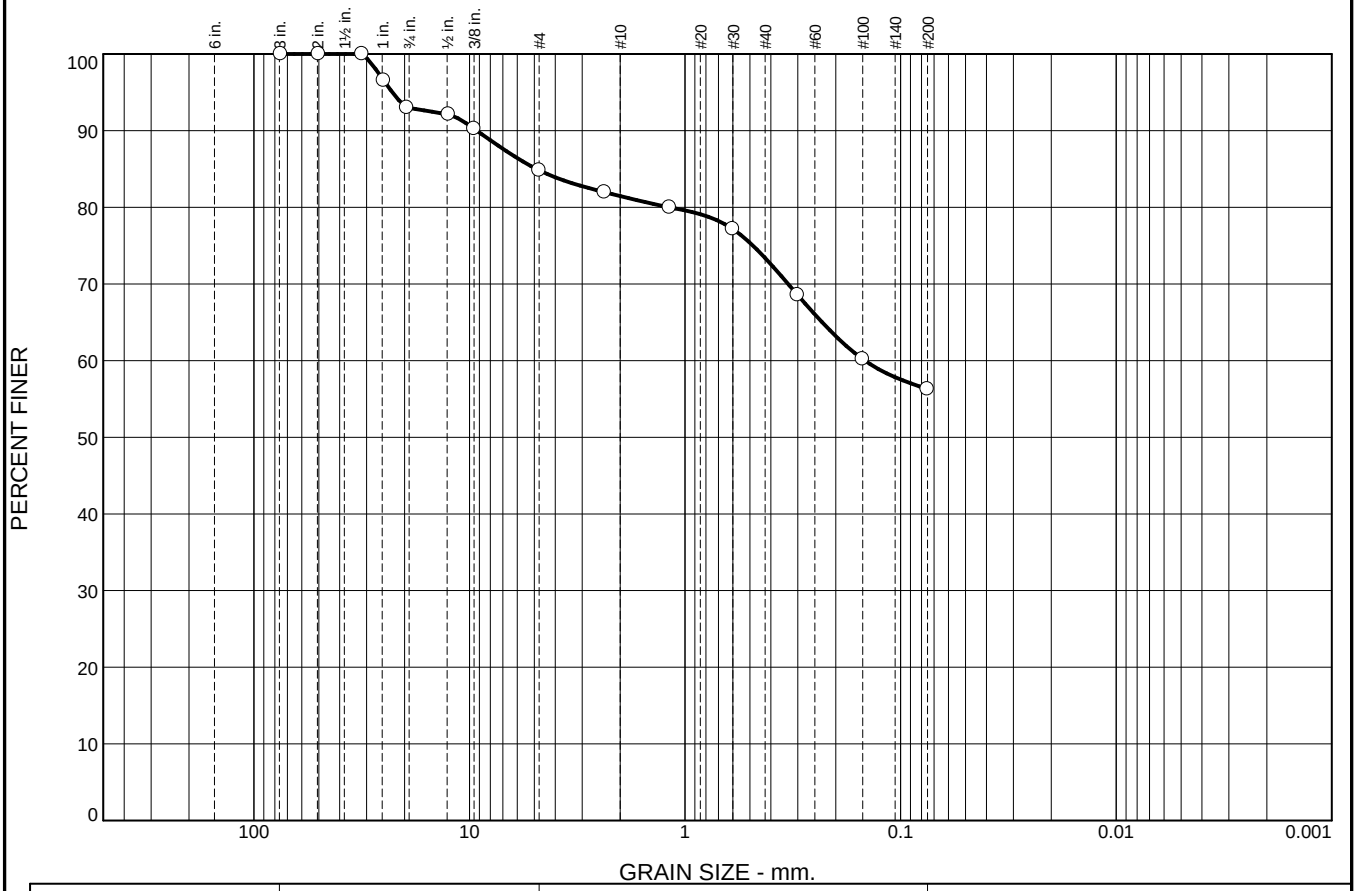
Remarks:
○Moisture content on sample was 14.1%

Figure

Tested By: T. Pineau **Checked By:** D. Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	7	8	4	8	17	56	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			4.8850	0.1465						

Material Description	USCS	AASHTO
○ Insitu March 2, 2018		

Project No. 18-12973 **Client:** Joose Environmental
Project: QC Soils Analysis Georgetown Small Craft Harbours

○ **Location:** BH-1-18 - SS#7 **Depth:** 22'-24' **Sample Number:** 4

FUNDY Engineering

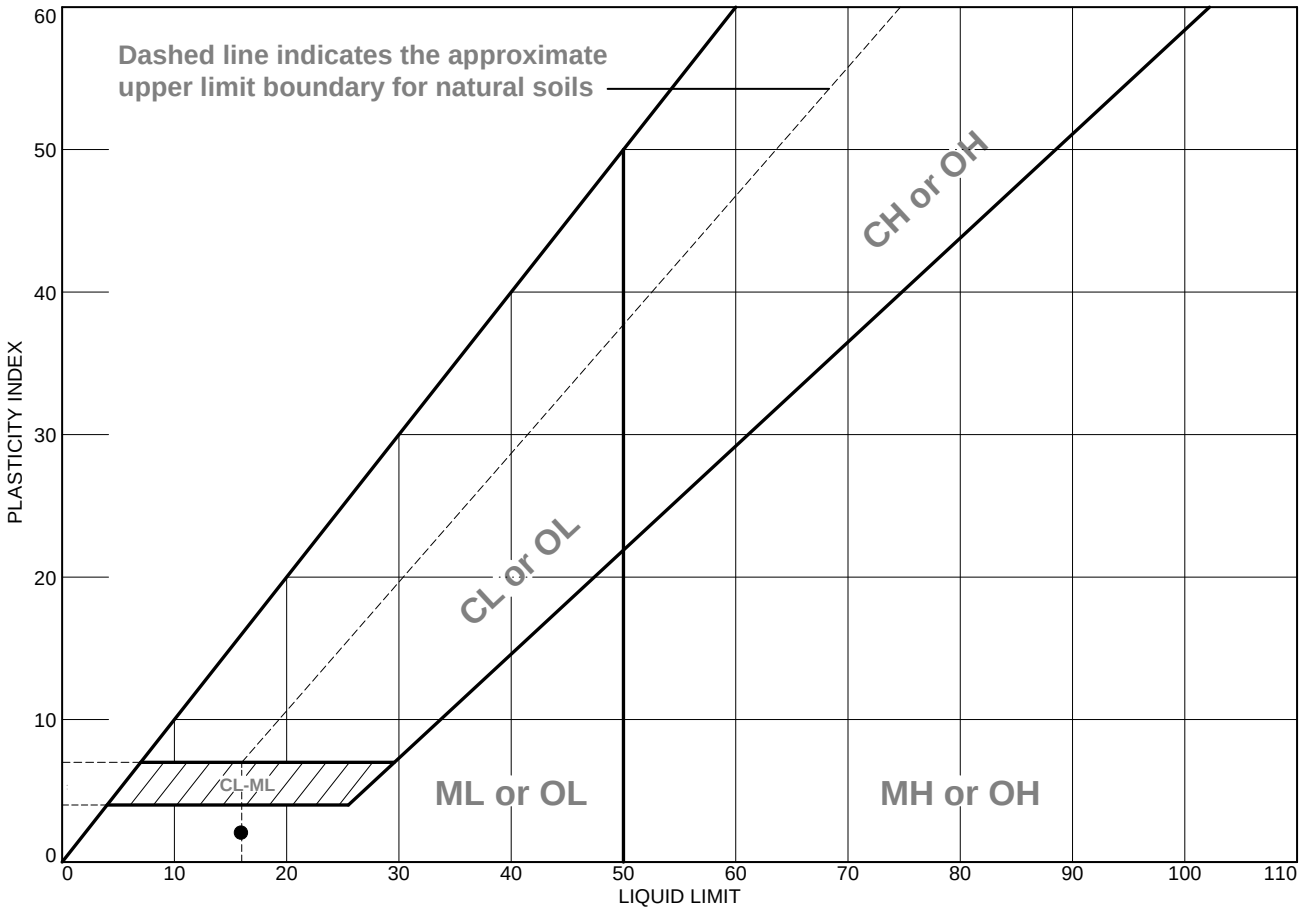
Remarks:
○Moisture content on sample was 14.3%

Figure

Tested By: T. Pineau **Checked By:** D. Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Insitu March 2, 2018	16	14	2	73	56	ML

Project No. 18-12973 **Client:** Joose Environmental

Project: QC Soils Analysis Georgetown Small Craft Harbours

●**Location:** BH-1-18 - SS#7 **Depth:** 22'-24' **Sample Number:** 4

Remarks:

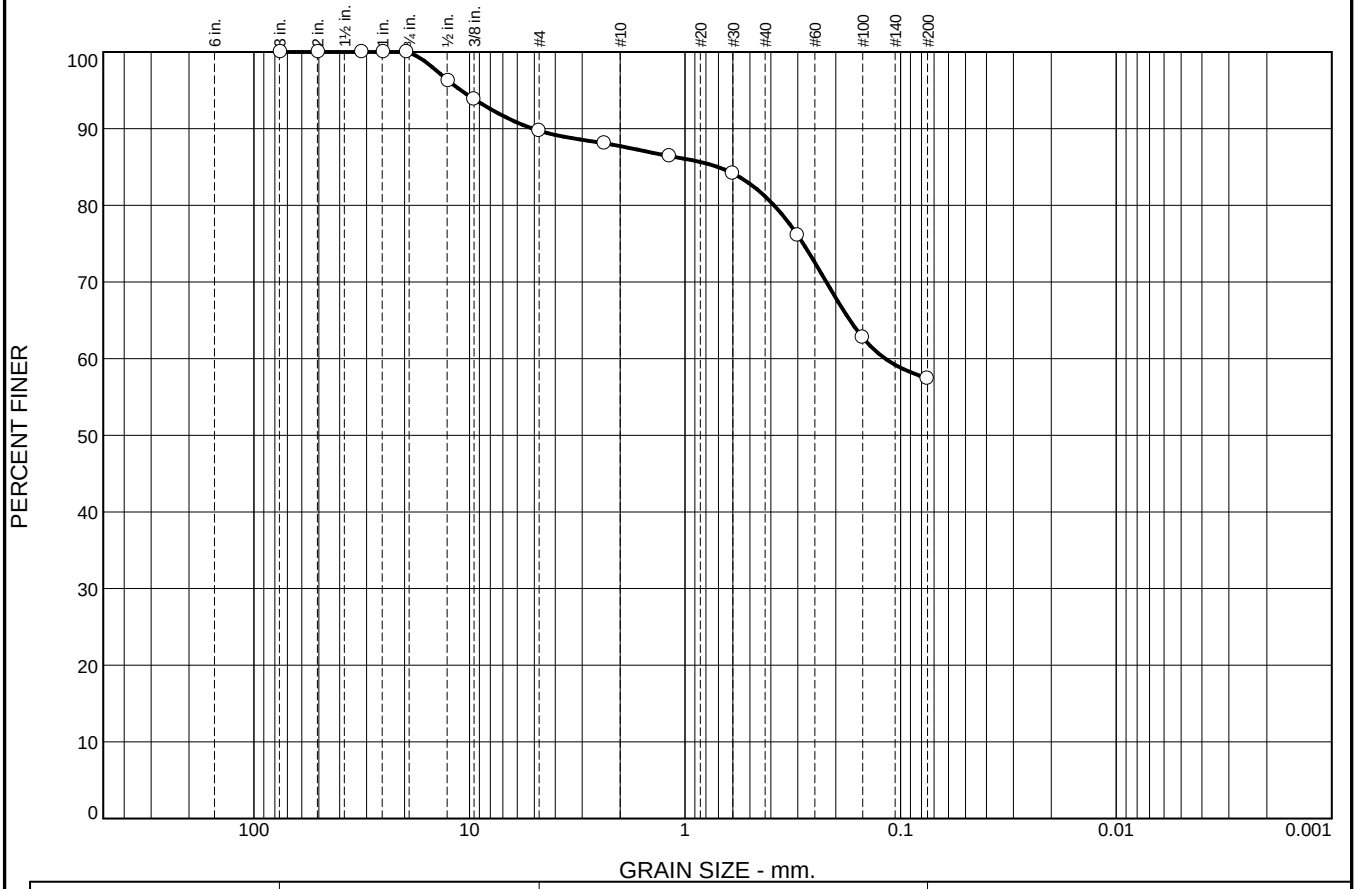
FUNDY Engineering

Figure

Tested By: D. Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	10	2	7	24	57	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7056	0.1179						

Material Description	USCS	AASHTO
○ Insitu March 2, 2018		

Project No. 18-12973 **Client:** Joose Environmental
Project: QC Soils Analysis Georgetown Small Craft Harbours

○ **Location:** BH-1-18 - SS#8 **Depth:** 25'-26' **Sample Number:** 5

FUNDY Engineering

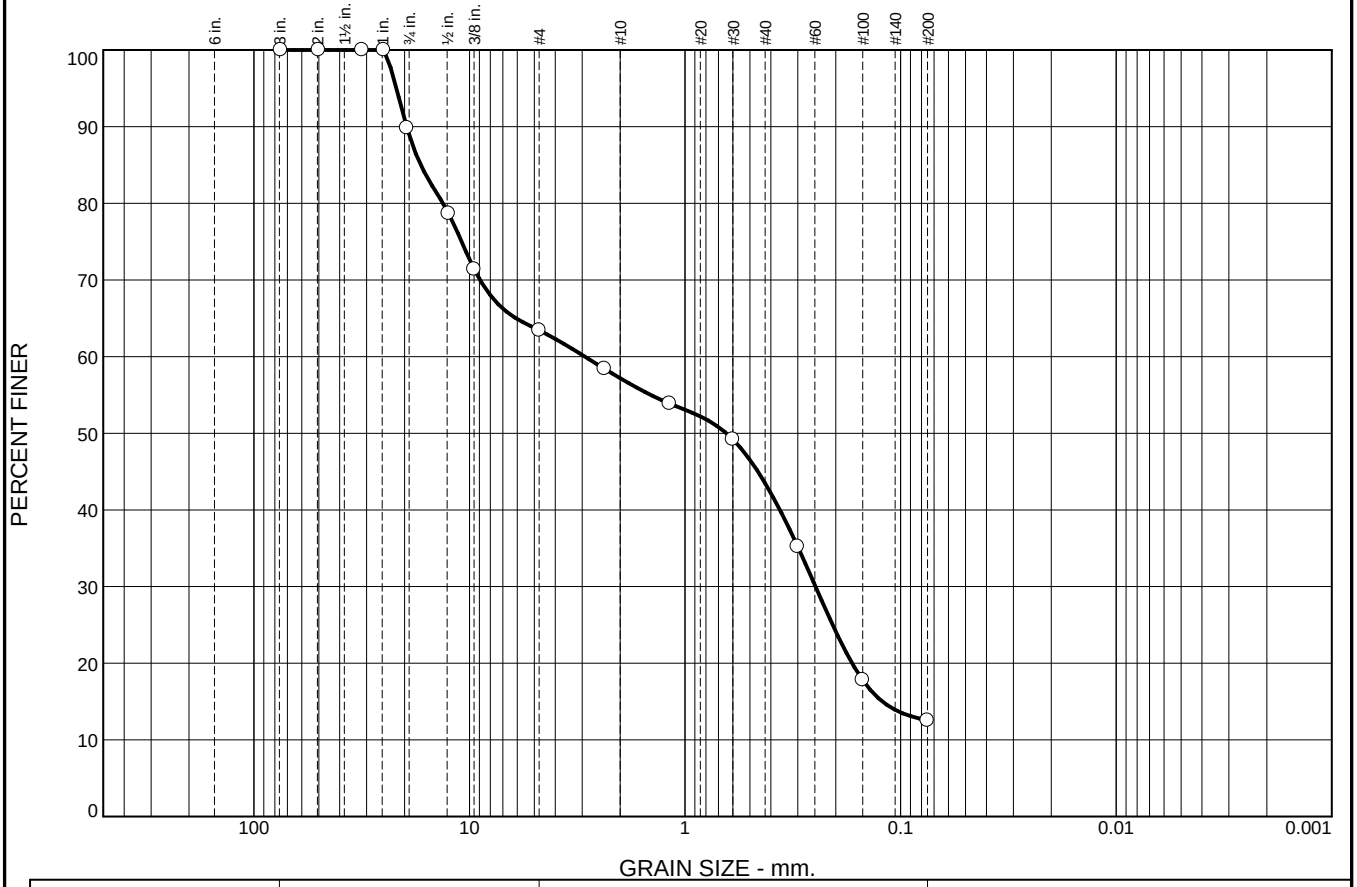
Remarks:
○Moisture content on sample was 14.7%

Figure

Tested By: T. Pineau **Checked By:** D. Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	11	26	6	14	30	13	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			16.8326	2.9153	0.6437	0.2481	0.1214			

Material Description	USCS	AASHTO
○ Insitu March 2, 2018		

Project No. 18-12973 **Client:** Joose Environmental
Project: QC Soils Analysis Georgetown Small Craft Harbours

○ **Location:** CPT- SS#1 **Depth:** 2'-10' **Sample Number:** 1

FUNDY Engineering

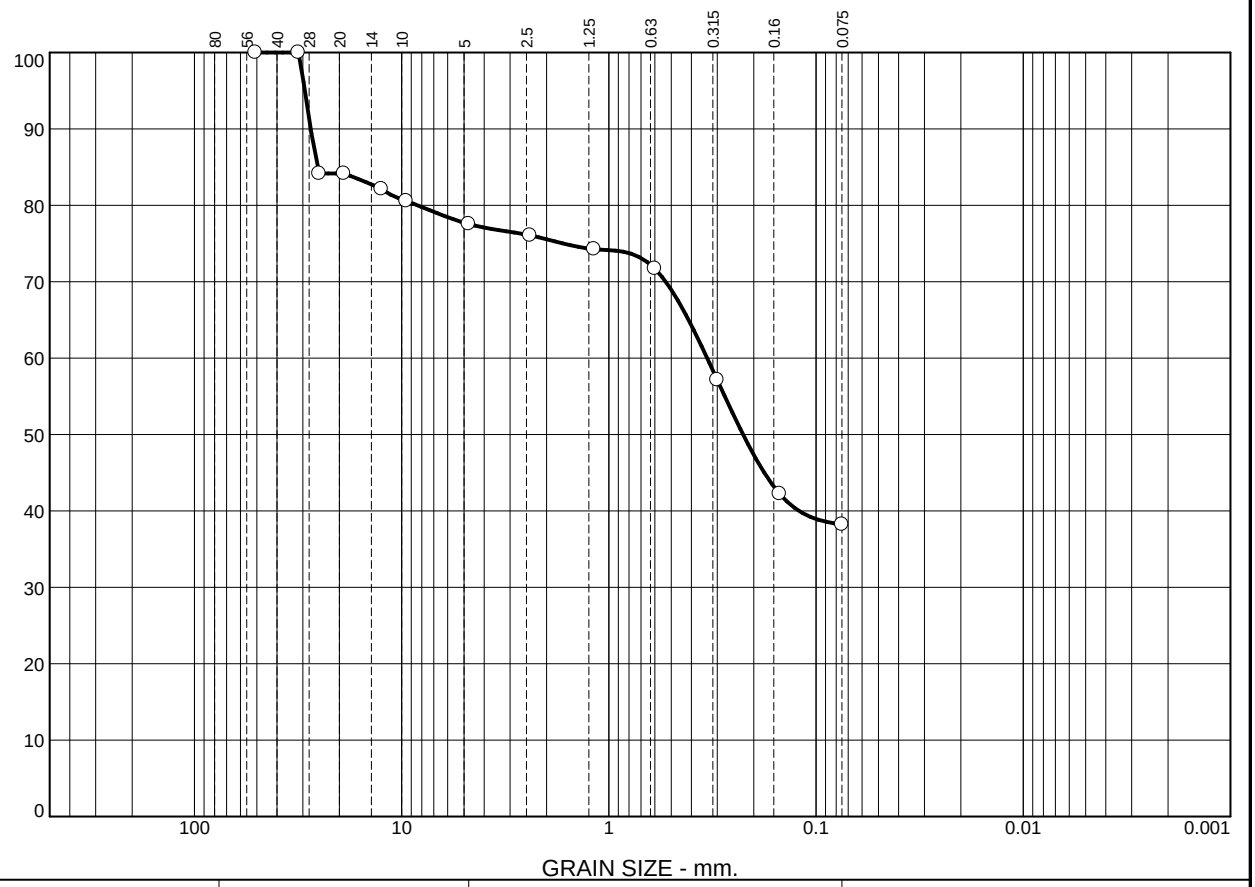
Remarks:
○Moisture Content on sample was 40.2%

Figure

Tested By: T. Pineau **Checked By:** D. Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	16	6	2	10	28	38	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			25.4493	0.3357	0.2249					

	Material Description	USCS	AASHTO
○			

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown

○ **Location:** Georgetown **Sample Number:** M2 SS#5

Remarks:
○Moisture Content is 16.2%

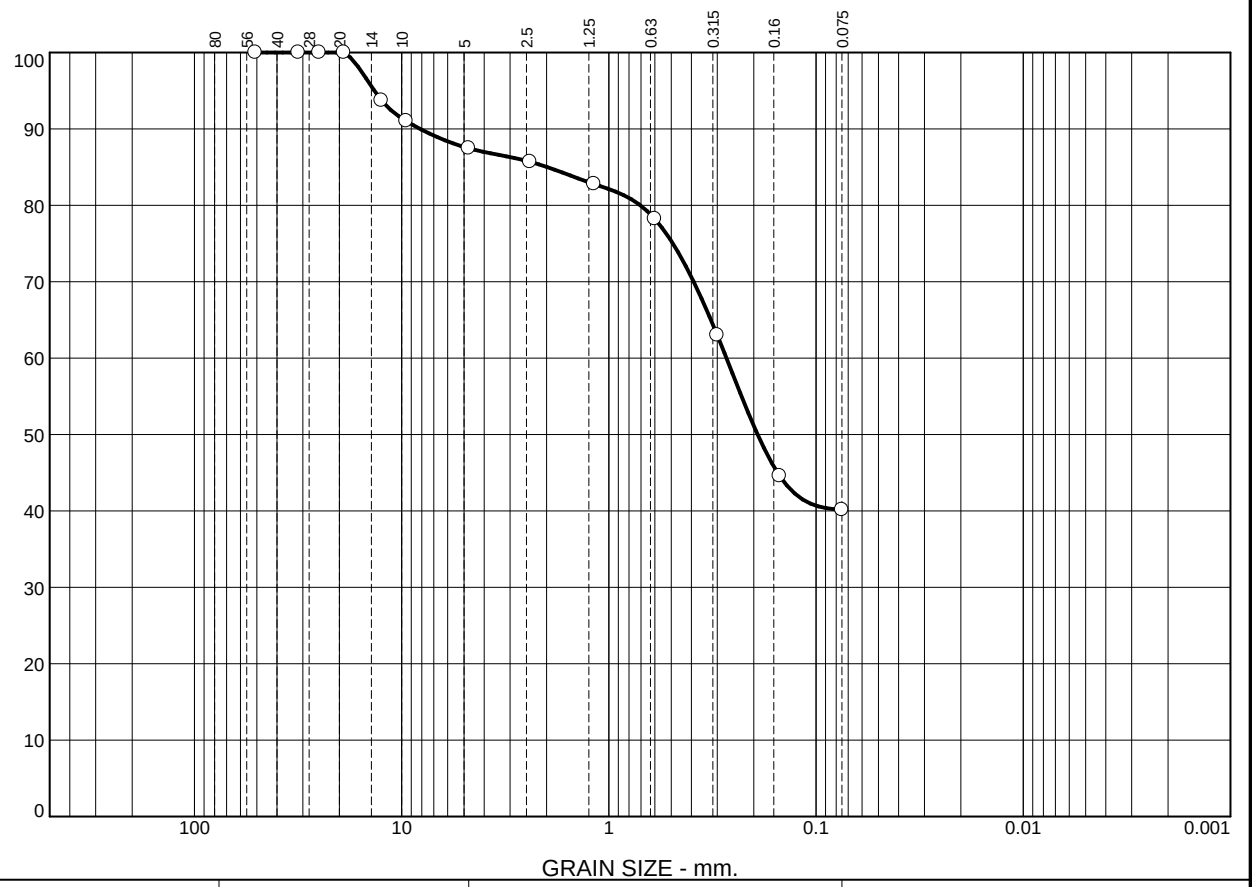
FUNDY Engineering

Figure

Tested By: T.Pineau **Checked By:** D.Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	13	2	13	32	40	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.9813	0.2707	0.1915					

Material Description	USCS	AASHTO
○		

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Sample Number:** M2 SS#7

Remarks:
○Moisture Content is 14.7%

FUNDY Engineering

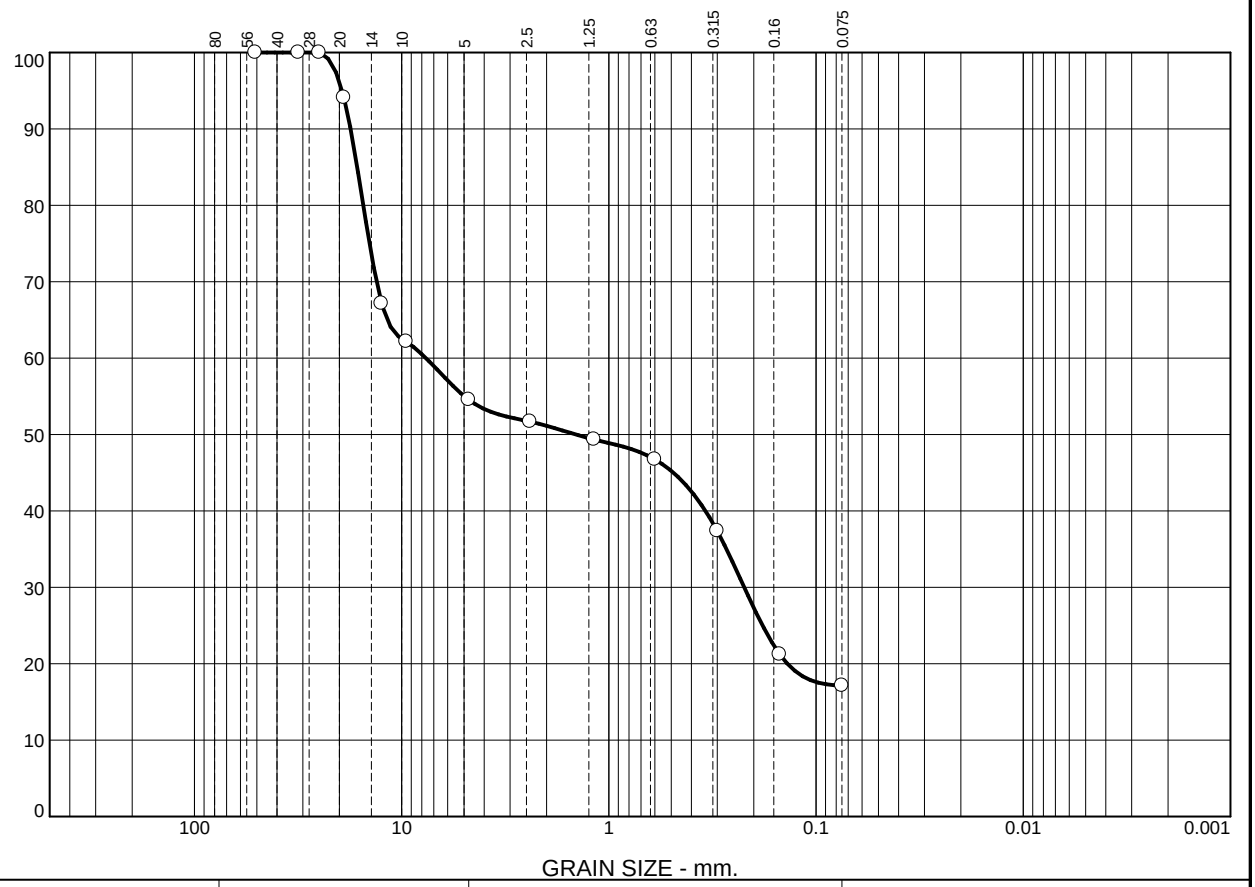
Figure

Tested By: T.Pineau **Checked By:** D.Taweel

These results are for the exclusive use of the client for whom they were obtained. They apply only to the sample tested and are not indicative of apparentl samples

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	6	39	4	8	26	17	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			16.4130	7.6347	1.4404	0.2221				

	Material Description	USCS	AASHTO
○			

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Depth:** 13-15ft **Sample Number:** M3 SS#7

Remarks:
○Moisture Content is 13.9%

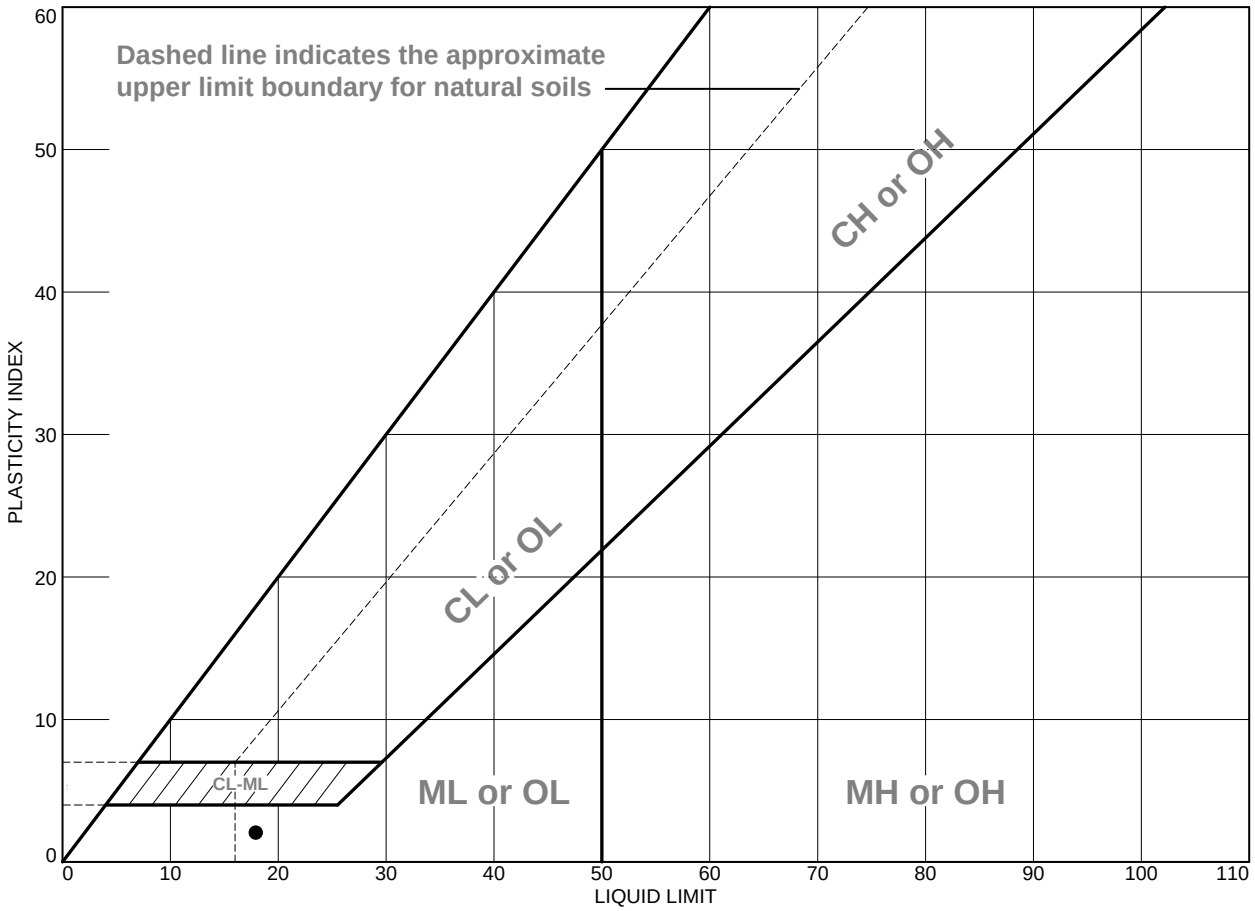
FUNDY Engineering

Figure

Tested By: T.Pineau **Checked By:** D.Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		18	16	2	43	17	GM

Project No. 18-12973 **Client:** Joose Environmental

Project: Georgetown Small Craft Harbour

●**Location:** Georgetown **Depth:** 13-15ft **Sample Number:** M3 SS#7

Remarks:

FUNDY Engineering

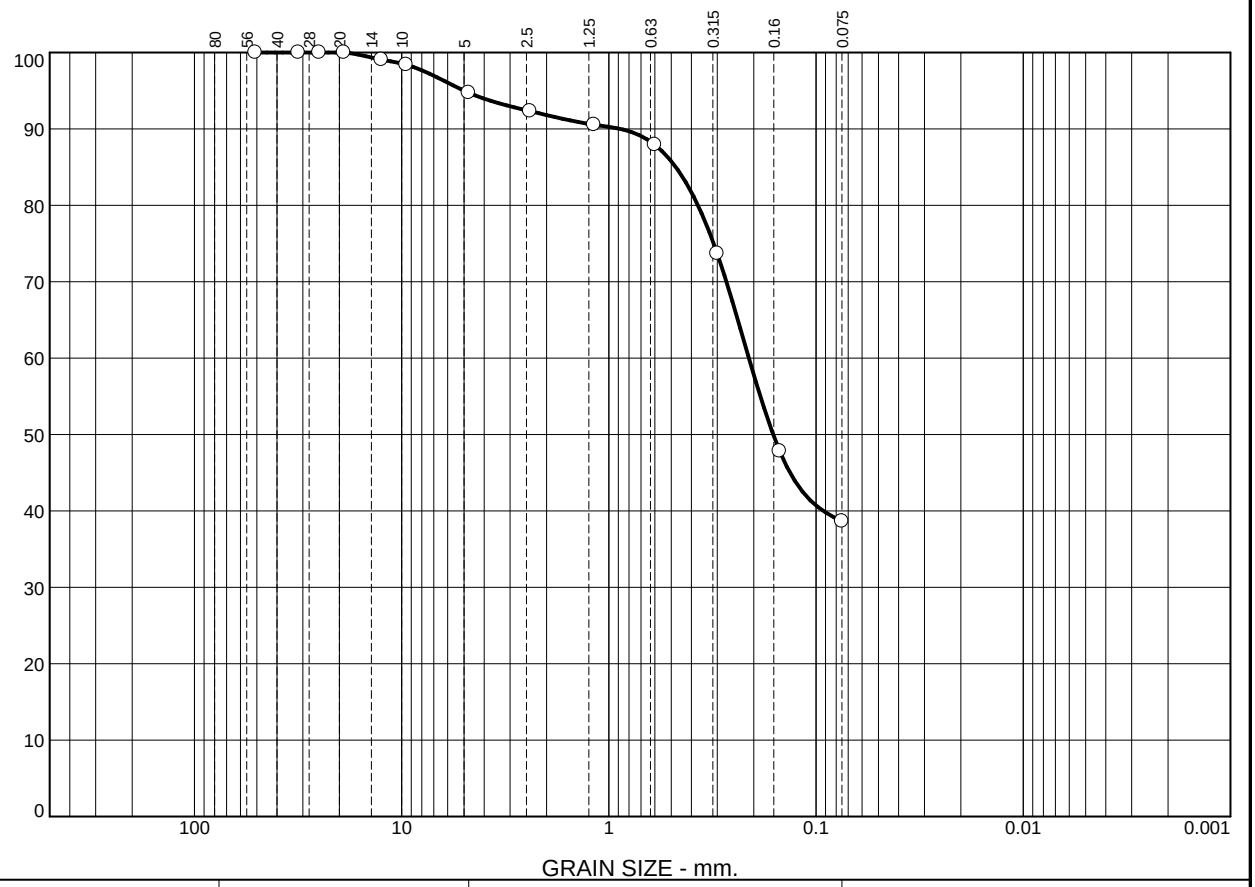
Figure

Tested By: T.Pineau **Checked By:** D.Taweel

These results are for the exclusive use of the client for whom they were obtained. They apply only to the sample tested and are not indicative of apparentl samples

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	5	3	9	44	39	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4754	0.2109	0.1612					

Material Description	USCS	AASHTO
○		

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Sample Number:** M5 SS#5

Remarks:
○Moisture Content is 12.9%

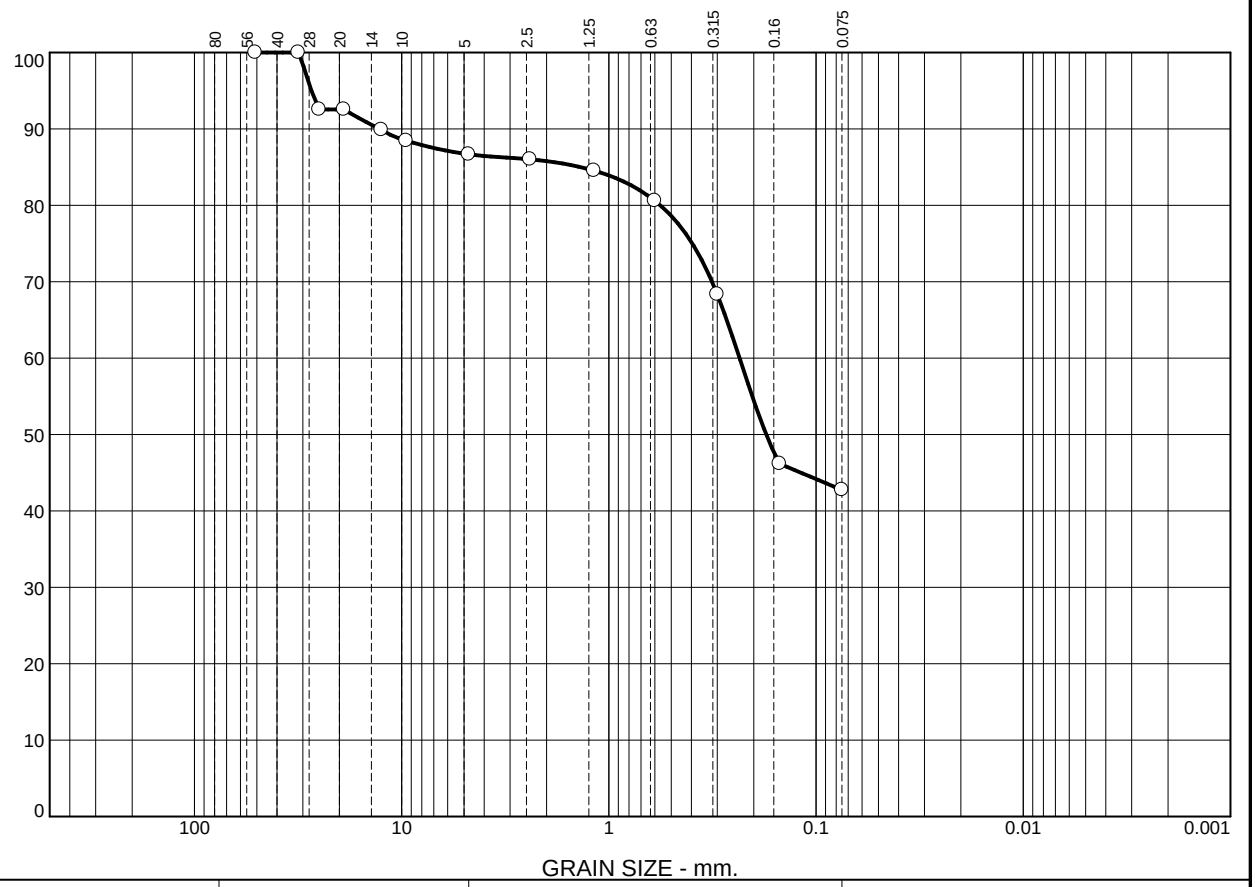
FUNDY Engineering

Figure

Tested By: T.Pineau **Checked By:** D.Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	7	6	1	10	33	43	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3708	0.2338	0.1741					

Material Description	USCS	AASHTO
○		

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Sample Number:** M7 SS#1

Remarks:
○Moisture Content is 56.4%

FUNDY Engineering

Figure

Tested By: T.Pineau **Checked By:** D.Taweel

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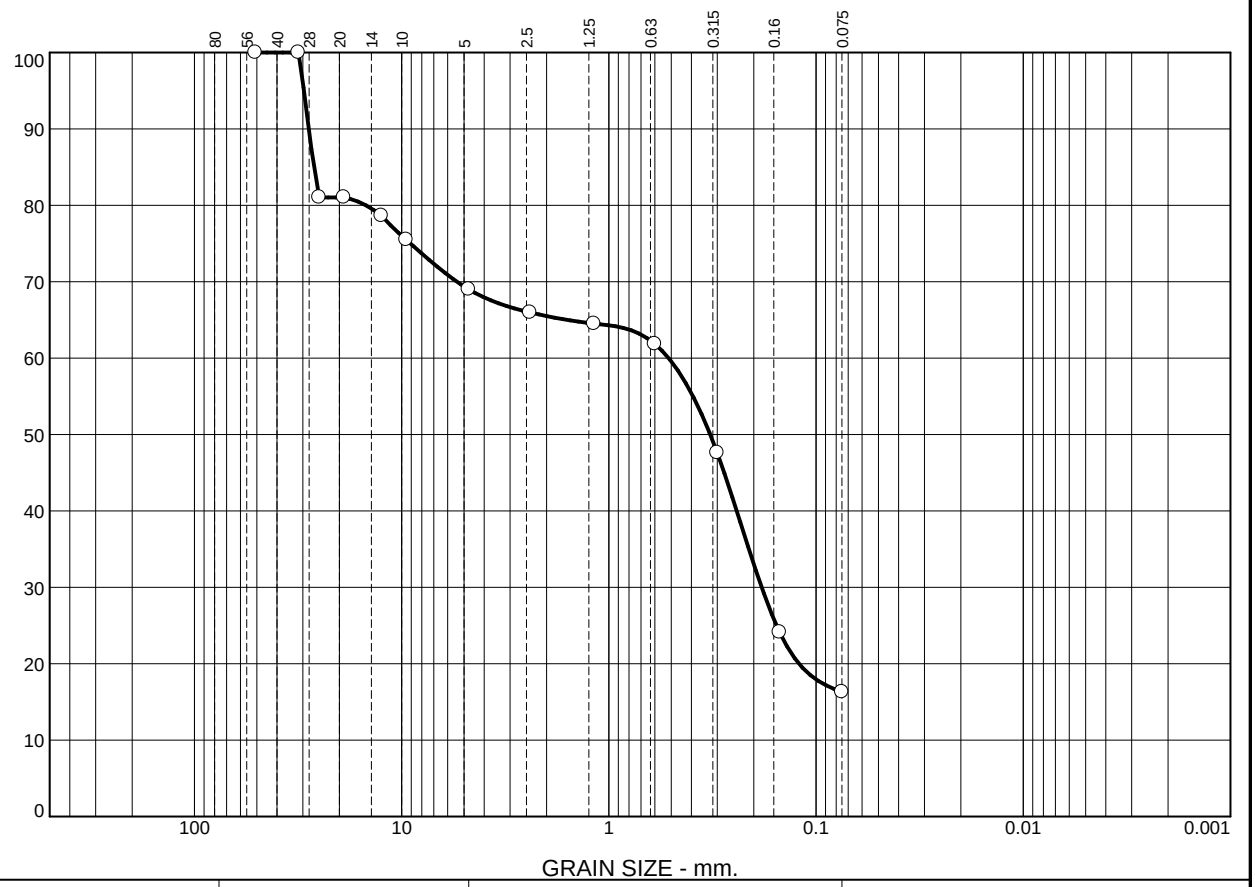
Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	19	12	3	9	41	16	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			26.5297	0.5148	0.3243	0.1831				

Material Description	USCS	AASHTO
○		

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Sample Number:** M7 SS#2

Remarks:
○Moisture Content is 9.4%

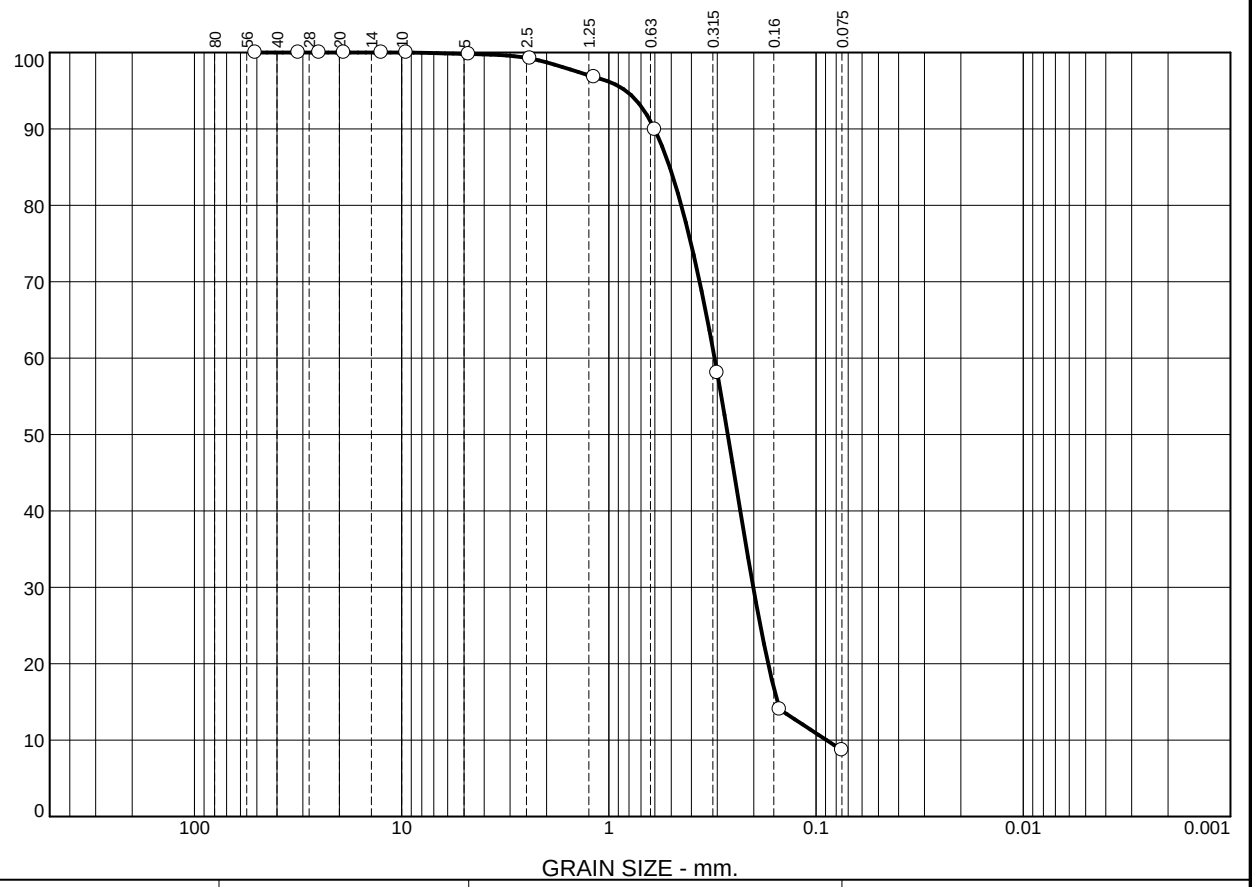
FUNDY Engineering

Figure

Tested By: T.Pineau **Checked By:** D.Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	21	69	9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5088	0.3089	0.2668	0.2009	0.1537	0.0889	1.47	3.47

Material Description	USCS	AASHTO
○		

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Sample Number:** M8 SS#1

Remarks:
○Moisture Content is 32.1%

FUNDY Engineering

Figure

Tested By: T.Pineau **Checked By:** D.Taweel

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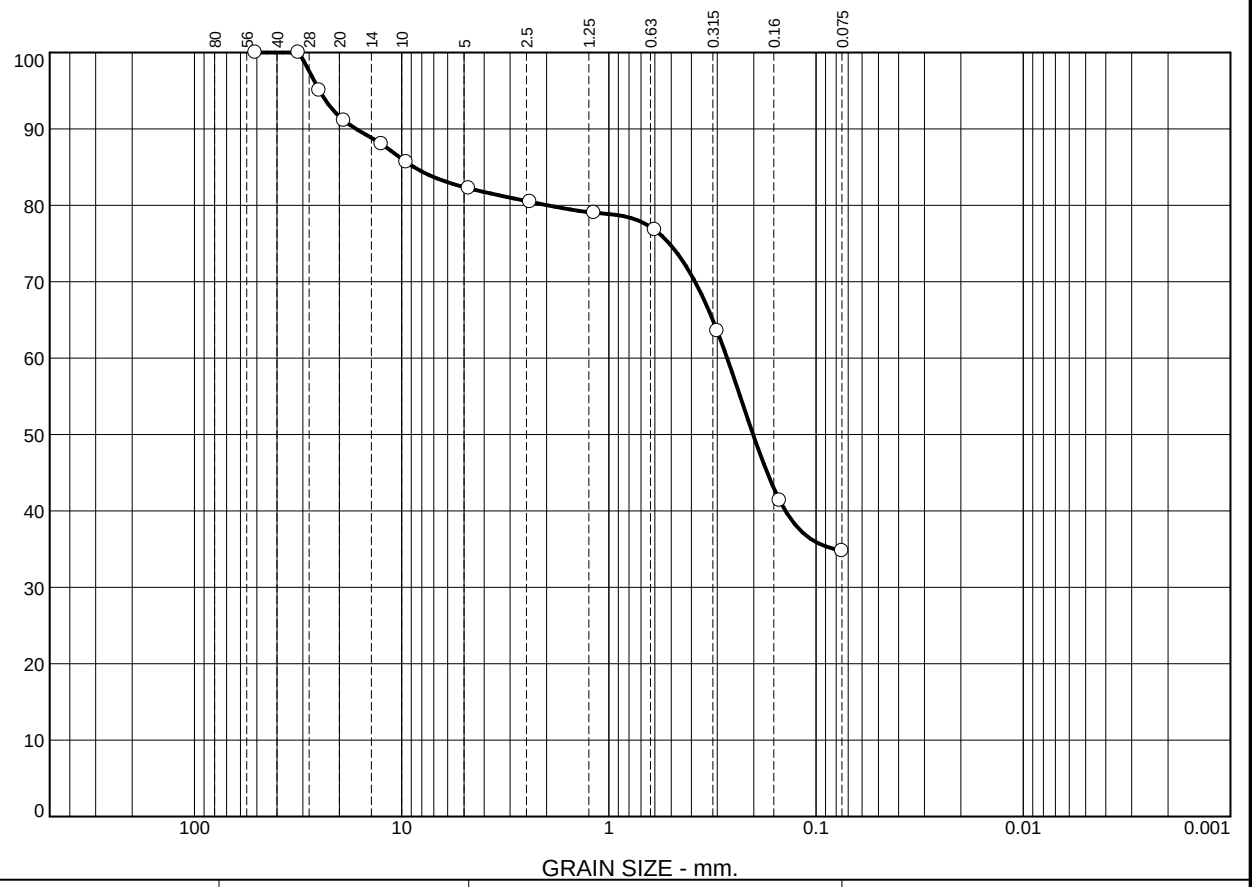
Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	9	9	2	8	37	35	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			8.7171	0.2686	0.2013					

Material Description	USCS	AASHTO
○		

Project No. 18-12973 **Client:** Joose Environmental
Project: Georgetown Small Craft Harbour

○ **Location:** Georgetown **Sample Number:** M8 SS#3

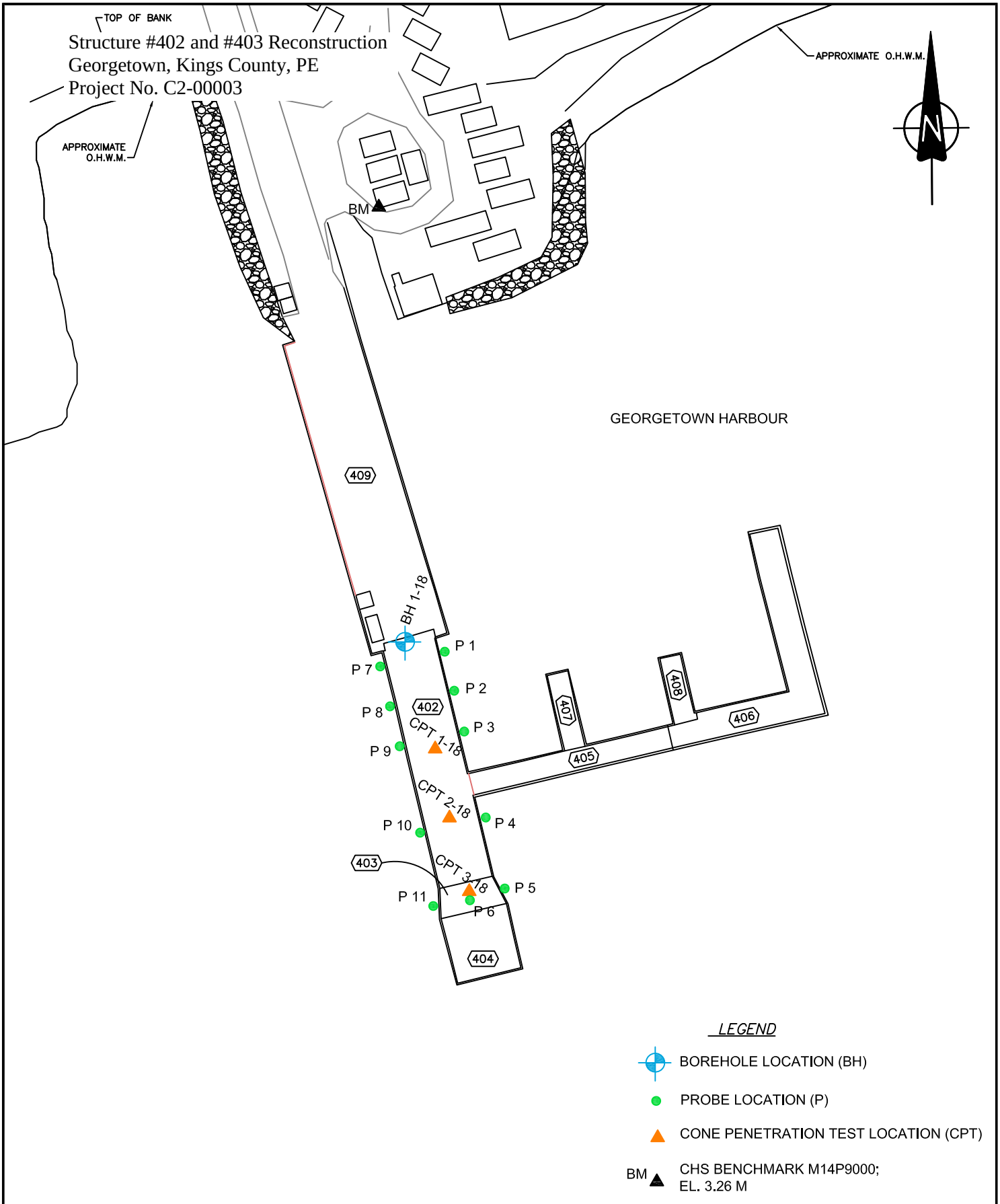
Remarks:
○Moisture Content is 12.4%

FUNDY Engineering

Figure

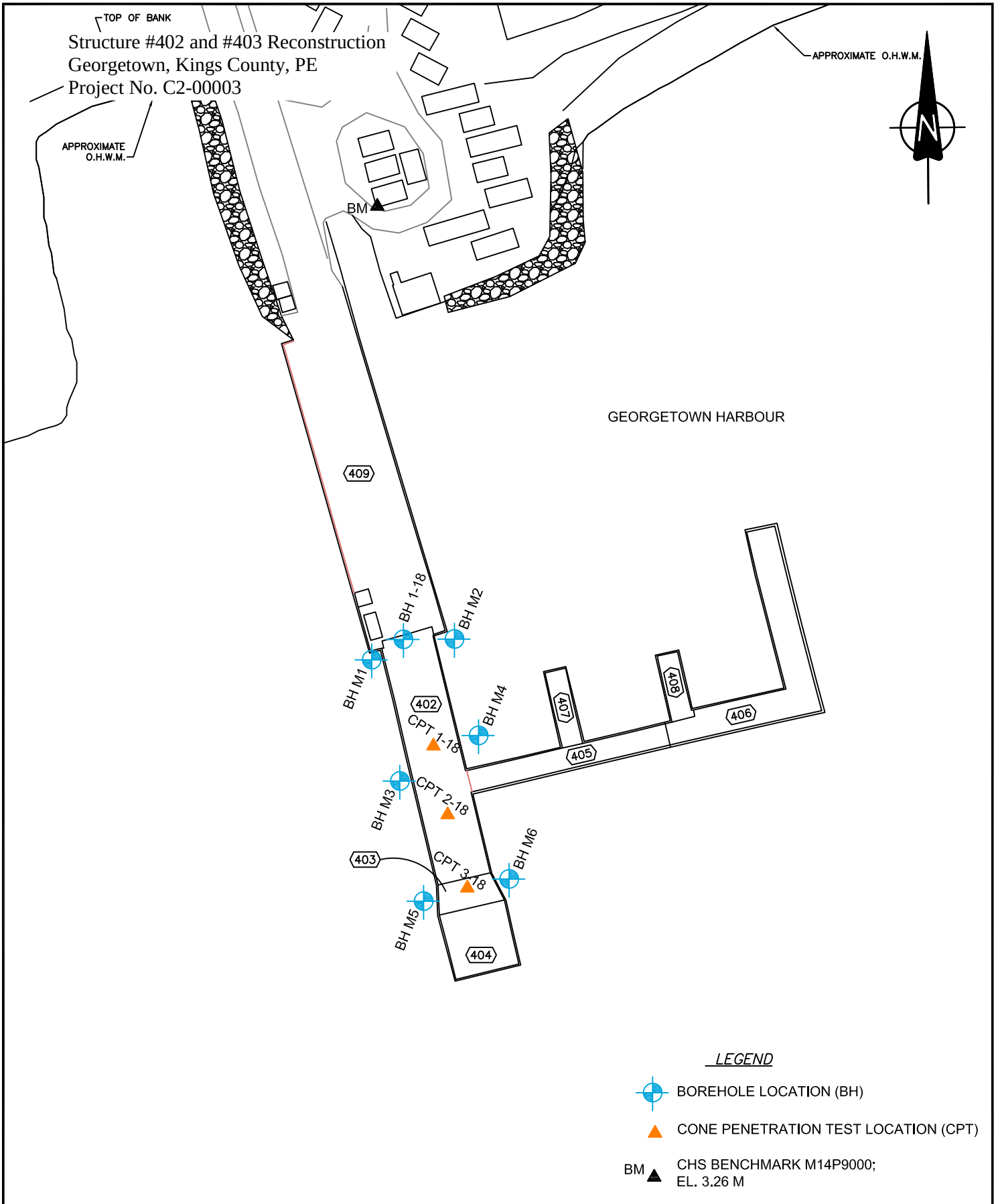
Tested By: T.Pineau **Checked By:** D.Taweel

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003



JOOSE ENVIRONMENTAL	BOREHOLE LOCATION PLAN PROPOSED PIER REPLACEMENT GEORGETOWN SMALL CRAFT HARBOUR, KINGS COUNTY, PEI	SCALE: 1 : 1000	JOB NO.: JE0295	DWG NO.: 1
		DATE: 2018/03/06	DWN BY: MLJ	APPD BY: GWZ
	CLIENT: SMALL CRAFT HARBOURS, FISHERIES AND OCEANS CANADA			

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003



BOREHOLE LOCATION PLAN

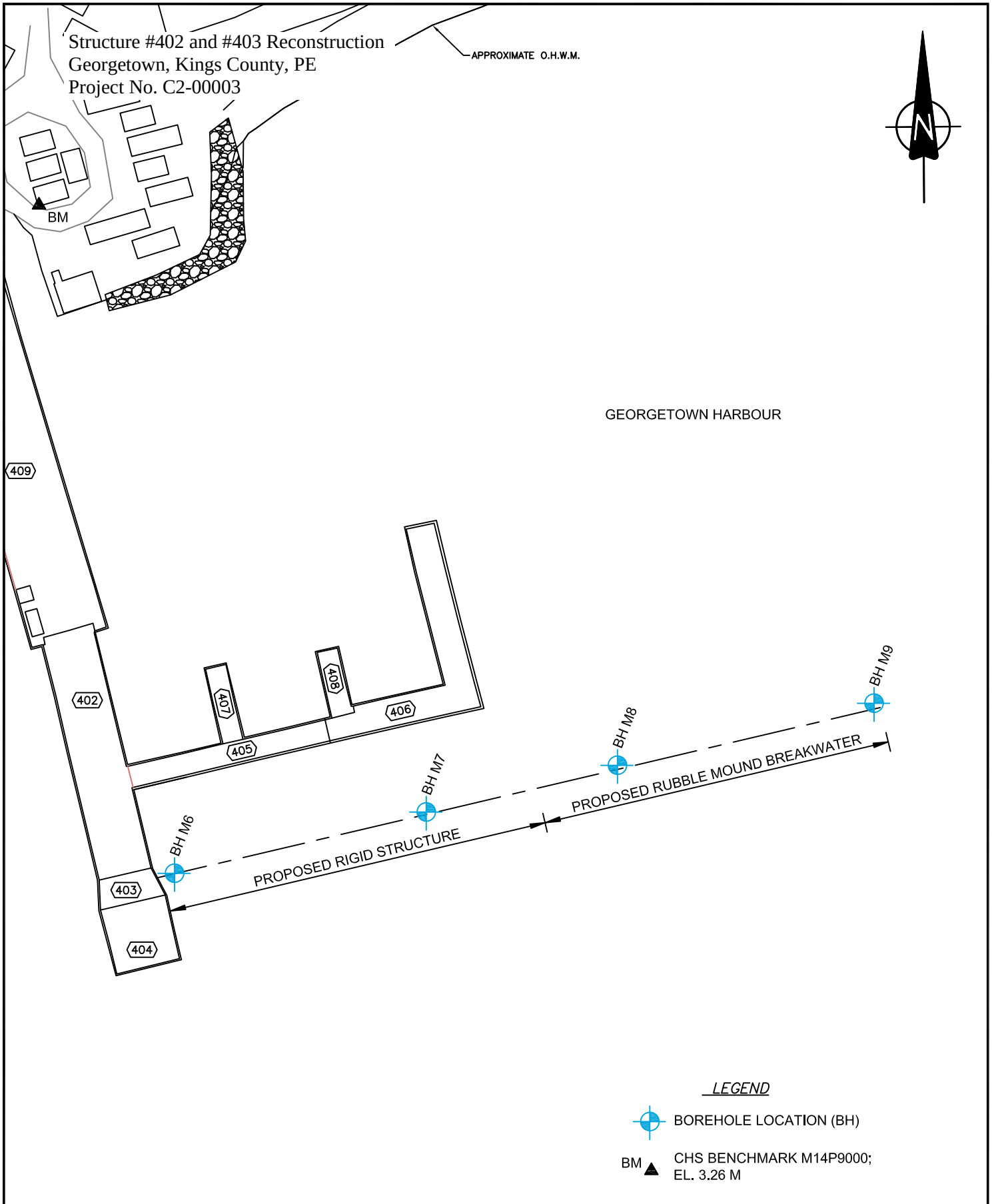
PROPOSED PIER REPLACEMENT

GEORGETOWN SMALL CRAFT HARBOUR, KINGS COUNTY, PEI

CLIENT: SMALL CRAFT HARBOURS, FISHERIES AND OCEANS CANADA

SCALE:		JOB NO.:	DWG NO.:
1 : 1000		JE0295	2
DATE	DWN BY:	APPD BY:	
2018/03/06	MLJ	GWZ	

Structure #402 and #403 Reconstruction
Georgetown, Kings County, PE
Project No. C2-00003



BOREHOLE LOCATION PLAN

PROPOSED BREAKWATER (L-SECTION)

GEORGETOWN SMALL CRAFT HARBOUR, KINGS COUNTY, PEI

CLIENT: SMALL CRAFT HARBOURS, FISHERIES AND OCEANS CANADA

SCALE:		JOB NO.:	DWG NO.:
1 : 1000		JE0295	3
DATE	DWN BY:	APPD BY:	
2018/03/06	MLJ	GWZ	