

PART 1 - GENERAL

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| 1.1 | <u>Related Sections</u> | .1 | Refer to other specification sections for related information. |
| | | .2 | Refer to Section 01 33 00 for Shop Drawing/ Submission requirements. |
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| 1.2 | <u>Source Approval</u> | .1 | Source of materials to be incorporated into work or stockpiled requires acceptance. |
| | | .2 | Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production. |
| | | .3 | If, in the opinion of Departmental Representative, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, procure an alternative source to demonstrate that materials from source in question can be processed to meet specified requirements. |
| | | .4 | Should a change of material source be proposed during work, advise Departmental Representative 4 weeks in advance of proposed change to allow sampling and testing. |
| | | .5 | Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory. |
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| 1.3 | <u>Production Sampling</u> | .1 | Aggregate will be subject to continual sampling during production. |
| | | .2 | Provide Departmental Representative with ready access to source and processed material for the purpose of sampling and testing. |

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| 1.4 | Measurement
<u>for Payment</u> | .1 | This item will not be measured separately. |
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PART 2 - PRODUCTS

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| 2.1 | <u>Materials</u> | .1 | Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances. |
| | | .2 | Flat and elongated particles are those whose greatest dimension exceeds four times their least dimension. |
| | | .3 | Fine aggregates satisfying requirements of applicable section shall be one, or a blend of the following:
.1 Natural sand
.2 Manufactured sand
.3 Screening produced in crushing of quarried rock, boulders, gravel or slag
.4 Coarse aggregates satisfying requirements of applicable section shall be one of the following:
.1 Crushed rock or slag
.2 Gravel composed of naturally formed particles of stone. |

PART 3 - EXECUTION

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| 3.1 | <u>Development of
Aggregate Source</u> | .1 | Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by the Departmental Representative. |
| | | .2 | Clear, grub and strip an area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials. |
| | | .3 | When operating in stratified deposits, use excavation equipment and methods that will produce a uniform, homogeneous aggregate. |
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| | .4 | When excavation is completed, provide drains or ditches as required to prevent surface standing water. |
| | .5 | Trim off and dress slopes of waste material piles and leave site in a neat condition. |
| 3.2 | <u>Processing</u> | |
| | .1 | Process aggregate uniformly using methods that prevent contamination, segregation and degradation. |
| | .2 | Blend aggregate, if required, to obtain gradation requirements specified. Use approved methods and equipment. |
| | .3 | Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted. |
| | .4 | Wash aggregates, if required, to meet specifications. Use only equipment accepted by Departmental Representative. |
| 3.3 | <u>Handling</u> | |
| | .1 | Handle and transport aggregates to avoid segregation, contamination and degradation. |
| 3.4 | <u>Stockpiling</u> | |
| | .1 | Stockpiling aggregates on stabilized, clean and well drained surfaces. |
| | .2 | To ensure that no material other than stockpiled aggregate is used, do not incorporate bottom 250 mm of stockpile into work, if aggregates are stockpiled on ground. |
| | .3 | Stockpile far enough apart to prevent intermixing. |
| | .4 | Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection. |
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- .5 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1 m for coarse aggregate and base course materials.
 - .2 Max 2 m for fine aggregate and sub-base materials.
 - .3 Max 1.5 m for other materials.
- .6 Complete each layer over entire stockpile area before beginning next layer.
- .7 Uniformly spot dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .8 Coning of piles or spilling of material over edges of pile will not be permitted.
- .9 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

-- END OF SECTION --

PART 1 - GENERAL

1.1 Description of Work

- .1 This section includes, but is not limited to, the following:
 - .1 Requirements for the demolition, removal or cutting associated with existing structural material, existing concrete curbs, copewall and slab, timber piles and fastening, and all excavation to permit construction and installation of the new wharf.
 - .2 Removal, salvage and reinstallation of existing electrical components and teck cable feeds.
 - .3 Requirements for temporary utilities as per Section 01 51 00.
 - .4 All normal removals as required to complete the work. All items to be verified by a site visit prior to submission of a tender. All available plans of the existing structure are available for viewing at the Project Manager's office, 2nd floor, 1713 Bedford Row, Halifax, NS.

1.2 Related Sections

- .1 Refer to other specification sections for related information.
- .2 Refer to Section 01 33 00 for Shop Drawing/ Submission requirements.

1.3 Submissions

- .1 Methodology:
 - .1 When requested, provide methodology for carrying out the work.
- .2 Provide submission in accordance with Section 01 33 00.

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| 1.4 <u>Protection</u> | .1 | Prevent movement, settlement or damage of adjacent structures. Provide bracing and shoring as required. In the event of damage, immediately replace such items or make repairs to approval of Departmental Representative and at no additional cost to Departmental Representative. |
| | .2 | Prevent debris from going adrift and becoming a menace to navigation. |
| | .3 | All damage to existing structures, roadways, pipelines, electrical systems not specified for removal to be repaired at the Contractor's cost to the satisfaction of the Departmental Representative. |
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| 1.5 <u>Measurement Procedures</u> | .1 | Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement. |

PART 2 – PRODUCTS

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| 2.1 <u>Not Applicable</u> | .1 | Not Applicable. |
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PART 3 - EXECUTION

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| 3.1 <u>Preparation</u> | .1 | Inspect site and verify with Departmental Representative items designated for removal and items to be preserved. |
| | .2 | Locate and protect utility lines. Preserve in operating condition active utilities traversing site. |
| | .3 | Provide temporary power and lighting as shown on the plan or as required by the Departmental Representative. |
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3.2 Demolition
and Removals

- .1 Remove items indicated.
- .2 Do not disturb adjacent structures designated to remain in place.
- .3 Remove existing concrete, timber and hardware. Salvage rock materials for re-use on site. Excess ballast which cannot be utilized within the work or materials which do not meet the new work material and gradation requirements are to be removed from the site.
- .4 The Contractor must ensure timbers are not permitted to go adrift during removal operations. Containment booms and regular cleaning of debris from the harbour bottom must occur in conjunction with the removal operations.
- .5 The Contractor must exercise caution during excavation and removals adjacent to the existing wharf structures, wharf and complete excavation in such a manner as to protect the existing structure from undermining.
- .6 Sawcut existing concrete deck at pile cap at end limits of removals where indicated on the plan.
- .7 Existing concrete materials to be disposed of. Salvage existing electrical teck cable for future use.
- .8 Remove, salvage and reinstate existing electrical equipment and teck cables.

3.3 Disposal
of Materials

- .1 Disposal of materials not designated for salvage or re-use in work, will be the contractor's responsibility, and must be disposed of off-site.
- .2 The material to be disposed is to be transported and disposed of in an environmentally acceptable manner to the satisfaction of the Departmental Representative, and in accordance with any local, Municipal, Provincial and Federal restrictions and regulations.

.3 Excavation material is to be disposed of off site.

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

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| 1.1 | <u>Related Sections</u> | .1 | Section 01 33 00 - Submittal Procedures |
| | | .2 | Section 01 74 21 - Construction/Demolition Waste Management and Disposal |
| | | .3 | Section 31 11 00 – Sitework Demolition and Removal |
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| 1.2 | <u>Measurement Procedures</u> | .1 | Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement |
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| 1.3 | <u>References</u> | .1 | American Society for Testing and Materials International, (ASTM):
.1 ASTM D4491-99a (latest edition), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
.2 ASTM D4595-86(2001)(latest edition), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
.3 ASTM D4716-01 (latest edition), Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
.4 ASTM D4751-99a (latest edition), Standard Test Method for Determining Apparent Opening Size of a Geotextile. |
| | | .2 | Canadian General Standards Board (CGSB):
.1 CAN/CGSB-4.2 No. 11.2-M89(April 1997) (latest edition), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
.2 CAN/CGSB-148.1 (latest edition), Methods of Testing Geotextiles and Complete Geomembranes.
.1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
.2 No.3-M85, Methods of Testing |

Geosynthetics - Thickness of Geotextiles.

.3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No.10-95, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

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| 1.4 | <u>Submittals</u> | .1 | Submit samples in accordance with Section 01 33 00 - Submittal Procedures. |
| | | .2 | Submit to Departmental Representative the following samples at least 4 weeks prior to beginning work:
.1 Minimum length of 2 m of roll width of geotextile. |
| | | .3 | Submit to Departmental Representative copies of mill test data and certificate at least 4 weeks prior to start of work, and in accordance with Section 01 33 00 - Submittal Procedures. |
| 1.5 | <u>Delivery, Storage and Handling</u> | .1 | During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents. |
| 1.6 | <u>Waste Management and Disposal</u> | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. |
| | | .2 | Remove from site and dispose of all packaging materials at appropriate recycling facilities. |
| | | .3 | Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging |

material for recycling in accordance with Waste Management Plan.

- .4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 Materials

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 3.5 m minimum.
 - .2 Length: 4.0 m minimum.
 - .3 Composed of: minimum 85% by mass of polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
- .2 Physical Properties:
 - .1 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 400 g/m².
 - .2 Grab tensile strength and elongation: to CAN/CGSB-148.1.
 - .1 Breaking force: minimum 800 N, wet condition.
 - .2 Elongation at future: minimum to maximum 70-100%.
- .3 Hydraulic Properties:
 - .1 Apparent opening size (AOS): 50 to 150 micrometres.
- .4 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.
- .5 Factory seams: sewn in accordance with manufacturer's recommendations.
- .6 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

PART 3 - EXECUTION

3.1 Installation

- .1 Place geotextile material by unrolling onto surface in orientation, manner and locations indicated and retain in position with securing pins and washers or weights.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on vertical and sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Pin successive strips of geotextile with securing pins at intervals recommended by manufacturer.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within 4 hours of placement.
- .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .9 Place neatly around wales and tie rods, ensure full coverage of entire area.
- .10 Place and compact soil layers in accordance with Section 31 10 00 – Concrete Forming and Accessories.
- .11 Place geotextile full length and width of inside steel sheet piling wall, along full width and length of type 3 fill (top) and along bottom of type 2 fill on north face.

- 3.2 Cleaning .1 Remove construction debris from project site and dispose of debris in an environmentally responsible and legal manner.
- 3.3 Protection .1 Vehicular traffic not permitted directly on geotextile.

-- END OF SECTION --

PART 1 - GENERAL

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| 1.1 | <u>Related Sections</u> | .1 | Refer to other specification sections for related information. |
| | | .2 | Refer to Section 01 33 00 for Shop Drawing/ Submission requirements. |
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| 1.2 | <u>Reference Standards</u> | .1 | ASTM C127-88(1993)e1 (or latest edition) Specific Gravity and Absorption of Coarse Aggregate. |
| | | .2 | AASHTO T85-88 (or latest edition) Specific Gravity and Absorption of Coarse Aggregate. |
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| 1.3 | <u>Submissions</u> | .1 | Product Data/Samples:
.1 Provide samples of materials proposed for work. |
| | | .2 | Methodology:
.1 Provide methodology for carrying out the work. |
| | | .3 | Provide submissions in accordance with Section 01 33 00. |
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| 1.4 | <u>Measurement for Payment</u> | .1 | Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement. |
| | | .2 | Measurement of supply and installation of corestone in cubic metre place measure (CMPM) based on neat lines from the drawings confirmed by the construction survey supplied by the Contractor. |

PART 2 - PRODUCTS

2.1 Rip Rap

- .1 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.
- .2 Specific gravity of not less than 2.65 when tested to ASTM C127 or AASHTO T85.
- .3 Rip rap will be sized as shown on drawings and will be free of seams that would affect its durability.
- .4 Greatest dimension of each stone not to exceed two times least dimension.
- .5 Rip rap shall be quarried or field stone, rough and angular in shape.
- .6 Rip rap shall vary in size between 200 kg and 400 kg where shown on the drawings.

2.2 Corestone

- .1 To be pit run or quarried material, rough and angular in shape, requiring approval by the Departmental Representative prior to being used in the work.
- .2 Material not to contain organic matter, frozen lumps, sod, roots, logs, stumps or any other objectionable matter.
- .3 Corestone gradation shall be within the following limits:

<u>Imperial Size</u>	<u>Metric Size</u>	<u>% Passing by Mass</u>
18"	450 mm	100
8"	200 mm	44 – 75
4"	100 mm	25 – 50
2"	50 mm	7 – 14

- .4 Material to be screened, if required, to ensure no fines or stones less than 0.2 kilograms are placed in the work.

- .5 Material to be blended so that homogenous mix of smaller and larger sizes within the approved range is attained.

PART 3 - EXECUTION

3.1 Preparation

- .1 Sound area and record elevation of material on which corestone will be placed before placing mattress material and/or rip rap.

3.2 Placement

- .1 Do not place corestone material until bottom area has been accepted by Departmental Representative.
- .2 Place corestone material to avoid segregation of material sizes. Do not drop material through water.
- .3 Do not place material under poor weather conditions. Place immediately prior to planned placement of timber cribs.

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 75 mm.
- .2 Other layers to be within 100mm 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 mattress lost due to storms, tidal erosion or by his own activities.

-- END OF SECTION --

PART 1 - GENERAL

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| 1.1 | <u>Related Sections</u> | .1 | Section 01 74 21 - Construction/Demolition Waste Management and Disposal |
| | | .2 | Section 05 50 00 - Metal Fabrications |
| | | .2 | Section 31 62 19 - Wood Piles |
| | | | |
| 1.2 | <u>Delivery, Storage and Handling</u> | .1 | Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling. |
| | | .2 | Replace damaged piles as directed by Departmental Representative. |
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| 1.3 | <u>Waste Management and Disposal</u> | .1 | Separate waste materials for in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal. |
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| 1.4 | <u>Existing Conditions</u> | .1 | Records of existing structures and geotechnical reports may be available for inspection at the offices of Public Works and Government Services Canada, 1713 Bedford Row, Halifax, NS. This material is not necessarily up to date and is for information purposes only. It should be complemented by site visits and consultation with appropriate expertise. |
| | | .2 | Notify Departmental Representative in writing if subsurface conditions at site differ from those indicated and await further instructions from Departmental Representative. |
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- ## PART 2 - PRODUCTS

- 2.1 Materials
- .1 Supply full length timber piles in as indicated in accordance with Section 31 62 19 – Wood Piles.
 - .2 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
 - .3 Pile lengths indicated are based on lengths estimated to remain in completed structure. Contractor shall allow a 1.0 meter cut-off allowance in their unit price.
 - .4 Do not splice piles without written permission of Departmental Representative. When permitted, provide details for Departmental Representative's review. Design details of splice to bear dated signature stamp of professional engineer registered or licensed in the Province of Nova Scotia.
 - .5 Welding materials to CSA W48.1.

PART 3 - EXECUTION

3.1 Equipment

- .1 Prior to pile installation, submit to Departmental Representative for review, details of equipment for installation of piles.
 - .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 augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .2 Hammer:
 - .1 When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.
- .3 Leads:
 - .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom with guys, stiff braces, or other means to ensure support to pile while being drive.
 - .2 Length: except for piles driven through water, provide sufficient length of leads to ensure that use of follower is unnecessary.
 - .3 Swing Leads: Obtain approval from Departmental Representative prior to using swing leads. Firmly guy top and bottom to hold pile in position during driving operation.

3.2 Preparation

- .1 Ensure that ground conditions at pile locations are adequate to support pile installing operation. Make provision for access and support of piling equipment during performance of work.

3.3 Pile Driving Analyzer

- .1 Contractor shall use a Pile Driving Analyzer and Wave Equation Analysis to determine and confirm driving criteria such as hammer size and variation in impact, suitability of driving cap and cushions, and penetration

resistance relative to set on at least three (3) piles at start-up of pile placement. Confirm criteria during pile installation by using Pile Driving Analyzer and Wave Equation Analysis on additional piles when requested by Departmental Representative. Departmental Representative will select piles. Work to be performed by geotechnical engineer registered or licensed in the Province of Nova Scotia.

- .2 Testing by Contractor will use Pile Driving Analyzer and Wave Equation Analysis to confirm driving criteria such as hammer size and variation in impact, suitability of driving cap and cushions, and penetration resistance relative to set for initial driving and restriking. Departmental Representative will select piles to be tested.
- .3 Dynamic monitoring of the pile driving using the pile driving analyzer will form the basis of determining pile capacities and determining final penetration resistance in initial driving and in restriking.
- .4 The dynamic monitoring consists of attaching strain transducers and accelerometers to the pile, usually close to the pile head, and connecting these to a monitoring station nearby by means of a cable. Contractor must take care to ensure that no damage is done to the transducers, cables or equipment.
- .5 The preparation of the pile head will be done by the Contractor.
- .6 Prepare piles to be instrumented by drilling and tapping holes for installation of strain transducers and accelerometers.
- .7 Make allowance for probable interruption in driving for: changing or modifying hammer, cap, cushions, or other equipment; replacing or adjusting of transducers and accelerometers; and assessing of monitored results.
- .8 Replace or adjust hammer and modify cap, cushions and other equipment, as directed by Departmental Representative.

- .9 Confirm that final set has been achieved, when instructed, by restriking instrumented piles seven (7) days or more after determination of penetration resistance for initial set.
- .10 The pile driving analyzer shall be on site prior to start of pile driving operations. The first three piles driven shall be monitored during initial driving and restrike, and two (2) CAPWAP (or approved equivalent) analyses performed.
- .11 After driving and monitoring the first three (3) piles driven, the pile driving analyzer shall be brought to the site on a minimum of six (6) additional occasions, at the discretion of the Departmental Representative. A total of three (3) piles shall be monitored on each occasion, during initial driving and restrike and two (2) CAPWAP (or approved equivalent) analysis performed. In addition, the pile driving analyzer shall be brought to the site:
 - .1 Prior to use of a hammer that has not been previously monitored with the pile driving analyzer.
 - .2 When, in the opinion of the Departmental Representative, hammers are not performing properly.
- .12 The cost for the dynamic monitoring will be considered incidental to the piling work and will not be separately measured.
- .13 Contractor shall notify Departmental Representative at least two (2) days in advance of the pile driving analyzer arriving on site.
- .14 Determine the static ultimate bearing capacity for piles that are tested. Determine developed capacities after restriking to investigate possible set-up or relaxation phenomenon. Determine the final penetration resistance to which the piles should be driven to ensure that the required pile bearing capacities are attained.
- .15 Measure the actual driving stresses developed in piles and indicate whether the magnitudes are sufficient to cause damage to piles. Check on tensile stresses developed in driving through any loose soils and if such stresses are excessive, recommend how they

should be reduced to safe levels.

- .16 Measure the actual energies transferred to piles and determine the energy ratios (transferred energy as a percentage of manufacturer's rated energy), at final penetration resistance. Determine whether the pile hammer is operating in a sufficiently consistent manner to enable final penetration resistance values to be used as a control on pile driving. The Departmental Representative reserves the right to require the Contractor to overhaul or replace pile hammers operating in an erratic or excessively inefficient manner.
- .17 Indicate, from Analyzer records, the location and extent of suspected damage to any pile being monitored. When requested by the Departmental Representative, monitor any additional piles where damage is suspected.
- .18 Employ auxiliary analyses and tests for determination of complex hammer or pile cushion stiffnesses, stress wave speed, or CAPWAP (or approved equivalent) analyses to determine damping and quake parameters, where deemed necessary by the Departmental Representative for proper monitoring of piles.
- .19 Reference all depth measurements to Chart Datum. All elevations shall be measured from an established bench mark approved by the Departmental Representative.
- .20 The dynamic monitoring shall be under the full-time site supervision of a geotechnical engineer, registered in the Province of Nova Scotia, who is experienced in using and interpreting the Pile Driving Analyzer.
- .21 Provide copies of Pile Driving Analyzer data to the Departmental Representative as it is collected in the field.
- .22 On completion of the Analyzer monitoring of a pile, submit one (1) copy of the test data to the Departmental Representative. Provide an interpretation of the findings in each case with

recommendations, as applicable.

- .23 Within seven (7) days after completion of pile driving analyzer testing, provide a written interim report describing results of the monitoring, CAPWAP (or approved equivalent) analysis, recommendations made and changes to pile driving operations that may have results.
- .24 After completion of the total Analyzer Testing Program, provide a final report in six (6) copies to the Departmental Representative, containing the following information:
 - .1 Project Data – Structure, location, name of Contractor, Client, vertical control datum, designation and locations of piles tested, etc.
 - .2 Pile Installation Equipment and Methods – Hammer details, hammer and pile cushion details, pile driving sequences, pile splicing arrangements, etc.
 - .3 Dynamic Testing – Pile number, type, length, pile toe elevation and data driven, pile properties, penetration resistance, measured force and impact velocity, transferred energy, set values, wave equation analysis results, auxiliary testing and analysis, damping and quake values, bearing capacity, driving stresses, assumed soil properties based on bore hole information, hammer performance, pile integrity, interpretation, conclusions and recommendations, actions taken at site to adjust piling operations, etc.
 - .4 Other relevant information.
- .25 Make available immediately on request and maintain for at least five (5) years, all field data and test results, including electronic test data. Do not erase records without written authorization from the Departmental Representative.

3.4 Field Measurement

- .1 Maintain accurate records of driving for each pile, including:
 - .1 Type and make of hammer, stroke or related energy.
 - .2 Other driving equipment, including water jet, driving cap, cushion.

- .3 Pile size and length, location of pile in pile group, location or designation of pile group.
- .4 Sequence of driving piles in group.
- .5 Number of blows per meter for entire length of pile and number of blows per 25 mm for last 1,000 mm.
- .6 Final tip and cut-off elevations.
- .7 Other pertinent information such as interruption of continuous driving, pile damage.
- .8 Record elevation taken on adjacent piles before and after driving of each pile.

- .2 Provide Departmental Representative with three (3) copies of records.

3.5 Driving

- .1 Use driving caps and cushions to protect piles. Reinforce pile heads as required by Departmental Representative. Piles with damaged heads as determined by Departmental Representative will be rejected.
- .2 Use steel drive shoes to protect pile toes during driving.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile.
- .5 Reinforce pile heads if necessary.
- .6 Re-strike already driven piles lifted during driving of adjacent piles to assure set.
- .7 Cut off piles neatly and squarely at elevations as indicated.
- .8 Remove cut off lengths from site on completion of work.
- .9 Contractor shall install temporary lateral bracing during construction to maintain position of piles until casting of deck.

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| 3.6 | <u>Design Load Capacity</u> | .1 | Installation of each pile will be subject to approval of Departmental Representative.
.1 Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration or other criteria used to determine load capacity.
.2 Install each pile to pile tip elevation as indicated. |
| 3.7 | <u>Obstructions</u> | .1 | Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, proceed as directed by Departmental Representative. |
| 3.8 | <u>Driving Tolerances</u> | .1 | Pile heads to be within 50mm of locations indicated. |
| | | .2 | Piles not to be more than 2% of length out of alignment. |
| 3.9 | <u>Repair/ Restoration</u> | .1 | Pull out rejected piles and replace with new piles. |
| | | .2 | No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles. |
| 3.10 | <u>Protection</u> | .1 | Arrange pile installation operations and methods to avoid damages to adjacent existing structures. When damages occur, remedy damaged items to restore to original or better condition at own expense. |

-- END OF SECTION --

PART 1 - GENERAL

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| 1.1 | <u>Related Sections</u> | .1 | Section 01 33 00 – Submittal Procedures |
| | | .2 | Section 01 45 00 – Quality Control |
| | | .3 | Section 31 61 13 – Pile Foundations, General Requirements |
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| 1.2 | <u>Reference Standards</u> | .1 | CAN/CSA-080 Series-08, Wood Preservation. |
| | | .2 | NLGA Standard Grading Rules for Canadian Lumber 1980 edition or most recent edition at time of tendering. |
| | | .3 | ASTM A123-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products. |
| | | .4 | ASTM A307-07b, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile. |
| | | .5 | CAN/CSA-O56-10, Round Wood Piles. |
| | | .6 | CAN/CSA-G40.21-04 (R2009), Structural Quality Steels. |
| | | .7 | CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding). |
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| 1.3 | <u>Shop Drawings</u> | .1 | At least two (2) weeks prior to finalizing timber order, submit a schedule of pile lengths for review. |
| | | .2 | Submit methodology for field treatment. |
| | | .3 | Provide submissions in accordance with Section 01 33 00. |

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| 1.4 | <u>Protection</u> | .1 | Avoid dropping, bruising or breaking of wood fibres. |
| | | .2 | Avoid breaking surfaces of treated piles. |
| | | .3 | Do not damage surfaces of treated piles below cut-off elevation by boring holes or driving nails or spikes into them to support temporary material or staging. Support staging in rope slings carried over tops of piles or by attaching to pile clamps of approved design. |
| | | .4 | Treat cuts, breaks or abrasions on surfaces of treated piles, bolt holes and field cuts in accordance with CAN/CSA-080 using field applied preservative. |
| | | | |
| 1.5 | <u>Inspection</u> | .1 | All timber piles to be inspected and accepted by Departmental Representative prior to being incorporated in the work. |
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| 1.6 | <u>Measurement for Payment</u> | .1 | Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement. |

PART 2 - PRODUCTS

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| 2.1 | <u>Materials</u> | .1 | Round Wood Piles:
.1 Bearing Piles: Red pine, with minimum butt size of 350mm and tip diameter in accordance with Table A-1 CAN/CSA-O56. Departmental Representative shall be sole judge as to quality and dimension of piles or equal to CAN/CSA-O56.
.2 Batter Piles: Red pine, with minimum butt size of 350mm and tip diameter in accordance with Table A-1 CAN/CSA-O56. Departmental Representative shall be sole judge as to quality and dimension of piles or equal to CAN/CSA-O56. |
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- .2 Timber Treatment:
 - .1 Preservative treatment to CAN/CSA-080 Series for Marine Construction Coastal Waters. Where assay retentions are not indicated, they are to be taken as 1.5 times the indicated gauge retention. Creosote preservative will not be permitted for fender piles.
 - .2 Make arrangements for timber testing by:
 - .1 Plant Inspection: Provide treatment plant identification, date of treatment, list of various pieces in the charge, charge number, plant assay testing results, concentration and type of preservative used, duration of treatment, gauge retention, species of wood; and make arrangements with the treatment plant to locate bundles, move bundles, break open bundles and carry out other measures to facilitate the inspection.
 - .2 Field Inspection: Providing same information as above and facilitating the inspection in the field.
 - .3 Filling in and submitting a pre-printed form, agreed to by the Departmental Representative, containing the above information.
 - .3 The Departmental Representative may test in the plant or in the field or may choose to not test some charges at either the plant or the field.
 - .4 Timber will be protected during handling, shipping, offloading and field handling, by use of suitable equipment and procedures. Use rope or fabric strap slings on site for moving bundles or individual timbers, rather than metal grabs, chains or cables.
 - .5 Field Treatment: same as pile preservative.
- .3 Miscellaneous Hardware: Hardware must meet the following specifications:
 - .1 Machine bolts, drift bolts, nuts, round plate washers: to ASTM A307.
 - .2 Spiles: to CSA B111.
 - .3 Pile Shoes: fabricated from steel plate minimum 6mm thickness. Steel plate to CSA-G40.21, Grade 300W. Welding to CSA W59. No galvanizing required.

.4 Hot dip galvanize bolts, nuts, washers and spikes to ASTM A123 with minimum zinc coating of 600 g/m².

.5 All hardware galvanized unless otherwise shown on plans or specified.

2.2 Wood Preservation

- .1 Wood piles are to be treated with wood preservative treatment as specified.

PART 3 - EXECUTION

3.1 Handling Timber

- .1 Timber will be protected during handling, shipping, offloading and field handling, by use of suitable equipment and procedures. Use rope or fabric slings on site for moving bundles or individual timbers, rather than metal grabs, chains or cables.

3.2 Handling Treated Timber

- .1 Handle treated material to avoid damage causing alteration in original treatment.
- .2 Treat in field, spike holes, boreholes, plugged holes, cuts and any damage to treated material, using preservative, as specified herein, regardless of plant treatment type.
- .3 Treat boreholes, using a pressurized container with an extension rod, to produce a fine spray in the holes with one application. Alternately a cylindrical brush may be used.
- .4 Treat field cuts and any abrasions with minimum of two liberal applications, using either spray or brush.
- .5 In addition, field cuts and underwater damaged areas will receive a coating of plastic compound, capped with lead flashing secured with galvanized roofing nails. Plastic compound not to be water soluble and is subject to approval.

- .6 Environmental Concern: Ensure no spillage or excess application of field preservative. Provide workmen with sufficient training and protective gear to properly and safely handle the treated materials and to apply field treatment, so as to prevent undue hazard to themselves, others, or the environment.
 - .7 Contain all debris and leachates (films on water surface) within the area of the work by using containment facilities such as floating booms or screens.
- 3.3 Preparation
- .1 Protect pile heads during driving and hold in position by using a combination cushion-driving head and pilot. Closely fit driving heads to top of pile, and extend down sides of pile for at least 75mm. Where necessary, protect pile heads by means of heavy steel straps of wrought iron rings.
 - .2 Equip piles with metal shoes.
- 3.4 Installation
- .1 Install piles in accordance with Section 31 61 13 – Pile Foundations, General Requirements.
 - .2 During driving, restrain lateral movement of piling at intervals not exceeding 6 m over length between ground surface and driving head.
 - .3 Treat tops of cut off bearing and batter piles with two liberal coats of copper naphthenate and a minimum of 13mm of tar roofing felt, folded over sides of pile and securely fasten. Saturate felt with copper naphthenate preservative and cover with 20 gauge or thicker galvanized metal or aluminum sheet, completely covering felt. Apply this procedure regardless of type of preservative used for initial treatment of pile. This procedure is not required for tops encased in concrete.
 - .4 Contractor shall install temporary lateral bracing during construction to maintain the position of the piles until the casting of the deck.

-- END OF SECTION --