

## GEOTEXTILES

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### **Part 1            General**

#### **1.1      SECTION INCLUDES**

- .1      Materials and installation of polymeric geotextiles. Purpose of which is to:
  - .1          Separate and prevent mixing of granular materials of different grading.
  - .2          Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

#### **1.2      RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3      Section 31 23 10 - Excavating, Trenching and Backfilling.

#### **1.3      MEASUREMENT PROCEDURES**

- .1      Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps. Overlap as defined by the drawings is 600 mm at each pile an additional 4 square metres at each tie rod.

#### **1.4      REFERENCES**

- .1      All standards used shall be of latest edition.
- .2      American Society for Testing and Materials International, (ASTM)
  - .1          ASTM D4491- Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2          ASTM D4595- Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .3          ASTM D4716- 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- Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .3      Canadian General Standards Board (CGSB)
  - .1          CAN/CGSB-4.2 No. 11.2- Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
  - .2          CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
    - .1              No.2 - Methods of Testing Geosynthetics - Mass per Unit Area.
    - .2              No.3 - Methods of Testing Geosynthetics - Thickness of Geotextiles.

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- .3 No.6.1 - Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
  - .4 No.7.3 - Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
  - .5 No. 10 - Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

### 1.5 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental representative following samples at least 4 weeks prior to beginning Work.
  - .1 Minimum length of 2 m of roll width of geotextile.
  - .2 Submit to departmental representative copies of mill test data and certificate at least 4 weeks prior to start of Work.

### 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 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 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 in appropriate on-site bins 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 MATERIAL

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls. Shall be rot proof, unaffected by action of oil or salt water and not subject to attack by marine life, insects or rodents
  - .1 Width: 3.5 m minimum.
  - .2 Thickness 4.0 mm minimum

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- .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 600 g/m<sup>2</sup>.
    - .2 Grab tensile strength and elongation: to CAN/CGSB-148.1, No.7.3.
      - .1 Breaking force: minimum 1000 N, wet condition.
      - .2 Elongation at break: minimum maximum 70-100%.
      - .3 Bursting strength: to CAN/CGSB-148.1, No.6.1 minimum 3,700 kPa, wet condition.
  - .3 Hydraulic properties:
    - .1 Apparent opening size (AOS): 50 to 150 micrometres.
    - .2 Filtration opening size (FOS): to CAN/CGSB-148.1 No.10 OPSS 1860.
    - .3 Permittivity: 0.2 K cm/sec.
  - .4 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to CAN/CSA G164.
  - .5 Factory seams: sewn in accordance with manufacturer's recommendations.

### **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 securing pins and washers or weights.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .4 Pin successive strips of geotextile with securing pins as recommended by manufacturer.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 hours of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 23 10 - Excavating Trenching and Backfilling
- .9 Clean all geotextile seams at each tie rod box to prevent leaching of fines.

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- .10 Place a separate 2 m square piece of geotextile, flush with wall over tie rod connector boxes prior to the placement of the continuous geotextile material.
  - .11 No traffic is permitted on the geotextile.

### 3.2 CLEANING

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

**END OF SECTION**

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## **Part 1 General**

### **1.1 RELATED WORK**

- .1 Section 31 32 21 - Geotextiles.

### **1.2 MEASUREMENT PROCEDURES**

- .1 Rip-rap material will be paid for at the unit bid price in cubic meters placed or agreed upon truck measure. This shall be full compensation for hauling, shaping of underlying material, equipment, tools, labour and incidentals necessary to complete the work. The excavation and disposing the material off site shall be considered incidental to this work and not paid separately.
- .2 Sandstone material required over and above that suitable for reuse, or otherwise required will be paid for at the unit bid price in cubic meters placed or agreed upon truck measure. This shall be full compensation for hauling, shaping of underlying material, equipment, tools, labour and incidentals necessary to complete the work. Any excavation and disposing of the material off site shall be considered incidental to this work and not paid separately.
- .3 Gravel surfacing will be paid for at the unit bid price in cubic meters placed. This shall be full compensation for hauling, shaping of underlying material, equipment, tools, labour and incidentals necessary to complete the work. The excavation and disposing the material off site shall be considered incidental to this work and not paid separately.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 To requirements of Prince Edward Island, Department of Transportation and Public Works Specification #213 (latest edition) as it relates to Class R-50 imported metamorphic or igneous rock.
- .2 Stone (including Gravel Surfacing): Imported metamorphic or igneous stones. Random rip rap shall consist of clean, hard, durable quarried stone, free from seams, cracks or other structural defects having a density of not less than 2.65 tonne/m<sup>3</sup>. Gravel materials to match that found on adjacent breakwater structure 304 as shown on the plans.
- .3 The rock material is subject to Los Angeles Abrasion Test (ASTM C131) and shall have a loss not greater than 35%.
- .4 When tested for soundness, five cycles of magnesium sulphate (ASTM c88), and the rock material shall have a loss not greater than 15%.
- .5 Sandstone Backfill (as required): Clean, good quality, durable material, meeting requirements PEI Dep't. of TI and E Specification #206.02.02

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### **Part 3 Execution**

#### **3.1 PLACING**

- .1 Where rip-rap is to be placed on slopes, excavate toe in slope in accordance with dimensions as indicated on drawing.
- .2 Prepare area to be rip rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface. Place rip rap on geotextile so as to avoid puncturing geotextile.
- .4 Place rip-rap in accordance with thickness and details as indicated on drawing.
- .5 Place stones in manner approved by Departmental Representative to secure surfaces and create a stable mass. Place larger stones at bottom of slopes and face of slopes.

**END OF SECTION**

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## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 31 62 19 - Timber Piles.
- .3 Section 05 50 00 - Metal Fabrications

### **1.2 DELIVERY, STORAGE AND HANDLING**

- .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.
- .3 Load transport and deliver piles.
- .4 Supply piles as required to complete work.

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

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

### **1.4 EXISTING CONDITIONS**

- .1 Sub-surface investigation report associated with the logs provided on the drawings are available for viewing.
- .2 Notify Departmental Representative in writing if subsurface conditions at site differ from those indicated and await further instructions.

### **1.5 SCHEDULING**

- .1 Submit schedule of planned sequence of driving to Departmental Representative for review, not less than two weeks prior to commencement of pile driving.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Supply full length piles as indicated and provide equipment to handle full length piles without cutting and splicing length of piles shown on drawings.
- .2 Do not splice piles without written approval of Departmental Representative. When permitted, provide details for review. Design details of splice to bear dated signature stamp of professional engineer registered or licensed in Province of PEI, Canada.
- .3 Supply pile points as shown on drawings.

- .4 Pile driven lengths are based on tip to cut off elevations as indicated. Pile supply lengths are based on estimated driven lengths plus approximately 1.0 m above cut off elevations for timber piles.
- .5 Piles to be driven to bedrock or as indicated elevations on drawings.

### **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 auguring, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .2 Hammer:
  - .1 Use appropriate size of hammer or other means to achieve the required tip elevation and refusal criteria
  - .2 Engineer will determine refusal criteria for piles. Refusal may be taken as 4 blows per 25mm of pile penetration when driven with a hammer with a maximum rated energy in the order of 750 joules times the pile tip diameter in centimetres.
- .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 driven.
  - .2 Length: except for piles driven through water, provide sufficient length of leads to ensure that use of follower is unnecessary.
  - .3 Swing leads:
    - .1 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 driving operation and load testing operation. Make provision for access and support of piling equipment during performance of Work.

#### **3.3 FIELD MEASUREMENT**

- .1 Maintain accurate records of driving for each pile, including:



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- .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 metre for entire length of pile and number of blows per 250 mm for last 1000 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 during before and after driving of each pile.
- .2 Provide Departmental Representative with three copies of records.

### **3.4 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 Hold piles securely and accurately in position while driving.
- .3 Deliver hammer blows along axis of pile.
- .4 Cut off piles neatly and squarely at elevations as indicated.
- .5 Remove cut-off lengths from site on completion of work.

### **3.5 DESIGN LOAD CAPACITY**

- .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 Departmental Representative to approve and cut off final driving of all piles prior to removal of pile driving rig from site.

### **3.6 OBSTRUCTIONS**

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, proceed as directed by Departmental Representative.

### **3.7 REPAIR/ RESTORATION**

- .1 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

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**3.8 PROTECTION**

- .1 Arrange sequencing of pile driving operations and methods to avoid damages to adjacent existing structures.
- .2 When damages occur, remedy damaged items to restore to original or better condition at own expense.

**3.9 DRIVING TOLERANCES**

- .1 Install timber piles to the following tolerances: pile needs to be within 50 mm of locations shown on drawings and to permit installation of timber pile caps.

**3.10 DAMAGED OR DEFECTIVE PILES**

- .1 Departmental Representative may reject any pile that is driven out of position, twisted or damaged during handling and/or driving.
- .2 Remove rejected pile and replace with new and if necessary a longer (?) pile.
- .3 No extra charges will be paid for the above work.

**END OF SECTION**

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## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 31 61 13 - Pile Foundations, General.

### **1.2 MEASUREMENT PROCEDURES**

- .1 Consider shoes, cap plates, straps and preservative treatment incidental to supply of piles.
- .2 Mobilization of equipment will not be considered as a separate item and will be incidental to supply of piles.
- .3 Departmental Representative will establish actual number and lengths of piles installed from driving records.
- .4 Unit of measurement for driving piles will be per meter measured from tip elevation to cut-off elevation at pile cap.
- .5 Unit of measurement for supplying piles will be based on per meter measurement from estimated tip elevation to design cut-off plus 1 m. Any additional length supplied due to market availability shall not be paid extra and shall be accounted for at the bid price.

### **1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A153-82 (1987), Specification for Zinc (Hot-Dip) Coating on Iron and Steel hardware.
  - .2 ASTM A307-92, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
- .2 Canadian Standards Association (CSA)
  - .1 CSA B111-1974, Wire Nails, Spikes and Staples.
  - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-O80 Series-M89, Wood Preservation (including CSA Preliminary Standard 080.31-M1989).

### **1.4 PROTECTION**

- .1 Avoid dropping, bruising or breaking of wood fibres.
- .2 Do not damage surfaces of treated piles.
- .3 Treat cuts, breaks or abrasions on surfaces of treated piles, bolt holes and field cuts in accordance with CAN/CSA-O80.18 Series.

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## **Part 2 Products**

### **2.1 MATERIALS**

- .1 All piles to conform to the requirements of CAN3-056, with minimum butt size of 330 mm, and tip diameter related to length as indicated in Table A-1 of CAN3-056.
- .2 All piles to be peeled and shod with a steel point as shown on plans or a substitute point approved by Engineer.
- .3 Pile species will be Red Pine. The preservative pressure treatment will be CCA to CAN/CSA-080.18 Series (latest revision).
- .4 Preservative Treatment shall be tested as per CAN/CSA-080.18 by the timber supplier or contractor. Detailed test results need to be submitted to the Engineer for approval prior to timber pile supply.
- .5 Departmental Representative will be sole judge of quality and dimension of piles to be incorporated in the work.
- .6 Wire nails, spikes, staples: to CSA B111.
- .7 Bolts, nuts and washers: to ASTM A307.
- .8 Hot dip galvanize bolts, nuts and washers and unless otherwise specified, staples, cable clamps, pipe sleeves, spikes and nails to CAN/CSA-G164. Other hardware to be galvanized to ASTM A 123.

## **Part 3 Execution**

### **3.1 WOOD PRESERVATION**

- .1 Treat wood piles with wood preservative treatment as specified herein.

### **3.2 PREPARATION**

- .1 Select piles in each bent group for uniformity of size and straightness to facilitate placing of brace timbers.
- .2 When necessary, protect pile heads by means of heavy steel straps or wrought iron rings.
- .3 Equip piles with metal shoes or other tip protection of approved design. Submit details of proposed method of tip protection to Engineer for approval.
- .4 Treat exposed ends of cut off piles as shown on the drawings and as follows:
  - .1 Apply peel and stick roofing membrane to the cut-off pile top.

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- .2 Cover the pile butt with a 20 gauge aluminum sheet cap as shown on the drawings

### **3.3 INSTALLATION**

- .1 Install piles in accordance with Section 31 61 13 - Pile Foundations, General.
- .2 Submit full details of method and sequence of installation of piling to Engineer for approval prior to start of pile installation work.
- .3 Provide temporary guide frames and/or bracing to hold piles in proper alignment during setting and driving.
- .4 Should an obstruction be encountered during driving, leave obstructed pile and proceed to drive remaining piles. Return and attempt to complete driving of pile later.
- .5 Secure a hardened steel point to each pile before driving.
- .6 Treat all end cut offs and field drilled bolt holes with preservative, as noted on the drawings.

### **3.4 SPLICES**

- .1 Splices of wood piles will not be permitted.

**END OF SECTION**