

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils.
 - .2 ASTM D1140-17, Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing.
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.2-9A, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.02 SUBMITTALS

- .1 A listing of proposed material source at least 10 days prior to delivery to Site.
- .2 Provide material samples to Site of suitable quantity, as requested by the Departmental Representative.
- .3 Submit material gradation test results in accordance with ASTM D422 and ASTM D1140 at least 5 days prior to delivery to Site.
- .4 Cofferdam construction and material details to be included in the Lock Dewatering Plan as requested in Section 35 20 22 - Dewatering.

2 PRODUCTS

2.01 MATERIALS

- .1 Pitrun
 - .1 Sound, hard particles, free from silt and clay lumps, soft shale, deleterious materials, organic matter and foreign substances.
 - .2 Smooth gradation curve with no excess or deficiency of any particular grain size and falls well within the required range.
 - .3 Reasonably well graded gravel and sand with a gradation that falls completely within the upper and lower bounds of the envelope defined by straight lines drawn directly between the following points:

<u>Sieve Size</u>	<u>% Passing by Mass</u>
100 mm	100%
50 mm	55% - 90%
25 mm	38% - 85%
16 mm	32% - 80%
5 mm	20% - 65%
315 µm	6% - 30%
80 µm	0% - 5%
 - .4 Less than 12% loss of weight after 5 cycles in accordance with the requirements of CAN/CSA-A23.2-9A.

3 EXECUTION

3.01 PREPARATION

- .1 Survey cofferdam foundation locations to estimate sediment accumulated over the inlet and outlet channels floors. Downstream cofferdam will require bathymetric survey techniques.
- .2 Use a long-stick excavator of suitable size, barge mounted excavator or other approved method to remove accumulated sediment from cofferdam foundation locations. Load removed material into haul trucks and dispose of at an approved off-Site waste management facility, or as otherwise approved by the Departmental Representative.
- .3 Remove sediment down to competent foundation. Obtain Departmental Representative authorization prior to commencing cofferdam fill placement.
- .4 Sediment build up is estimated to be approx. 2000 m³ within the footprint of the cofferdams.
- .5 Deploy silt curtains around cofferdam footprint prior to construction of in-water works. Refer to Section 35 20 22 - Dewatering for turbidity requirements.

3.02 MATERIAL PLACEMENT

- .1 Haul and temporarily stockpile pitrun material at approved on-Site locations.
- .2 Do not drop or dump material or directly into water. Place material into water with suitably sized excavator to minimize adverse turbidity effects. Compaction of material below water will not be required.
- .3 Once material is 500 mm above the waterline, place material in maximum 200 mm lifts and track-pack each lift with an excavator with a minimum operating mass of 20 metric tonnes, minimum 2 passes.
- .4 Suspend fill placement operations at any time when, in the opinion of the Departmental Representative, work cannot be performed in accordance with the specifications because rain, flooding, cold weather, or other unsatisfactory conditions.
- .5 Construct fill at the locations, and to the lines, grades, slopes and elevations specified in the Drawings, or as established by the Departmental Representative.
- .6 Overbuild final fill slopes and then trim them to the lines, grades, slopes and elevations specified in the Drawings.
- .7 Place fill to within ±500 mm of the dimensions and elevations provided in the Drawings, or as established by the Departmental Representative.

3.03 EXCAVATION AND REMOVAL

- .1 Do not commence cofferdam removal until all instream Work has been completed and authorization by the Departmental Representative has been provided.
- .2 Fill lock chamber side of cofferdam with water to equalize hydrostatic

pressure on both sides of the cofferdams prior to their removal.

- .3 Use a long-stick excavator of suitable size, barge mounted excavator or other approved method to remove pitrun material. Load removed pitrun material into haul trucks and dispose of at an approved off-Site waste management facility, or as otherwise approved by the Departmental Representative.

3.04 OTHER COFFERDAM CONSIDERATIONS

- .1 Overall cofferdam construction activities and sequencing are to be included in the Lock Dewatering Plan, refer to Section 35 20 22 - Dewatering.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.
 - .2 ASTM D882-12, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - .3 ASTM D1004-13, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
 - .4 ASTM D1593-13, Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting.
 - .5 ASTM D1790-14, Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact.
 - .6 ASTM D3786-18, Standard Test method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.
 - .7 ASTM D4437-16(2018), Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
 - .8 ASTM D4491-17, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .9 ASTM D4533-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - .10 ASTM D4632-15a, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - .11 ASTM D4751-16, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
 - .12 ASTM D4833-07(2013)e1, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - .13 ASTM D6241-14, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-related Products Using a 50-mm Probe.
 - .14 ASTM D6392-12(2018), Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

1.02 SUBMITTALS

- .1 Submit the manufacturer's affidavit certifying that each geo-product being supplied meets the specified requirements prior to delivery to Site.
- .2 Submit PVC liner installation details within the Lock Dewatering Plan as requested in Section 35 20 22 - Dewatering. Include details and products to be used to temporarily tack or hold the PVC liner on the lock walls until overlying materials are placed. PVC liner installation details to be received prior and approved by the Departmental Representative prior to the materials being delivered to Site.

2 PRODUCTS

2.01 GEOTEXTILE

- .1 Provide non-woven synthetic fibre fabric, needle punched, composed of a minimum 85% polypropylene or polyester polymers, formulated to resist

deterioration by ultraviolet exposure and free of manufacturing defects, cuts, tears or any other damage, that meets or exceeds the following physical properties:

- .1 CBR Puncture: 3500N, ASTM D6241.
 - .2 Grab strength: 1200 N, ASTM D4632.
 - .3 Grab tensile elongation: 50%, ASTM D4632.
 - .4 Trapezoidal tear strength: 500 N, ASTM D4533.
 - .5 Mullen burst strength: 4,500 kPa, ASTM D3786.
 - .6 Apparent opening size: 150-225 μm , ASTM D4751.
 - .7 Permittivity: 0.7-1.0 sec^{-1} , ASTM D4491.
 - .8 Flow Rate: minimum 2650 L/min/m², ASTM D4491.
- .2 Provide shop-made sewn seams, as required, to optimize placement procedures, time and material quantity. Provide seams that meet or exceed the strength properties of the geotextile. Use sewing thread that has equal or better resistance against chemical and biological degradation as the geotextile.

2.02 PVC LINER

- .1 Provide PVC alloy polymeric geomembrane liner that remains flexible throughout its service life and is resistant to UV degradation, that meets or exceeds the following physical properties:
- .1 Thickness: 30 mil ± 2 , ASTM D1593.
 - .2 Tensile strength: 10 N/mm, ASTM D882.
 - .3 Elongation: 450%, ASTM D882.
 - .4 Tear strength: 26 N, ASTM D1004.
 - .5 Low temperature: -30°C, ASTM D1790.
- .2 Provide a single continuous piece of PVC liner with shop-made seams. Shop seams to meet or exceed:
- .1 Shear strength: 6.5 kN/m, ASTM D6392.
 - .2 Peel strength: 3.3 kN/m, ASTM D6392.

3 EXECUTION

3.01 INSTALLATION

- .1 Keep geo-products wrapped in original packaging until immediately prior to installation. Protect from direct sunlight, excessive heat, dirt and rodents while in transit and storage.
- .2 Prepare the receiving surfaces to the lines, grades, slopes and elevations specified in the Drawings. Remove rock fragments or other objects having sharp projections.
- .3 Install geo-products at the locations, to the lines, grades, slopes and elevations specified in the Drawings. Temporarily retain in position with sand bags, tie straps or weights placed at the outer edges, along seams, and at other intermediate points as required to prevent displacement.
- .4 Install geo-products in accordance with the manufacturer's written requirements. Where manufacturer's requirements are different from the Contract Documents, the more stringent requirement will prevail.
- .5 Place geo-products in a smooth, wrinkle-free and slack condition to conform to the contour of the subgrade without becoming overly taut when covered

over.

- .6 Provide minimum geotextile overlap of 900 mm at field seams, including patches or repair areas.
- .7 Protect installed geo-products from displacement, damage or deterioration before, during and after placement of overlying materials.
- .8 PVC liner to be positioned underwater by qualified divers prior to placing materials ovetop. Temporarily tack or suspend edges of PVC liner at lock wall to hold in upright position until overlying materials are placed.
- .8 Replace damaged or deteriorated geo-products to approval of the Departmental Representative.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)
 - .1 CSA-G40.21, Structural Quality Steel.

1.02 SUBMITTALS

- .1 Product data for the steel sheet piling prior to delivery to Site.
- .2 A detailed description of the template guide structure, crane, and the sheet pile driving equipment at least 30 days prior to mobilizing the equipment to the Site. Include the type of hammer, hammer energy, efficiency factor, details and dimensions of the driving cap, and the other type of leads or the type of vibratory driver/extractor.
- .3 Sheet pile installation records within 24 hours after driving of the sheet pile is completed. Sheet pile installation record to include:
 - .1 Project and Contract names, and name and signature of the Contractor's personnel responsible for quality control including preparing records.
 - .2 Date of driving and Site conditions.
 - .3 Specified sheet pile identification, location and cutoff elevations.
 - .4 Size and initial length of the sheet pile.
 - .5 Penetration and number of blows.
 - .6 Elevation, time and duration of an interruption in driving or erratic or unusual sheet pile behavior.
 - .7 Other pertinent information, including any required by the Departmental Representative.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Inspect each shipment of material and timely replace any damage materials. Replace piles that have damaged interlocks or are excessively deformed or deflected.
- .2 Unload, handle, and store materials in accordance with the manufacturer's written instructions. Do not damage the piles or shop-applied coatings. Do not store piles in direct contact with the ground, and keep the interlocks free of dirt, sand, mud or other debris.

2 PRODUCTS

2.01 MATERIALS

- .1 Steel Sheet Piling:
 - .1 In accordance with CSA-G40.21, Grade 300W.
 - .2 Continuous interlock Z trough section, PZC 18.
 - .3 Section modulus of 1,800 cm³/m.
 - .4 Minimum flange thickness of 9.5 mm.
 - .5 Minimum web thickness of 9.5 mm.
 - .6 Mass of 118 kg/m².

- .7 Working stress for the bending moment is not to exceed 60% of the yield point strength of the steel of the pile.
- .8 Piles that are free of excessive camber or sweep, and with truly formed and unobstructed interlocks.
- .9 No coating required.

2.02 SHOP FABRICATION

- .1 Shop press or weld 2 piles to form a pair for driving.
- .2 Provide lifting holes near the top of each sheet pile.

3 EXECUTION

3.01 PREPARATION

- .1 Inspect the work Site, and remove any boulders or any other obstructions that may affect piling installation.
- .2 Design and provide a temporary template guide structure capable of keeping the sheet piles plumb during driving.
- .3 Provide pile driving hammers or vibratory driver/extractor of sufficient size and type suitable for the work. Provide cranes with a boom length that is at least twice the length of the piles being driven.
- .4 Provide a driving cap designed to fit the steel sheet piling and to prevent unsuitable damage to the pile tops.

3.02 INSTALLATION

- .1 Install the steel sheet piling at the locations and in sufficient numbers and lengths to obtain the specified penetration and outline specified in the Contract Documents.
- .2 Completely inspect the interlocks of each pile immediately before its installation, and protect the interlocks from damage at all times.
- .3 Drive the piles in pairs unless authorized otherwise by the Departmental Representative.
- .4 At regular intervals as required by the Departmental Representative, verify that the piles are plumb during driving and that creeping or walking has not occurred. Promptly extract and re-install piles as required.
- .5 If obstructions such as boulders are encountered, make every effort to place the piling to the required depth using methods acceptable to the Departmental Representative.
- .6 Install the sheet piles by "driving in steps" in which adjacent sheet piles are driven in sequence using a series of short steps until the specified depth is achieved.
- .7 Neatly trim the top of the piles to the elevations shown in the drawings.
- .8 Prevent the piles from becoming twisted, bent, or otherwise damaged during

the pile handling and driving operation and, if applicable, during any adjacent construction work.

3.03 INSTALLATION TOLERANCES

- .1 Location: Maximum deviation of +/-500 mm at the cutoff level from the specified location.
- .2 Elevation: Maximum deviation of +/-500 mm at the specified cutoff or driving elevation.
- .3 Orientation: Maximum deviation of 2% of the sheet pile length from plumb.

3.04 REPAIR OF DAMAGED OR IMPROPERLY INSTALLED PILES

- .1 Remove sheet piles that are out of line or plumb, twisted, broken, or otherwise damaged and replace with undamaged piles.

END OF SECTION