

3886
Silt Fence

3886.1 SCOPE

This Specification covers silt fence for use in retaining sediment. Installation procedures are to be in accordance with 2573. The following types are provided for specific uses:

Standard Machine Sliced	General use during site grading to keep sediment from moving off of the right-of-way and to protect critical areas. Can be used in ditch check applications.
Heavy Duty	Areas inaccessible to equipment due to space limitations, wet soils, steep slopes, etc. Must be hand installed.
Super Duty	Areas where extra strength and insurance is required for the protection of critical areas or traveling public due to long steep slopes next to and draining to the mainline, or stockpiles needing to be located near critical environmental areas.
Preassembled	Light duty applications are to protect temporary construction or to supplement the other types of silt fence.

3886.2 REQUIREMENTS

Silt fence shall conform to Table 3886-1 and the following requirements.

A Geotextile

Geotextile shall be uniform in texture and appearance and shall have no defects, flaws, or tears that would affect its physical properties. It shall contain sufficient ultraviolet ray (U.V.) inhibitors and stabilizers to provide a minimum 2 -year service life from outdoor exposure.

B Pre-manufactured Materials**B1 Super Duty**

The main support and strength shall conform to 2533, Precast Concrete Median Barrier.

B2 Preassembled

Each post shall be securely fastened to the geotextile by a minimum of five gun staples 25 mm (**1 inch**) long that are also suitable for such a purpose. Stapling should be done at a diagonal angle to the threads of the geotextile fabric.

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C Posts

Standard metal T posts with a welded plate shall be used in conjunction with the machine sliced and heavy duty installations. Wooden posts used in conjunction with the preassembled silt fence shall have a sharpened end and shall protrude below the bottom of the geotextile to allow for a minimum of 457 mm (**18 inch**) embedment.

D Geotextile Fasteners

D1 Zip Ties

Geotextile used in Machine Sliced and Heavy Duty applications shall be fastened to posts using plastic zip ties with a minimum tensile strength of 22 kg (**50 pounds**).

D2 Wire Ties

Geotextile used in Super Duty applications shall be fastened to anchor points using wire ties or plastic zip ties with a minimum tensile strength of 22 kg (**50 pounds**).

3886.3 SAMPLING AND TESTING

Geotextiles must be sampled and tested prior to use, when the amount to be installed is 300 m (**1000 feet**) or greater or in special circumstances at the request of the Engineer. In the presence of the Engineer, sampling shall be by random selection in the field at the rate of one swatch (sample) per ten rolls or fraction thereof. Swatches shall be a full roll width and at least 3 m (**9 feet**) long, discarding the first 1 m (**3 feet**) of fabric from the outside of the roll. Samples shall be available for testing at least 21 days prior to intended use.

**TABLE 3886-1
SILT FENCE**

	Machine Sliced	Heavy Duty	Super Duty	Preassembled
Description	Machine installed geotextile fastened to posts on-site	Hand installed geotextile fastened to posts on-site.	Pre-cast concrete median barriers placed end to end with geotextile fastened to front face of barriers.	Ready to install unit of geotextile attached to drivable posts
Geotextile				
Type	Woven monofilament*	Woven monofilament*	Woven monofilament*	Woven
Width	915 mm (36 inches)	915 mm (36 inches)	915 mm (36 inches)	915 mm (36 inches)
Grab Tensile ASTM D 4632 (machine direction)	59 kg (130 lb) min.	59 kg (130 lb) min.	59 kg (130 lb) min.	45 kg (100 lb) min.
Apparent Opening Size ASTM D 4751	0.60-0.425 mm (# 30-40 Sieve)	0.60-0.425 mm (# 30-40 Sieve)	0.60-0.425 mm (# 30-40 Sieve)	0.85-212 mm (# 20-70 Sieve)
U.V. Stability ASTM D 4355, 500 hrs.	70% min.	70% min.	70% min.	70% min.
Permittivity (minimum) ASTM D 4491	1.0/sec	1.0/sec	1.0/sec	0.05/sec
Posts			N/A	
Material	Steel T-Post with welded plate	Steel T-Post with welded plate		Wood
Min. Size	1.8 kg / m (1.26 lbs./ft)	1.8 kg / m (1.26 lbs./ft)		50 mm x 50 mm (2 x 2 inches)
Min. Length	1.5 m (5 feet)	1.5 m (5 feet)		1.5 m (5 feet)
Min. Embedment	610 mm (24 inches)	610 mm (24 inches)		458 mm (18 inches)
Max. Spacing	1.8 m (6 feet), 1.2 m (4 feet) for ditch checks	1.8 m (6 feet)		1.8 m (6 feet)
Geotextile Fastener to Post				
Fastener	Plastic Zip Ties- 22 kg (50 lb.) Tensile	Plastic Zip Ties- 22 kg (50 lb.) Tensile	Wire Tie or Plastic Zip Tie- min. 22 kg (50lb) Tensile	Gun Staples 25 mm (1 inch) long
Min. Fasteners per post	3	3	1 tie at each individual barrier end	5

* No substitutions allowed, monofilament in both directions.

3887

3887

Flotation Silt Curtain

3887.1 SCOPE

This specification covers flotation silt curtain used for containing suspended sediment in an area of open water. The following types are provided for the specified uses:

Still Water	Lakes or large bodies of water with little to no current
Moving Water	Streams and rivers with a current less than 2.1 m/s (7.0 feet/second)
Work Area	Moving or still water, used to confine a work area

3887.2 REQUIREMENTS

Flotation silt curtain shall be constructed of fabric fastened to a flotation carrier and weighted along the bottom edge. Depth of curtain shall be as indicated in the Plans. Depth of curtain shall refer to the dimension of the curtain fabric extending below the flotation, i.e. hanging in the water. The flotation silt curtain shall conform to Table 3887-1. Upon completion of the work the curtain shall be removed in a manner that will prevent re-suspension of sediment into the water.

**TABLE 3887-1
FLOTATION SILT CURTAIN REQUIREMENTS**

	TYPE	
	Still Water	Moving Water & Work Area
Curtain Fabric Material Type	Impermeable vinyl-nylon laminate	Impermeable vinyl-coated nylon
Mass per square meter (square yard)	0.6 kg (18 oz)	0.75 kg (22 oz)
Grab Tensile Strength ASTM D 4632 (B)	1.3 kN (300 lbs)	2.2 kN (500 lbs)
Depth of Curtain (A)	From 0.6 to 3 m (2-10 feet)	From 0.6 to 3 m (2-10 feet)
Flotation	150 mm (6 inches) diameter Marine quality expanded polystyrene	200 mm (8 inches) diameter Marine quality expanded polystyrene
Net Buoyancy, per meter (foot)	200 N (13 lbs)	300 N (20 lbs)
Top Load Carrying Components	Fabric Only	Fabric plus 8 mm (5/16 inch) galvanized steel cable 40.0 kN (9800 lb) min. break strength
Ballast, mass per meter (pound/ foot), min.	1.0 kg (0.7 lb/foot) enclosed 6 mm (1/4 inch) galvanized chain	1.6 kg (1.1 lb/foot) enclosed 8 mm (5/16 inch) galvanized chain
Connection Between Sections	Laced grommets	Aluminum collar reinforced quick disconnects

(A) As specified in the Contract

(B) Minimum average roll value.

3887.3 SAMPLING AND TESTING

Material furnished under this Specification may be accepted on the basis of the manufacturer's guaranteed analysis. However, the Department reserves the right to sample, test, inspect, and accept or reject the materials based on its own tests.

3888

3888
Erosion Stabilization Mats

3888.1 SCOPE

This Specification covers permanent, long lived turf reinforcement mats to provide soil reinforcement for vegetation establishment in ditch bottoms, waterways, steep and engineered slopes, and shorelines where shear stresses are high or where there are highly erodible soils that have frequent runoff. Erosion stabilization mats shall be composed of UV stabilized, non-degradable, synthetic fibers, filaments, nettings, and/or wire mesh processed into three dimensional reinforcement matrices. Erosion stabilization mats shall provide sufficient thickness, strength, and void space to permit soil filling and retention and the development of vegetation within the matrix. All turf reinforcement mats shall be filled with topsoil, topsoil blends, or compost. To prevent temporary loss of topsoil media after placement, see 2575 and 3885. Various classes with different applications, varying in severity of shear stresses, are as follows:

ESM Class	Application	Minimum Permissible Shear Stress (A) in channel applications -½ hr. Pa (pounds/sq. foot)	Minimum Tensile Strength (B) ASTM-D 6818	Matrix Composition (C)
1	Slopes and ditches	100 Pa (2.1 lbs/sq. ft)	1.82 kN/m (125 lbs/ft)	Nylon, Polypropylene, Polyolefin, or Polyester
2	Slopes and ditches	288 Pa (6 lbs/sq. ft)	2.19 kN.m (150 lbs.ft)	Nylon, Polypropylene, Polyolefin, or Polyester
3	Slopes and ditches	384 Pa (8 lbs/sq. ft)	2.55 kN/m (175 lbs/ft)	Nylon, Polypropylene, Polyolefin, or Polyester
4	Slopes and ditches	480 Pa (10 lbs/sq. ft.)	20 kN/m (1370 lbs/ft)	Nylon Polypropylene, polyolefin, or Polyester
5	Steep slope surface soil reinforcement		20 kN/m (1370 lbs/ft)	Nylon, Polypropylene, Polyolefin, or Polyester, bonded to twisted wire mesh (D)

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- (A) Sustained shear for minimum ½ hour vegetated with Retardance Class B.
- (B) Minimum Average Roll Value of either direction.
- (C) Minimum thickness of 6.4 mm (¼ inches), UV stability ASTM D4355 at 500 hours of 80 percent.
- (D) Minimum 50-year design life.

3888.2 REQUIREMENTS

A General

Erosion stabilization mats are made of a three dimensional matrix of synthetic material and shall be continuously bonded at filament intersections. Filaments which are discontinuous or loosely held together by woven, unstitched, or glued netting will not be permitted.

All mats shall be soil filled. The mats shall have cells at least 10-19 mm (3/8 -3/4 inch) in depth to allow soil filling and retention.

B Materials and Dimensions

Material and dimension requirements will be as indicated in the Plans.

C Anchors, Staples, and Pins

The anchoring method and installation pattern used to link the Erosion Stabilization Mats to the soil surface shall be identified in the Plan. Where the anchoring method is not specified in the Plan, the following shall be used as directed by the Engineer:

1. Metal U -shaped, 11 gauge, 254 mm (10 inches) in length.
2. Metal pins should be at least 4.7 mm (3/16 inch) diameter steel with a 38 mm (1 ½ inch) steel washer at the head of the pin, 254 mm (10 inches) in length.
3. Welded 95 mm (3/8 inch) diameter rebar "T" stakes 305 mm (12 inches) in length.

3888.3 APPROVED MATERIALS

Approved products for this specification are on file on the Mn/DOT Web page under the Materials Engineering Section.

3888.4 SAMPLING AND TESTING

Material furnished under this specification may be accepted on the basis of the manufacturer's guaranteed analysis. However, the Department reserves the right to sample, test, inspect, and accept or reject the materials based on its own tests.

3889

Temporary Ditch Checks

3889.1 SCOPE

This Specification covers temporary ditch checks used for slowing water velocity and temporarily containing sediment in ditch bottoms.

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3889.2 REQUIREMENTS

Temporary ditch checks shall conform to the requirements for the following types, as specified in the Contract.

A Type 1: Sliced in Silt Fence

Type 1 ditch check shall meet the requirements of 3886-silt fence-machine sliced with a maximum 1.2 m (**4 foot**) post spacing.

B Type 2: Bioroll

Type 2 ditch checks shall consist of 3987 Type 2 Storm Water Filter Logs.

C Type 3: Bioroll Blanket System

Type 3 ditch checks shall consist of two components; Type 2 or 3 Storm Water Filter Log in accordance with 3897, staked on top of a Category 3, specification 3885 erosion control blanket. The blanket shall form a minimum width of 3.7 m (**12 feet**) perpendicular to the ditch gradient.

D Type 4: BLANK

E Type 5: Rock Weeper

Type 5 ditch checks shall be composed of a geotextile liner, coarse concrete aggregate, and riprap. The geotextile filter fabric liner shall be in accordance with 3733 Type IV. The coarse concrete aggregate forming the front half of the weeper shall be in accordance with 3137-1 CA-1. The riprap forming the back half of the weeper shall be in accordance with 3601, Class 1 and be composed of 100 percent crushed or quarry run material.

The rock weeper shall be created such that the side profile forms a triangle with 1:2 (V:H) slopes on both the front and back slopes. The coarse concrete aggregate shall be installed on the front half of the triangle with a 1:2 slope to a height of 0.6 m (**2 feet**). The riprap shall be installed on the back half of the triangular section.

F Type 6: Geotextile Triangular Dike

Type 6 ditch checks shall be triangular shaped having a height of at least 200 mm – 250 mm (**8-10 inches**) in the center with equal sides and a 400 mm – 500 mm (**16-20 inches**) base. The triangular shaped inner material shall be urethane foam. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle 0.61-0.91 m (**2-3 feet**). Length of each section shall be 0.91-2.1 m (**3-7 feet**). Standard length shall be 2.1 m (**7 feet**) unless otherwise indicated in the plans.

G Type 7: Rock Check

Type 7 ditch checks shall be composed a geotextile liner and riprap. The geotextile filter fabric liner shall be in accordance with 3733 Type IV. The riprap shall be in accordance with 3601, Class I-IV, as specified in the Contract, and be composed of 100 percent crushed or

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quarry run material. Riprap shall be configured in a trapezoidal shaped berm with respect to the side profile such that the bottom of the berm is approximately 1.5 m (**5 feet**) wide, the top of the berm is approximately 0.6 m (**2 feet**) wide, and the height of the berm is approximately 0.6 m (**2 feet**) deep.

3889.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3890

Compost

3890.1 SCOPE

This Specification covers compost material used as a soil amendment for landscape planting or turf establishment purposes.

3890.2 REQUIREMENTS

Compost material furnished under this Specification shall consist of a natural humus product derived from the aerobic decomposition of organic wastes. The compost shall be considered mature and usable by Mn/DOT when 60 percent decomposition has been achieved as determined by an ignition-loss analysis and any one additional test method including the Solvita test of 5 or above. This shall mean that the compost product has no offensive smell, no identifiable organic materials, and will not reheat more than 11 °C (**20 °F**) degrees above ambient temperature. Compost must be produced by a process to further reduce pathogens (PFRP) and weed seeds, and process verified by fecal coliform or *Salmonella* sp. Tests, where applicable. Compost foreign particle restrictions up to 3% at 4 mm (**0.16 inch**) will apply to the shredded pieces from the plastic bags used to transport feedstocks to the composting facility, but will be considered acceptable if visible in the finished product. Biosolids as a compost additive or co-compost material shall be acceptable if product description and source is on file with Mn/DOT and meets all specifications for Grade 1 Compost.

Compost shall be registered for sale with the State of Minnesota. Additionally, the material shall meet the Minnesota Pollution Control Agency requirements for allowable levels of any inherent contaminants (7035.2836 Subp. 6 Sec. A), or the Code of Federal Regulations, Title 40, section 503.13(b)(3), amended for mercury. Compost must meet minimal chemical contaminant standards in order to be used in a Mn/DOT project. No material may be mixed into a compost that does

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not comply with Minnesota Rules Chapter 7045 (Hazardous Waste). Compost used in Mn/DOT transportation systems is not allowed to exceed 10% of the Minnesota Pollution Control Agency's Superfund residential soil cleanup guidelines, termed Soil Reference Values or SRVs (i.e. 10% of individual chemical or chemical mixture Hazard Index, Hazard Quotient, or acceptable cancer risk level). No chemical contaminant, including pesticides, can be present in concentrations that would result in toxic effects to soil organisms, plants, or animals which reside in or on the composted soil areas or use the treated area for food or shelter. At the time of delivery to the Project, the compost shall be in a condition considered safe for exposure to dusts during handling.

A Grade 1 Compost

Grade 1 compost for use in turf establishment shall be a nutrient rich type derived from the decomposition of animal derived material with a texture similar to a highly organic soil and meeting the following requirements:

	Min	Max
Organic Matter Content	30%	----
C/N Ratio	6:1	20:1
NPK ratios ^a	2:2:1	4:4:2
pH	5.5	8.0
Moisture Content	35%	55%
Bulk Density kg/m ³ (lbs/cy. yd)	415 (700)	950 (1600)
Inert Material	----	3% @ 4 mm (0.15 inch)
Soluble salts (mmho/cm)	----	10
Germination Test ^b	80%	100%
Screened Particle Size	----	10 mm (0.375 inch)
Contaminants	----	US EPA 503 ^c

^a To obtain the nitrogen, phosphorus or potassium levels specified, the compost may be fortified with commercial fertilizer.

^b Germination test must list the species of Cress or lettuce seed used.

^c or MPCA 7035.2836 Subp. 6 Sec. A.

B Grade 2 Compost

Grade 2 compost for use of as a landscape planting medium, shall be a humus rich type derived from the decomposition of leaves and yard wastes. Animal or poultry manure, at any stage of decomposition, shall not be acceptable. Texture shall be similar to a shredded peat and shall meet the following requirements:

	Min	Max
Organic Matter Content	30%	----
C/N Ratio	6:1	20:1
pH	5.5	8.5
Moisture Content	35%	55%
Bulk Density kg/m ³ (lbs/cu.yd.)	415(700)	890(1500)
Inert Material ^a	---- 3%	@ 4 mm (0.15 inch)
Soluble salts (mmhos/cm)	----	10
Germination Test ^b	80%	100%
Screened Particle Size	----	19 mm (¾ inch)
Contaminants	----	US EPA 503 ^c

^a Includes plastic bag shreds

^b Germination test must list the species of Cress or lettuce seed used.

^c or MPCA 7035.2836 Subp. 6 Sec. A.

C Grade 3 Compost

Grade 3 compost derived from a composite of up to 10 percent of animal derived material feedstock added to leaf and yard waste feedstock by weight, meeting all requirements of Grade 1 Compost.

3890.3 APPROVED MATERIALS

Vendors approved by the Department's Turf Establishment and Erosion Prevention Unit and on file on the web under the Materials Engineering Section meet this specification requirement.

3890.4 SAMPLING AND TESTING

Compost shall be tested and approved by the Engineer prior to delivery to the Project. Prior to the Engineer sampling the product, compost vendors must furnish certification that their compost has been chemically and biologically tested and found to meet the specification standards described above. When any federal or state chemical specific requirements are conflicting, the vendor shall meet the most stringent requirement. The Department also reserves the right to conduct bioassay testing of any material.

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Prospective sources shall be indicated to the Engineer at least 1 month prior to delivery to the Project in order to allow adequate time for testing and approval of the material. Material from sources approved by the Agricultural Engineer may be accepted on the basis of a certificate of compliance according to 1603. In this case, certified test reports shall be furnished prior to delivery and acceptance to the Engineer and also to the Agricultural Engineer.

All testing shall be in accordance to current standard testing procedures of the University of Minnesota Soils Testing Laboratory, Soil Science Department, or equivalent.

3891

Storm Drain Inlet Protection

3891.1 SCOPE

This specification covers materials used for temporarily protecting storm drain inlets that are either constructed during the Project or exist prior to the Project, from sedimentation during construction activities. For purposes of this specification storm drain inlets are defined as manholes, catch basins, curb inlets and other drop type inlets that provide for the ingress of surface water into underground drainage systems.

3891.2 TYPES

Types of storm drain inlet protection to be provided shall be as follows:

Inlet protection to be utilized in median areas, field inlets and other areas where vegetation will ultimately be established.

Inlet protection to be utilized in and adjacent to streets, parking lots and other areas that will ultimately be paved.

3891.3 APPROVED MATERIALS

In addition to the Approved Products List, approved materials that can be furnished for use are as follows:

A Rock Log

Rock logs shall meet the requirements of 3897.2 Type 7.

B Compost Log

Compost logs shall meet the requirements of 3897.2 Type 5.

C Sediment Control Inlet Hat

Sediment control inlet hats shall be a polyethylene hat-like structure covering the inlet with small weep holes on the side providing a filtering function of the storm water runoff and a large opening above the weep holes for emergency overflow.

D Silt Fence Ring and Rock Filter Berm or Rock Log Combination

Silt fence shall meet the requirements of 3886 Type Heavy Duty. Silt fence shall be placed in a circular configuration around the inlet to form a minimum 1.5 m (**5 foot**) diameter zone of protection. Rock logs (3897.2 Type 7) shall line the outside toe of the silt fence. Rock Filter berms shall consist of 3882 Type 9 Mulch, at the Silt Fence toe, as indicated on the Plans.

E Pop-up Head

Pop-up head inlet protection shall form a solid steel plate over the inlet casting or solid steel box that fits inside a grate assembly with the exception of a center cylindrical drain tube riser. The tube riser shall be fully extended when providing drainage functions and have holes that provide filtering capabilities. The tube riser shall be covered with a removable knit type geotextile that provides additional sediment filtering capabilities. The tube riser shall be able to be pushed down flat to the steel plate to allow construction vehicles to drive over it, facilitate cleanout, or to shut off drainage to the inlet.

F Filter Bag Insert

Filter bag insets shall consist of a replaceable reinforced filter bag suspended from a retainer ring, or frame that fits within a grate or it shall consist of a geosynthetic filter bag suspended from a rebar or steel rods. The filter bag that is suspended from a frame shall be constructed of a polypropylene filter geotextile fabric with a minimum weight of 222 g/m² (**4 ounce/square yard**), a minimum flow rate of 5908 L/minute/m² (**145 gallon/minute/square feet**), a minimum permittivity of 2 per second, and designed for a minimum silt and debris capacity of 0.57 m³ (**2 cubic feet**). The filter bag shall be reinforced with an outer polyester mesh fabric. The filter bag shall be suspended from a galvanized steel ring or frame utilizing a stainless steel band and locking clamp. The frame shall be designed with an overflow feature. Overflow capacity shall be at a minimum equal to the design flow capacity of the structure's grate opening.

When the filter bag insert is the type suspended from the grate the geosynthetic fabric shall meet 3886 for Machine Sliced and a minimum silt and debris capacity of 0.57 m³ (**2 cubic feet**). All edges, seams shall be minimum double stitched. The Filter bag insert shall have an oval, edge heat sealed overflow 10 by 15 mm (**4 by 6 inches**) holes cut into all four panel sides.

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K Other

Devices approved by the Department's Erosion Control Engineering Unit and on file on the web under the Materials Engineering Section's Approved Products List can be furnished as meeting this specification requirement.

3891.4 REQUIREMENTS

Dimension requirements will be as indicated in the Plans.

3891.5 SAMPLING AND TESTING

Sampling and testing samples shall be furnished in the size and number directed by the Engineer.

3892

Temporary Down Drain

3892.1 SCOPE

This Specification covers material used as a temporary Down drain to convey drainage down a slope while turf is establishing.

3892.2 REQUIREMENTS

In the absence of plan specifications, Temporary Down drain shall consist of a 250 mm (**10 inch**) minimum diameter corrugated polyethylene tubing (PE). The corrugated polyethylene tubing shall be nonperforated and shall comply with AASHTO M 252.

The Down drain shall be anchored with stakes. The stakes shall be nominal 50 x 50 mm (**2 x 2 inch**) cross-section, at least 1 m (**3 feet**) long, and with a pointed end. Maximum spacing between the stake installations shall be 2.5 m (**8 feet**).

3892.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3893

Sandbags

3893.1 SCOPE

This Specification covers material used for sandbags to dike off construction areas or to serve as temporary erosion control installations.

3893.2 REQUIREMENTS

Sandbags shall consist of a woven polypropylene fabric sewn together with double stitching. The polypropylene fabric shall meet or exceed the following:

Grab Tensile Strength

ASTM D 4632 420 N, min.

UV Stability

ASTM D 4355 70% min.

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Overall size of the sandbag shall be at least 350 x 650 mm (**14 x 26 inch**).

3893.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3894

Sediment Mat

3894.1 SCOPE

This Specification covers a sediment absorbing biodegradable mat temporarily placed in a stream bed to intercept and retain sediment caused by in-stream construction activities.

3894.2 REQUIREMENTS

The sediment mat shall consist of a flat pad that can be laid out singly or grouped together. The pad shall be composed of a bottom layer of burlap, a center core of wood excelsior fiber blanket and an upper layer of jute netting. The burlap shall be a construction grade 280 g (**10 ounce**) mass fabric. The wood excelsior fiber center core shall be approximately 25 mm (**1 inch**) thick and shall have a mass of at least 0.50 kg (**1 pound**) per m² (**square yard**). The jute netting shall be a construction grade having a mass of at least 0.50 kg (**1 pound**) per m² (**square yard**) with approximately 25 mm (**1 inch**) openings. The pad shall be stitched together along the edges and through the center to prevent movement of the layers in relation to each other. Overall size of each pad shall be approximately 1.2 x 3.0 m (**4 x 10 feet**) with an overall mass of approximately 11 kg (**24 pounds**).

3894.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3895

Fiber Log

3895.1 SCOPE

This Specification covers fiber logs used to stabilize shorelines and to facilitate the establishment of vegetation.

3895.2 REQUIREMENTS

The fiber log shall consist of natural coconut fibers (coir) that have been compressed and stuffed into a netting. Dimensions of the log shall be approximately 300 mm (**12 inches**) in diameter. Mass of the log shall be no less than 11 kg/m (**7.4 pounds per foot**). The outer netting shall consist of coir yarn. Service life shall be a minimum of 5 years.

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3895.3 SAMPLING AND TESTING

Samples for testing shall be of such size and numbers as requested by the Engineer.

3896

Soil and Root Additives

3896.1 SCOPE

This specification covers additives for improving soil or root stock to ease transplanting, stimulate growth and improve the health of plant stock or seed.

3896.2 REQUIREMENTS

Additives shall conform to the requirements for one or more of the following, as specified in the Contract:

A Plant Hormones

Rooting hormone powder or liquid, used to stimulate rooting of plant cuttings, bare root stock and perennial plant material, shall contain known root hormones including any of the following: indole-3-butyric acid (IBA) indole acetic acid (IAA) or cytokinins. The inert ingredients shall not be harmful to the environment. Pre-mixed liquid forms must be handled and mixed according to the manufacturer's recommendations. This material may be tank mixed or pre-blended with hydrophilic polymers and endomycorrhizal inoculum.

B Hydrophilic Polymers

Super-absorbent polymer or hydrophilic compound, used to modify physical characteristics of soils to manage soil air and water, shall be an organic and fully biodegradable cross-linked polymer or other hydroscopic compound with water-binding groups and shall consist of potassium polyacrylate/polyacrylamide copolymer, sugar alcohols, polysaccharides, humates, alpha-hydroxypropionic acid or other documented hydrophilic compound. The product shall have a minimum life span of 60 days in the soil. Application rate shall be in accordance to manufacturer's recommendations for new plantings. This material may be mixed or pre-blended with rooting hormones and mycorrhizal treatments.

C Mycorrhizal Inoculum

C1 Endomycorrhizal Inoculum

Endomycorrhizal inoculum, microorganisms symbiotic with, and beneficial to plant roots, shall contain several species of *Glomus* that can be applied to the soil or base of a plant as a liquid, powder, or pellet. Minnesota origin of inocula is preferred. Additional endomycorrhizal species of *Gigaspora*, *Scutellospora*, *Entrophospora*, *Acaulospora*, or *Sclerocystis* may also be present. The Inoculum will not be rejected if ectomycorrhizal species of *Pisolithus* or *Rhizopogon*

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are present. The inoculum shall have a defined live spore count and shall be applied according to the manufacturer's recommendations for new plantings. Antagonistic pathogens shall not be present above trace levels. This material may be mixed or pre-blended with hydrophilic polymers and rooting hormones.

C2 Ectomycorrhizal Inoculum

Ectomycorrhizal inoculum, microorganisms symbiotic with, and beneficial to plant roots, shall contain *Rhizopogon* and or other cold tolerant species that can be applied to the soil or base of a plant as a liquid, powder, or pellet. Minnesota origin of inocula is preferred. The inoculum shall have a defined live spore count and shall be applied according to the manufacturer's recommendations for new plantings. Antagonistic pathogens shall not be present above trace levels. This material may be mixed or pre-blended with hydrophilic polymers and rooting hormones.

3896.3 SAMPLING AND TESTING

Product data sheet, research tests and Material Safety Data Sheet shall be submitted to the Engineer for approval prior to delivery and use on the project.

3897

Filter Logs

3897.1 SCOPE

This specification covers filter logs used for slowing and filtering storm water runoff, and other water encountered on the Project.

3897.2 REQUIREMENTS

Filter logs shall conform to the requirements of the following types, as specified in the Contract.

Type Straw Bioroll

Straw Bioroll shall consist of grain straw free of seed bearing stalks of noxious grasses or weeds as defined by the rules and regulations of the Minnesota Department of Agriculture. Straw shall be encased in polypropylene netting that will photo degrade within 6 to 9 months. The netting shall have approximate openings of 13 mm x 13 mm ($\frac{1}{2}$ inch x $\frac{1}{2}$ inch). The encased straw shall form a cylindrical log that is a minimum of 3 m (**10 feet**) long and 150-175 mm (**6 – 7 inches**) in diameter. Straw shall be packed into the net casing at a density between 32 to 64 kg/m³ (**2 to 4 pounds/cubic feet**).

3897.2

Type Wood Fiber Bioroll

Wood Fiber Bioroll shall consist of excelsior fibers. Excelsior fibers shall be encased in a polypropylene netting that will photo degrade within 6 to 9 months. The netting shall have approximate openings of 13 mm x 13 mm (**½ inch x ½ inch**). The encased excelsior fibers shall form a cylindrical log that is a minimum of 3 m (**10 feet**) long and 150-175 mm (**6 – 7 inches**) in diameter. A minimum of 80 percent of the fiber material shall be 150 mm (**6 inches**) or longer. Excelsior fibers shall be packed into the net casing at a density between 22 to 58 kg/m³ (**1.4 to 3.6 pound/cubic feet**).

Type Compost Log

Compost Log shall consist of a blend of 30-40% weed free compost as per 3890 Grade 2 and 60-70% partially decomposed wood chips. The compost/wood blend material shall pass a 51 mm (**2 inches**) sieve with a minimum of 70% retained on the 10 mm (**3/8 inch**) sieve, in accordance with TMECC 02.02-B, "Sample Sieving for Aggregate Size Classification". The compost/wood chip blend shall be pneumatically shot into a geotextile cylindrical bag. The geotextile bag shall consist of a knitted material with openings of 10 mm (**3/8 inches**) and contain the compost/wood chip material while not limiting water infiltration. The encased compost shall form a cylindrical log that is a maximum of 55 m (**180 feet**) and approximately 200 mm (**8 inches**) in diameter.

Type Rock Log

All aggregate shall be washed before placed in a rock bag. Rock shall be supplied in accordance with 3137.2 Class D with a gradation in accordance with Table 3137-1 CA-1 through CA-5. The casing material for the rock shall be between 1.2 m (**4 feet**) and 3 m (**10 feet**) in length and between 100 mm (**4 inches**) and 150 mm (**6 inches**) in diameter when filled with rock. The casing material shall have a minimum grab tensile strength of 575 N (**130 pounds**) and a minimum Mullen Burst Strength of 1200 kPa (**175 psi**).

3897.3 SAMPLING AND TESTING

Samples for laboratory testing shall be of numbers and size as requested by the Engineer.

3898

Flocculants

3898.1 SCOPE

This specification covers naturally derived additives for coagulating dispersed clays, and reducing turbidity in storm water runoff prior to discharge to natural surface waters. The use of flocculants to settle out clay-sized particles allows for increased sediment trapping efficiency and is to be used as part of a designed storm water treatment system.

3898.2 REQUIREMENTS

Flocculants shall be environmentally benign, biodegradable, and consist of natural origin biopolymers to improve water quality and protect aquatic biota. The pH and temperature of the sediment laden storm water must be tested and be within the manufactures specified pH and temperature range. Adequate time for chemical reaction with clay-sized particles must be provided for in the field prior to discharge to a surface water, wetland, or identified water of concern.

Flocculants shall conform to the requirements as detailed by each type.

A Liquid

The flocculant shall be stored in a concentrated liquid state. A manufacture's label must be affixed to the container that lists the percent of concentration in the container and the application dose rate. All dose rate calculations must be verified by the Engineer prior to application to the treatment system.

B Flocculant Sock

The flocculant shall be in a gelatin-like state that is packaged in individual compartments of the encasing sock material. The encasing material shall allow water to flow through it such that the water to be treated comes in contact with the gelatin-like flocculant material.

The Flocculant Sock shall have attachment anchor cords or grommets as needed for use in pipes, sediment control filter systems, and ditch bottoms.

The Flocculant Sock shall at a minimum treat 945 m³ (250,000 gallons) of water flowing through it.

C Granular Flocc

The flocculant shall be stored in a granulated state. A manufacture's label must be affixed to the bag or container that states the purity of the product and the application mixing rate. All dose rate calculations must be verified by the Engineer prior to application to the treatment system.

3898.3 SAMPLING AND TESTING

A certificate of compliance, and Material Safety Data Sheet shall be submitted to the Engineer for approval prior to delivery and use on the project.