

Section 35 43 00 – Permanent Geosynthetic Turf Reinforcement Mat

GENERAL

1.01 SUMMARY

- A. This section specifies the permanent Geosynthetic Turf Reinforcement Mat (TRM) Futerra™ 7010 with Flexterra® High Performance - Flexible Growth Medium™ (HP-FGM™) infill, to prevent long-term soil and vegetation loss resulting from excessive water flow (velocity and shear stress) in which unreinforced vegetation could not resist. Both the TRM and HP-FGM are made in the United States of America. The HP-FGM provides immediate and temporary protection against movement and/or loss of soil until vegetation can be established. The HP-FGM infill also provides an ideal environment for rapid seed germination and accelerated plant and root establishment within the matrix of the TRM.
- B. Related Sections: Other Specification Sections, which directly relate to the work of this Section include, but are not limited to the following:
 - 1. *Section 01 57 13 - Temporary Erosion and Sedimentation Controls*
 - 2. *Section 02 24 23 – Chemical Sampling and Analysis of Soils*
 - 3. *Section 31 25 00 - Erosion and Sedimentation Controls*
 - 4. *Section 31 35 00 - Slope Protection*
 - 5. *Section 32 01 90.16 - Amending Soils*
 - 6. *Section 32 91 00 - Planting Preparation*
 - 7. *Section 32 92 00 - Turf and Grasses*
 - 8. *Section 35 30 00 - Shoreline Protection*

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials and application rate.
- B. Certifications: Manufacturer shall submit a letter of certification that the product meets or exceeds all technical and packaging requirements and is made in the U.S.A.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in UV and weather-resistant factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations.

PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. PROFILE Products LLC
750 Lake Cook Road – Suite 440
Buffalo Grove, IL 60089
International - +1-847-215-1144
United States and Canada – 800-366-1180 (Fax 847-215-0577)
www.profileproducts.com

2.02 MATERIALS

A. Turf Reinforcement Mat shall be Futerra 7010, manufactured for the purpose of permanent channel lining and turf reinforcement. The TRM shall be made from 100% synthetic material and contain no biodegradable components or materials.

1. The TRM shall be a homogeneous, three-dimensional matrix consisting of continuous monofilament yarns which are thermally fused at the crossover points to provide a structure that will maintain its dimensional stability without laminated or stitched layers. No nettings or stitching shall be permitted. The TRM shall have a minimum 95% open space available for soil, HP-FGM and root interaction. The TRM shall not lose its structural integrity and shall not unravel or separate when TRM is cut in the field.
2. The TRM shall exhibit no buoyancy factor (i.e., the specific gravity of the fibers used should be greater than 1.0) so as to allow the TRM to maintain intimate contact with the soil (particularly between fasteners) under low flow or submersed conditions.
3. The TRM, when infilled with HP-FGM, shall meet the following property values:

	Test Method	Units	Roll Value	
			Typical	MARV
Mechanical Properties				
Mass Per Unit Area	ASTM D 6566	oz/yd ² (g/m ²)	8.0 (270)	6.5 (220)
Thickness (Min)	ASTM D 6525	inches (mm)	0.40 (10)	0.30 (7.5)
Tensile Strength (MD)	ASTM D 6818	lb/ft (kN/m)	170 (2.5)	150 (2.2)
Resiliency (Min)	ASTM D 6524	%	85	80
Light Penetration (Min)	ASTM D6567	%	1.0	
Ground Cover (Max)	ASTM D6567	%	99	
UV Stability (2000 hrs)	ASTM D4355	%	80	
Endurance				
Functional Longevity ¹	Observed	Months	> 36	
Performance				
C-Factor ² / % Effectiveness ²	Large Scale ³	n/a / %	< 0.01 / > 99	
Manning's n Range	ASTM D6460 ⁴	n/a	0.025 – 0.045	
Permissible Veg. Velocity	Large Scale ³	ft/s (m/s)	16.0 (4.9)	
Permissible Veg. Shear	Large Scale ³	lb/ft ² (N/m ²)	8.0 (380)	
Permissible Unveg. Velocity	ASTM D6460 ⁴	ft/s (m/s)	12.0 (3.7)	
Permissible Unveg. Shear	ASTM D6460 ⁴	lb/ft ² (N/m ²)	3.3 (160)	
Vegetation Establishment	ASTM D7322	%	800	
Physical				
	Units		Typical Value	
Dimensions [width x length]	ft (m)		8.0 x 169 (2.4 x 51.5)	
Roll Area	yd ² (m ²)		150 (125.4)	
Estimated Roll Diameter	ft (m)		2.0 (0.6)	
Estimated Roll Weight	lb (kg)		75 (34)	
Color	n/a		Black	

1. Functional longevity is an estimate of product functionality and is dependent upon moisture, light, microbial and other environmental conditions.

2. Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface. % Effectiveness = One minus Cover Factor multiplied by 100%.

3. Large scale testing conducted at Utah Water Research facility using rainfall simulator on 2.5H:1V slope, sandy-loam soil, at a rate of 5" per hour for a duration of 60 minutes.

4. Flume testing performed at Colorado State University – data and details available upon request.

- B. All components of the HP-FGM shall be pre-packaged by the Manufacturer to assure both material performance and compliance with the following values. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes and biostimulant materials should be added to this product.
1. Thermally Processed* (within a pressurized vessel) Wood Fiber – 80%
*Heated to a temperature greater than 380 degrees Fahrenheit (193 degrees Celsius) for 5 minutes at a pressure greater than 50 psi (345 kPa)
 2. Wetting agents (including high-viscosity colloidal polysaccharides, cross-linked biopolymers, and water absorbents) – 10%
 3. Crimped Biodegradable Interlocking Fibers – 5%
 4. Micro-Pore Granules – 5%

EXECUTION

3.01 SOIL TESTING

- A. Soil Samples shall be taken and sent to a third-party, independent lab for analysis and in compliance with Section 02 24 23 – Chemical Sampling and Analysis of Soils, if applicable.
- B. The tests shall include analysis and interpretation of results.
- C. The soil testing methods used shall be compliant with recognized agronomic testing standards, as outlined in Section 02 24 23, for revegetation of disturbed sites.
- D. Soil Analysis shall include results for:
1. Soil pH
 2. Soluble Salts
 3. Excess Carbonate
 4. Organic Matter
 5. Nutrient readings for:
 - i. Nitrogen, Phosphorus, Potassium
 - ii. Magnesium, Calcium, Sodium, Manganese, Sulfur, Zinc, Copper, Iron, Boron
 6. Cation Exchange Capacity
 7. Percent Base Saturation Sodium
- E. ProGanics® BSM, BioPrime™, JumpStart™, Aqua-pHix™ and NeutraLime™ Dry or other amendments shall be specified according to Section 32 01 90.16 – Amending Soils and applied with the hydroseeding slurry at Manufacturer recommended rates based on soil test results.

3.02 VEGETATION SPECIES SELECTION

- A. Once soils have been analyzed for agronomic potential and amendment recommendations, selection of suitable plant species for achieving sustainable growth and effective erosion control shall be determined by a qualified seed supplier, consulting professional and/or regulatory agency. Species selection and establishment shall be compliant with Section 32 92 00 – Turf and Grasses, if applicable.
- B. Site and project specific information considered for species selection shall include:
1. Project Location and Planning
 - i. Climate
 - ii. Elevation

- iii. Aspect
- iv. Slope/Gradient
- v. Permanent or Temporary Planting
- vi. Installation Date(s)
- 2. Soil Conditions
 - i. Soil Texture
 - ii. Soil pH
 - iii. Toxicities/Deficiencies noted in the previous section.
- 3. Site Maintenance Requirements
 - i. Mowing
 - ii. Irrigation
 - iii. Animal grazing preference
- 4. Preferred Vegetation
 - i. Drought Tolerant
 - ii. Native Vegetation
 - iii. Shrub Species
 - iv. Turf Grasses
 - v. Cool Season
 - vi. Warm Season
 - vii. Blend of Cool and Warm Season
 - viii. Legume Species
 - ix. Cover Crops

3.03 PREPARATION

- A. The installation site shall be prepared by clearing, grubbing and excavation or filling the area to the design grade.
- B. The surface to receive the TRM shall be prepared to relatively smooth conditions free of obstructions, rocks, dirt clods, roots, stumps, depressions, debris and soft or low density pockets of substrate. Erosion features such as rills, gullies, etc. must be graded out of the surface before TRM deployment. The substrate shall be capable of supporting a vegetative cover as determined by soil testing.
- C. Compaction as specified by the geotechnical engineer will be required before deploying product to make sure the TRM makes immediate contact with the soil.
- D. Cut trenches for initial anchor trenches, termination trench and longitudinal anchor trenches (12 in (30 cm) wide and 12 in (30 cm) in depth) as shown on the drawings.

3.04 INSTALLATION

- A. Care shall be taken during installation to avoid damage occurring to the TRM as a result of the installation process. Should the TRM be damaged during installation, a TRM patch shall be placed over the damaged area extending 1.0 ft (0.3 m) beyond the perimeter of the damage.
- B. Install anchoring devices at a frequency of 2.5 pins/staples per square yard (3 pins/staples per square meter). Additional anchoring devices may be required depending on site conditions or alignment of the slope or channel. Always staple (12 in (30 cm) centers) the seams between individual TRM rolls.
- C. When overlapping successive TRM rolls, the rolls shall be overlapped upstream over downstream and/or upslope over downslope.
- D. For channels, begin at the downstream end in the center of the channel. Inspect trenches for position accuracy and depth and re-dig to required dimensions. If trenches have not yet been constructed, dig

initial anchor trenches, check slot trenches and longitudinal anchor trenches as illustrated in installation guidelines or as directed on the plans. Unroll approximately 10 ft (3 m) of the TRM, positioning the roll face down (as it unrolls) over the initial anchor trench, extending several inches beyond the trench with the roll sitting on the downstream side of the anchor trench. Positioning roll in this manner permits backfilling and compaction of soil into the trench while allowing installer to proceed with proper deployment of TRM by unrolling upstream, over the anchor trench.

- E. Position second TRM with a minimum 4-in (10 cm) overlap of the previous TRM and secure it into the anchor trench. After entire width area is installed with the TRM, then backfill and compact the anchor trench.
- F. Continue deploying TRM upstream to the next check slot. Overlay a minimum of 18 in (45 cm) the ends of rolls with the next roll(s) being deployed, or position in bottom of check slot, anchor and backfill and compact check slots. Continue the processes until you reach the upstream starting point of the TRM.
- G. For slopes, construct top anchor trench 1-3 ft (0.3-0.9 m) beyond crest of slope, or as illustrated in drawings or shown in manufacturers recommended installation guidelines. Position TRM roll at crest of slope with sufficient material to line the entire anchor trench plus enough material left over to cover the trench. Position adjacent rolls to facilitate 6 in. (0.15 m) overlaps. Anchor TRM in trench with appropriate pins/staples at 1 ft (0.3 m) centers. Once several rolls are anchored in trench, begin to backfill and compact trench to original elevation. The preferred method of deploying roll down slope is to stand in front of the roll and pin it as it rolls out down the slope, minimizing foot traffic on TRM, which will eliminate depressions under the mat. Always allow the mat to drape over the soil, never pulling it taut, to minimize tenting. Place additional pins into any apparent depressions to maintain contact with the soil.
- H. Hydraulically fill the TRM with 0.35 in (9 mm) of HP-FGM, applied with hose at close range. Optimum application rate is 3,000 lb/ac (3,360 kg/ha) or to the depth of where the tips of TRM are still exposed.
- I. Strictly comply with HP-FGM manufacturer's installation instructions and recommendations. For optimum HP-FGM pumping and application performance, use approved mechanically agitated, hydraulic seeding/mulching machines, hose of sufficient length to reach the TRM, use of a 50 degree tip/nozzle is highly recommended. Apply HP-FGM from hose positioned over shoulder with nozzle approximately at chest level (4-5 ft or 1.2-1.5 m) to achieve optimum TRM infill.
- J. For optimum hydraulic performance and vegetative establishment, be careful not to overfill the TRM. The tips of the TRM shall be slightly exposed.
- K. Apply supplemental water over the area as directed by site personnel during germination and initial three months of vegetation growth.

3.05 CLEANING AND PROTECTION

- A. After application, thoroughly flush the tank, pumps and hoses to remove all material. Wash all material from the exterior of the machine and remove any slurry spills. Once dry, material will be more difficult to remove.
- B. Clean spills promptly. Advise owner of methods for protection of treated areas. Do not allow treated areas to be trafficked or subjected to grazing.

3.06 INSPECTION AND MAINTENANCE

- A. All inspections and maintenance recommendations shall be conducted by qualified professionals consistent with the owner, engineer/specifier and regulatory entity(s) expectations.

- B. Initial inspections shall insure installations are in accordance with the project plans and specifications with material quantities and activities fully documented. Refer to Section 32 92 00 – Turf and Grasses for any additional details.
- C. Subsequent inspections shall be conducted at pre-determined time intervals and corrective maintenance activities directed after each significant precipitation or other potentially damaging weather or site event.

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