Erosion Control Solutions for Stormwater Compliance: Practical Tools for Modern Site Management

Presented By:
Erosion Control Technology Council

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Agenda

- General Overview
- Hydraulic Erosion Control Products
- Rolled Erosion Control Products
- Sediment Retention Products
- Turf Reinforcement & Transition Mats
- Anchors

About ECTC

We are a council of the top industry stakeholders, manufacturers, component suppliers, material distributors and test laboratories dedicated to expanding knowledge and implementation of Erosion and Sediment Control Technologies and protecting valuable water resources.

Who We Service

ECTC Assists Agencies, Engineers, Designers, Contractors and others in the proper application, installation and specification of erosion and sediment control technologies while establishing guidelines for product quality and performance. ECTC is dedicated to facilitating innovation in product development and marketing and the dissemination of information and technologies to the public.

Membership

Membership in the Erosion Control Technology Council (ECTC) is made up of companies that are dedicated to advancing the knowledge, experience and expertise of erosion and sediment control.

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RL Pritchard, Jute

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What Is Erosion?

- Erosion: The wearing away of natural (earth) and unnatural (embankment, slope protection, structure, etc.) surfaces by the action of external forces.

PROCESS OF EROSION

Problems From Erosion

On-Site

- Loss of topsoil
- Cost Associated with site clean-up and rework

Off-Site

- Sediment Migration from site
- Pollution of waterways affecting water quality and wildlife habitats

Potential for extensive litigation costs

- EPA / NPDES Program
- Local Authorities

Costs Associated

Pollutants

Erosion-related pollutants cost the United States up to US $13 billion annually.

Removal

United States spends over US $1 billion removing sediment from harbors and waterways annually.

Stormwater Runoff

EPA estimates that sediment deposition in reservoirs from storm water runoff costs up to US $500 million annually.

Table 4. Damages by wind and water erosion and the cost of erosion prevention each year.

Type of damage	Cost (millions of dollars)
*Wind erosion**	
Exterior paint	18.5
Landscaping	2,894.0
Automobiles	134.6
Interior, laundry	986.0
Health	5,371.0†
Recreation	223.2
Road maintenance	1.2
Cost to business	3.5
Cost to irrigation and conservation districts	0.1
Total wind erosion costs	9,632.5
Water erosion‡	
In-stream damage	
Biological impacts	No estimate
Recreational	2,440.0
Water-storage facilities	841.8
Navigation	683.2
Other in-stream uses	1,098.0
Subtotal in-stream	5,063.0
Off-stream effects	
Flood damages	939.4
Water-conveyance facilities	244.0
Water-treatment facilities	122.0
Other off-stream uses	976.0
Subtotal off-stream	2,318.0
Total water erosion costs	7,381.0
Total costs of wind and water erosion damage	17,013.5§
Cost of erosion prevention‖	8,400
Total costs (on and off-site)¶	44,399.0
Benefit/cost ratio	5.24

*(95–97, 129). †Health estimates are partly based on Lave and Seskin (130). ‡(93, 96, 97, 129). §Agriculture accounts for about two-thirds of the off-site effects. ‖See text. ¶The total on-site costs are calculated to be $27 billion (see Table 3 and text).

Water Storage

Annual water storage replacement costs from sediment range from US $2 to US $6 billion.

Cost Savings

For every $1 invested in Erosion control $5.24 would be saved due to on- and off-site costs associated with erosion

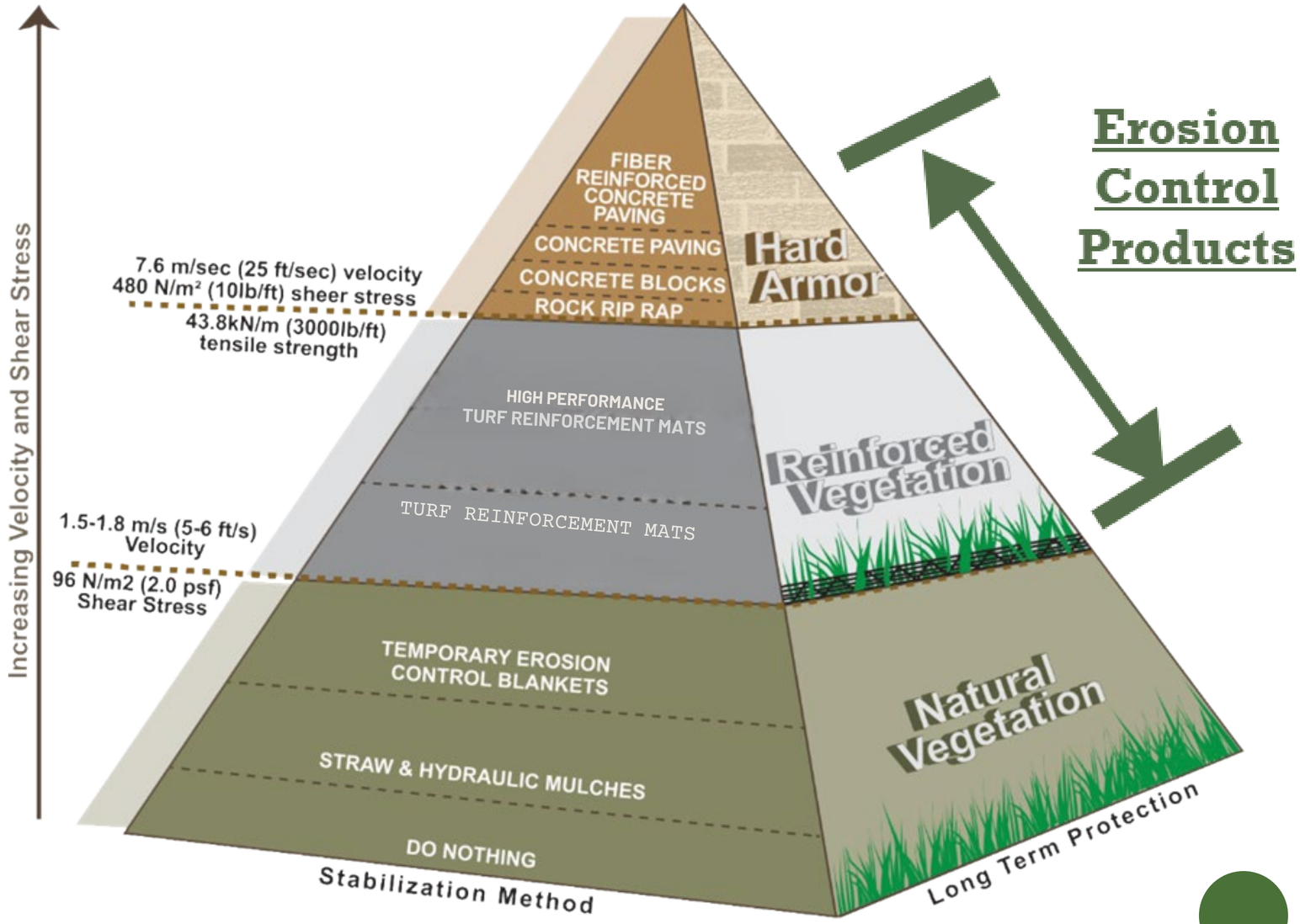
EROSION CONTROL SOLUTIONS

What

Erosion control products are innovative manufactured materials that can bridge the gap between “doing nothing” and Hard Armor solutions as erosive potential increase.

Why

Erosion Control products are designed to keep seed and soil in place during erosive events to encourage re-vegetation.



Hard Armor

- Articulated Concrete Blocks
- Rock
- Concrete

Soft Armor

- Erosion Control Blankets
- Turf Reinforcement Mats
- Bio-Engineering

Revegetation

- Blown Straw
- Hydraulic Mulch
- Bonded Fiber Matrix

SEDIMENT CONTROL SOLUTIONS

What

Sediment control devices are innovative manufactured products that intercept, slow, filter and retain fugitive sediments that have been moved by erosive forces.

Why

Sediment Control products are designed to capture and retain fugitive sediments after erosion has occurred and limit eroded soil from leaving a disturbed site.

Perimeter Control

- Silt Fence
- Filter Socks
- Sediment Retention Devices

Velocity Reduction

- Rip Rap Check Dams
- Slope Interrupters
- Filter Berms

Water Quality

- Inlet Protection
- Floating Pond Skimmers
- Sediment Ponds
- Turbidity Curtains

E&SC Product Innovation and Technology Verification

Slope Test

Erosion and sediment control products and technologies have been extensively tested and researched.

Testing Facility

Product performance evaluated through independent third-party labs such as: Texas Transportation Institute and TRI Environmental, Inc.

Channel Test

Evaluation conducted using standardized ASTM methodologies

Sediment Test

Innovative products developed to address changing global climatic conditions and increased regulation with a focus on improving water quality.

Evaluation

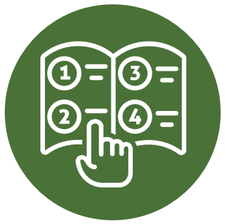
·National testing programs, like AASHTO Product Evaluation and Audit Services, provide regulators with reliable third-party data to verify E&SC product quality and performance.

https://data.ntpep.org/Home/Index

Importance of Installation

All products require proper installation for maximum performance

Proper preparation including soil type and grading



Follow Manufacturer's Instructions for best success

Proper Application rate of HECPs and anchors.

See ECTC Youtube channel for installation videos

Specifications

Currently Exist for RECPs, TRMs, HECPs, SRFRs

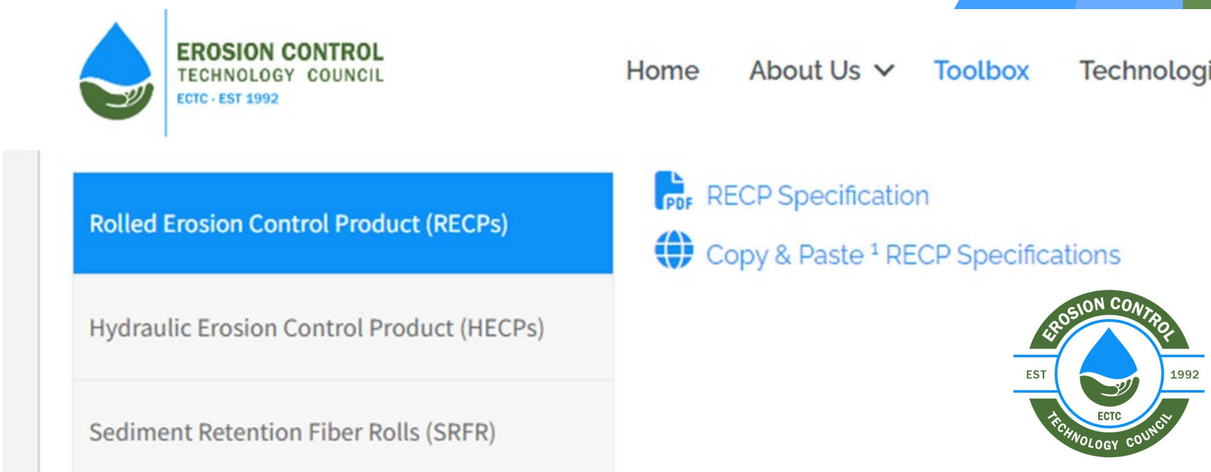
- New Specifications are always being researched
- Within specification exist various types and sub-types to help understand how a product performs to help user find the right product for the application

Index vs Performance Based Properties

- Index properties are to be used to verify product characteristics, and made correctly. Examples include mass per unit area and tensile.
- Performance properties are used for design. Examples include c-factor and shear stress.

Available on ECTC website

- Toolbox Option
- Cut & Paste Option
- www.erosioncouncil.org



Temporary Rolled Erosion Control Product (RECP)

Highlights

- A fiber mat composed of natural or synthetic fibers bound together to form a continuous matrix that is formed into a roll and, when deployed, provides erosion control and facilitates vegetation establishment.
- Composed of various natural and synthetic components, including but not limited to agricultural fibers (straw/coconut/hemp/corn stalks/switchgrass), wood shavings, coconut, and synthetic polymer fibers, as well as netting a stitching components that can be made from natural or synthetic materials.
- Provides variable product life span from <3 months (ultra short-term) to >3 years (long-term), based on composition of RECP.
- Designed to control construction site erosion from wind and rain events, thus protecting the seed and seed bed, leading to improved revegetation of disturbed construction sites.

Application

RECP application should be considered in any scenario where erosive forces from wind, rain, and stormwater accumulation may occur.
Examples include: slopes, conveyance channels, shore lines, and river banks

Considerations for RECP application include:

- Soil Type
- Steepness of Slope
- Type of flow scenario; concentrated (channel) or sheet flow (slope)
- Anchoring Frequency
- Desired service life
- Vegetation variety and germination requirements

Matrix Types

Straw Fiber

- Typically Wheat or Rice
- Biodegradable, longevity six months to one year

Excelsior Fiber

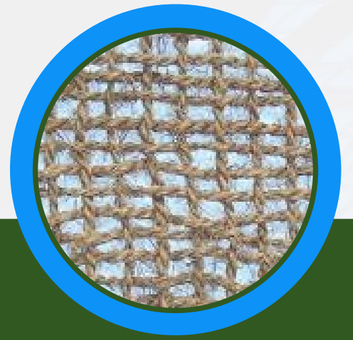
- Machine Made Wood Long Fiber
- Biodegradable, longevity up to 24 months

Coconut

- Imported and Longest Lasting
- Biodegradable, longevity twenty-four months to thirty-six months

Blend

- Typically Straw and Coconut
- Biodegradable, longevity eighteen months to twenty-four months



Open Weave

- Considered a textile
- Biodegradable woven mesh mats, longevity twelve to thirty- six months

- **RECPs are typically composed of natural, degradable matrices .**
- **RECPs can be made with or without supportive nettings or woven into continuous open weave meshes .**
- **Selection of product composition largely dependent on required service life and required product performance .**

Netting Types

Rapid Degradable

- Typically, White or Clear
- Photodegradable
- 6 weeks to 6 months longevity

Regular Degradable

- Typically, Green
- Photodegradable
- 1-2 years longevity

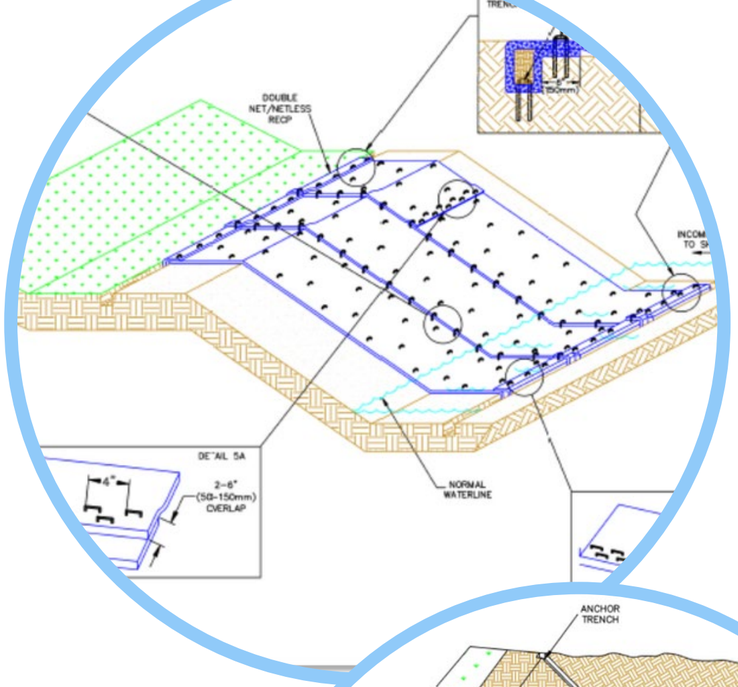
Natural

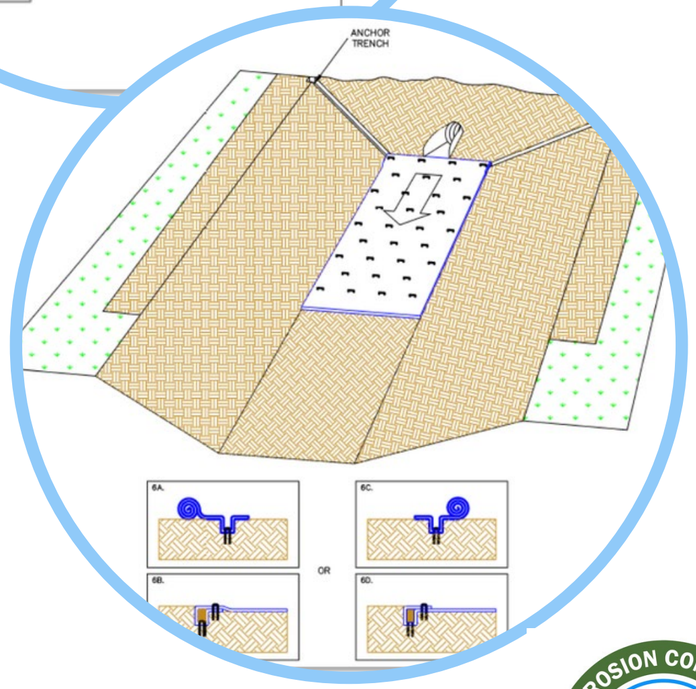
- Biodegradable
- Typically, Jute Scrim
- Completely Biodegradable
- 3-12 months longevity

UV-Stabilized

- Typically, Black
- Technically Photodegradable
- 3 – 25 years longevity

Installation





- RECP installation is hugely important in both controlling soil erosion and germination of new vegetation.
- Installation guidelines are widely available from product manufacturers websites and www.erosioncouncil.org
- Important installation variable include soil type, top-soil depth, anticipated erosive force, slope and/or channel length and incline, among other considerations.
- These variables will inform the anchor type and frequency required, edge or seam overlap, and anchor trench placement and design.
- Videos available at Youtube channel @erosioncontroltechcouncil

ECTC Standard Specification For Temporary Rolled Erosion Control Products

For use where natural vegetation alone will provide sufficient permanent erosion protection.

Type 1

ULTRA SHORT-TERM - Typical 3 month functional longevity.			C Factor[b]	Shear Stress[c]	MD Material Tensile Strength	TD Material Tensile Strength	Material Thickness	Ground Coverage	Material Mass	Installed Slope Steepness[d]
Type	Product Description	Material Composition	Performance Test	Performance Test	Typical ASTM D6818	Typical ASTM D6818	Typical ASTM D6525	Typical ASTM D6567	Typical ASTM D6475	Maximum
1.A[a]	Netting / Open Weave Textile	*A photodegradable synthetic mesh or woven biodegradable natural fiber netting.*	≤ 0.10	≥ 1.0 lbs/ft^2 (48 Pa)	≥ 125 lbs/ft (1.8 kN/m)	≥ 10 lbs/ft (0.1 kN/m)	≥ 0.03 in (0.76 mm)	≥ 3 %	≥ 0.2 oz/yd^2 (7 g/m^2)	5:1 (H:V)
1.B	Netless Rolled Erosion Control Blankets	*Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form an RECP.*	≤ 0.10	≥ 1.0 lbs/ft^2 (48 Pa)	≥ 125 lbs/ft (1.8 kN/m)	≥ 10 lbs/ft (0.1 kN/m)	≥ 0.30 in (≥ 7.6 mm)	≥ 50% - ≤ 90 %	≥ 10.0 oz/yd^2 (339 g/m^2)	3:1 (H:V)
1.C	Single-net Erosion Control Blankets	*Processed degradable natural and/or polymer fibers mechanically bound together by a single rapidly degrading, synthetic or natural fiber netting.*	≤ 0.10	≥ 1.5 lbs/ft^2 (72 Pa)	≥ 60 lbs/ft (0.9 kN/m)	≥ 20 lbs/ft (0.3 kN/m)	≥ 0.25 - ≤ 0.50 in (≥ 6.4 - ≤ 12.7 mm			
1.D	Double-net Erosion Control Blankets	*Processed degradable natural and/or polymer fibers mechanically bound together between two rapidly degrading, synthetic or natural fiber nettings.*	≤ 0.10	≥ 1.75 lbs/ft^2 (84 Pa)	≥ 75 lbs/ft (1.1 kN/m)	≥ 40 lbs/ft (0.6 kN/m)	≥ 0.25 - ≤ 0.50 in (≥ 6.4 - ≤ 12.7 mm			

Type 2

SHORT-TERM - Typical 12 month functional longevity.			C Factor[b]	Shear Stress[c]	MD Material Tensile Strength	TD Material Tensile Strength	Material Thickness	Ground Coverage	Material Mass	Installed Slope Steepness[d]
Type	Product Description	Material Composition	Performance Test	Performance Test	Typical ASTM D6818	Typical ASTM D6818	Typical ASTM D6525	Typical ASTM D6567	Typical ASTM D6475	Maximum
2.A[a]	Netting / Open Weave Textile	*A photodegradable synthetic mesh or woven biodegradable natural fiber netting.*	≤ 0.10	≥ 1.0 lbs/ft^2 (48 Pa)	≥ 125 lbs/ft (1.8 kN/m)	≥ 10 lbs/ft (0.1 kN/m)	≥ 0.03 in (≥ 0.76 mm)	≥ 3 %	≥ 0.2 oz/yd^2 (7 g/m^2)	5:1 (H:V)
2.B	Netless Rolled Erosion Control Blankets	*Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form an RECP.*	≤ 0.10	≥ 1.0 lbs/ft^2 (48 Pa)	≥ 125 lbs/ft (1.8 kN/m)	≥ 10 lbs/ft (0.1 kN/m)	≥ 0.30 in (≥ 7.6 mm)	≥ 50% - ≤ 90 %	≥ 10.0 oz/yd^2 (339 g/m^2)	3:1 (H:V)
2.C	Single-net Erosion Control Blankets	*Processed degradable natural and/or polymer fibers mechanically bound together by a single degrading, synthetic or natural fiber netting.*	≤ 0.10	≥ 1.5 lbs/ft^2 (72 Pa)	≥ 60 lbs/ft (0.9 kN/m)	≥ 20 lbs/ft (0.3 kN/m)	≥ 0.25 - ≤ 0.50 in (≥ 6.4 - ≤ 12.7 mm)	≥ 50% - ≤ 90 %	≥ 8.0 oz/yd^2 (271 g/m^2)	3:1 (H:V)
2.D	Double-net Erosion Control Blankets	*Processed degradable natural and/or polymer fibers mechanically bound together between two degradable, synthetic or natural fiber nettings.*	≤ 0.10	≥ 1.75 lbs/ft^2 (84 Pa)	≥ 75 lbs/ft (1.1 kN/m)	≥ 40 lbs/ft (0.6 kN/m)	≥ 0.25 - ≤ 0.50 in (≥ 6.4 - ≤ 12.7 mm)	≥ 50% - ≤ 90 %	≥ 8.0 oz/yd^2 (271 g/m2)	2:1 (H:V)

Specifications

Specifications

EXTENDED-TERM - Typical 24 month functional longevity.

Type	Product Description	Material Composition	C Factor[b] Performance Test	Shear Stress[c] Performance Test	MD Material Tensile Strength Typical ASTM D6818	TD Material Tensile Strength Typical ASTM D6818	Material Thickness Typical ASTM D6525	Ground Coverage Typical ASTM D6567	Material Mass Typical ASTM D6475	Installed Slope Steepness[d] Maximum
3.A	Open Weave Textiles	*An open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.*	≤ 0.05	≥ 2.0 lbs/ft^2 (96 Pa)	≥ 100 lbs/ft (1.5 kN/m)	≥ 40 lbs/ft (0.6 kN/m)	≥ 0.20 - ≤ 0.40 in (≥ 5.1 - ≤ 10.1 mm)	≥ 40 %	≥ 11.0 oz/yd^2 (373 g/m^2)	2:1 (H:V)
3.B	Erosion Control Blankets	*An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix.*	≤ 0.05	≥ 2.0 lbs/ft^2 (96 Pa)	≥ 100 lbs/ft (1.5 kN/m)	≥ 40 lbs/ft (0.6 kN/m)	≥ 0.25 - ≤ 0.50 in		≥ 8.0 oz/yd^2	

Type 3

LONG-TERM - Typical 36 month functional longevity.

Type	Product Description	Material Composition	C Factor[b] Performance Test	Shear Stress[c] Performance Test	MD Material Tensile Strength Typical ASTM D6818	TD Material Tensile Strength Typical ASTM D6818	Material Thickness Typical ASTM D6525	Ground Coverage Typical ASTM D6567	Material Mass Typical ASTM D6475	Installed Slope Steepness[d] Maximum
4.A	Open Weave Textiles	*An open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.*	≤ 0.05	≥ 2.25 lbs/ft^2 (108 Pa)	≥ 100 lbs/ft (1.5 kN/m)	≥ 40 lbs/ft (0.6 kN/m)	≥ 0.20 - ≤ 0.40 in (≥ 5.1 - ≤ 10.1 mm)	≥ 50 %	≥ 20.0 oz/yd^2 (678 g/m^2)	1:1 (H:V)
4.B	Erosion Control Blankets	*An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix.*	≤ 0.05	≥ 2.25 lbs/ft^2 (108 Pa)	≥ 100 lbs/ft (1.5 kN/m)	≥ 40 lbs/ft (0.6 kN/m)	≥ 0.20 - ≤ 0.50 in (≥ 5.1 - ≤ 12.7 mm)	≥ 50% - ≤ 95 %	≥ 8.0 oz/yd^2 (271 g/m^2)	1:1 (H:V)

Type 4

a. C Factor and permissible shear stress for Types 1.A. and 2.A. mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material.

b. This value should be the maximum C Factor from standardized large-scale rainfall performance testing, ASTM D6459 or equivalent deemed acceptable by the engineer.

c. Required minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in) soil loss) during a 30-minute flow event in large-scale performance testing, ASTM D6460 or equivalent deemed acceptable by the engineer.

d. This value should represent the maximum gradient the product should be recommended for rainfall/slope application.

Turf Reinforcement Mat (TRM)

Highlights

- RECPs Lasting Greater than Thirty-Six Months are Considered Turf Reinforcement Mats (TRMs) and High Performance Turf Reinforcement Mats (HP-TRMs)
- Typically composed of non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements, processed into a permanent, three-dimensional matrix, Although sometimes they may have degradable components.
- Designed to impart immediate erosion protection, enhance vegetation establishment, and provide long-term functionality by permanently reinforcing vegetation during and after maturation.
- Used when established Vegetation can not withstand the forces applied to it.

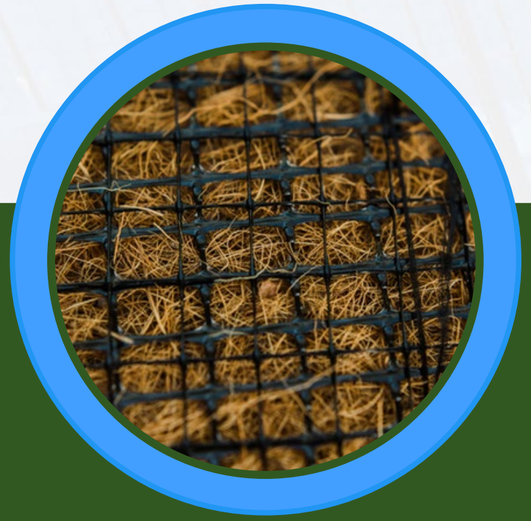
Application

TRM application should be considered when long term solutions is needed, or slope is a steep grade.
Examples include: 1:1 slopes, channels, and levees.

Considerations for TRM application include:

- Soil Type
- Steepness of Slope
- Type of flow scenario; concentrated (channel) or sheet flow (slope)
- Anchoring Frequency
- Desired service life
- Vegetation variety and germination requirements

TRM Types

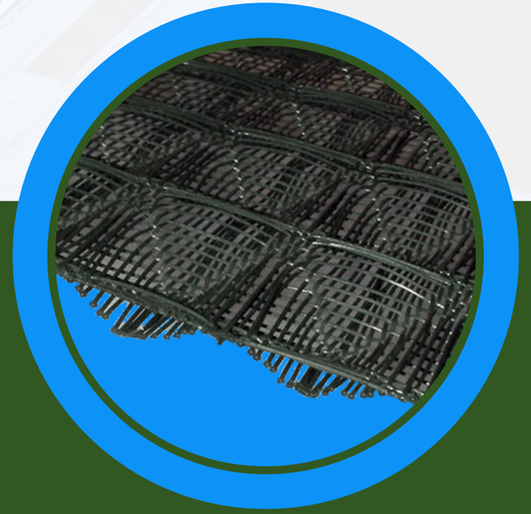


Stitch Bonded

- Fiber Filled

Melt Bonded Fiber

- Can be combined with Grid



Woven

- High Performance (HPTRM)

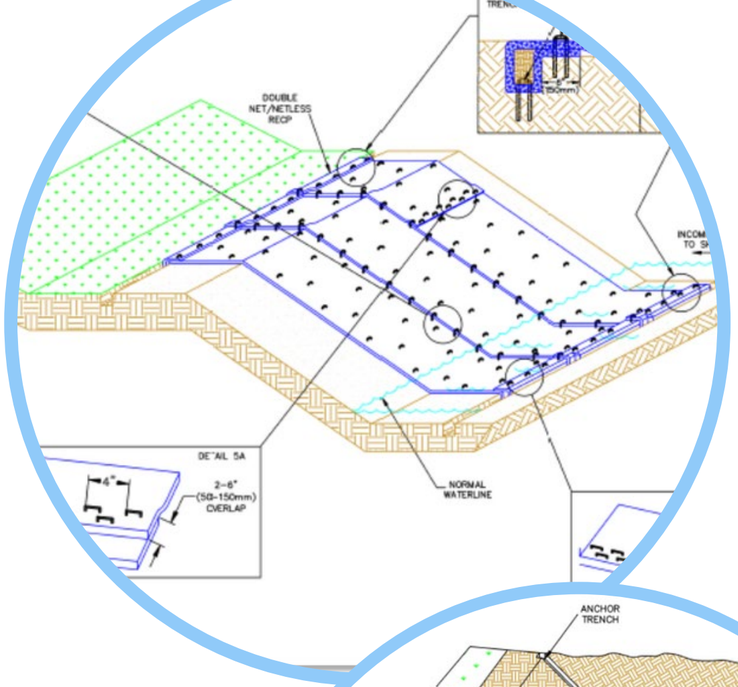
- The choice between different TRMs depends on the specific application and flow rate .
- Vegetation growth through the mat is essential to maximizing performance and erosion control .

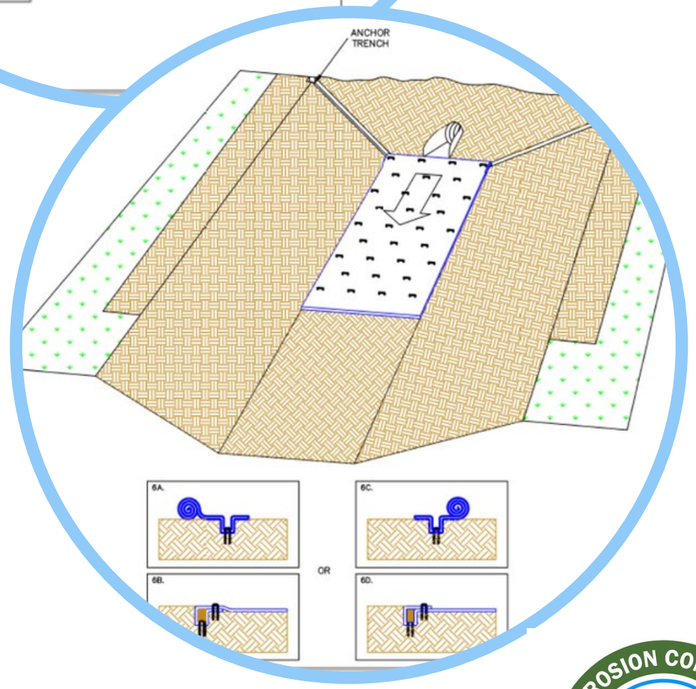
Vegetation Options

Surface Applied

Soil Filled

Installation





- TRM installation is hugely important in both controlling soil erosion and germination of new vegetation.
- Installation guidelines are widely available from product manufacturers websites and www.erosioncouncil.org
- Important installation variable include soil type, top-soil depth, anticipated erosive force, slope and/or channel length and incline, among other considerations.
- These variables will inform the anchor type and frequency required, edge or seam overlap, and anchor trench placement and design.
- Videos available at Youtube channel @erosioncontroltechcouncil

- Primary Consideration Must Be Given to Performance
- Resistance to Rainfall/Rainsplash
- Resistance to Shear Stress and Velocity
- Standard TRMs Do Not Offer Significant Mechanical Performance by themselves, They are designed to work with vegetation.
- Physical (Index) Properties Only Aid in Identifying Products and Quality Control and Quality Assurance.
- Performance properties are used to design a project.

Table 2. ECTC Standard Specification For Turf Reinforcement Mats (TRMs)

For applications where vegetation alone will not sustain expected flow conditions and/or provide sufficient long-term erosion protection.

							Index Value at Time of Manufacture				
Type	**Product Description**	**Material Composition**	**Slope Application Maximum Gradient**	**Performance Test Unvegetated Shear Stress [b,c,d] Typical ASTM D6460**	**Performance Test Vegetated Shear Stress [c,e] [e,f] Typical ASTM D6460**	**Seedling Emergence [d] Typical ASTM D7322**	**Tensile Strength MD [d,f] Typical ASTM D6818**	**Tensile Strength TD [d,f] Typical ASTM D6818**	**Material Mass / Unit Area [d] Typical ASTM D6566**	**Thickness [d] Typical ASTM D6525**	**UV Stability [d,f] Typical ASTM D4355**
5.A	**Turf Reinforcement Mat**	*A product composed of UV-stabilized non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements, processed into a permanent, three-dimensional matrix which may be supplemented with degradable components.*	1:1 (H:V)	≥ 2.0 lb/ft² (≥ 96 Pa)	≥ 6.0 lb/ft² (≥ 287 Pa)	≥ 250%	≥ 150 lbs/ft (≥ 2.2 kN/m)	≥ 150 lbs/ft (≥ 2.2 kN/m)	≥ 8.0 oz/yd² (≥ 271 g/m2)	≥ 0.25 in (≥ 6.35 mm)	≥ 80% @ 500 hrs
5.B	**Turf Reinforcement Mat**		1:1 (H:V)	≥ 2.0 lb/ft² (≥ 96 Pa)	≥ 8.0 lb/ft² (≥ 383 Pa)	≥ 250%	≥ 175 lbs/ft (≥ 2.6 kN/m)	≥ 175 lbs/ft (≥ 2.6 kN/m)	≥ 8.0 oz/yd² (≥ 271 g/m2)	≥ 0.25 in (≥ 6.35 mm)	≥ 80% @ 500 hrs
5.C	**Turf Reinforcement Mat**		0.5:1 (H:V)	≥ 2.0 lb/ft² (≥ 96 Pa)	≥ 10.0 lb/ft² (≥ 479 Pa)	≥ 250%	≥ 200 lbs/ft (≥ 2.9 kN/m)	≥ 200 lbs/ft (≥ 2.9 kN/m)	≥ 8.0 oz/yd² (≥ 271 g/m2)	≥ 0.25 in (≥ 6.35 mm)	≥ 80% @ 1,000 hrs
5.D	**Turf Reinforcement Mat**		0.5:1 (H:V)	≥ 2.0 lb/ft² (≥ 96 Pa)	≥ 12.0 lb/ft² (≥ 575 Pa)	≥ 250%	≥ 325 lbs/ft (≥ 4.8 kN/m)	≥ 225 lbs/ft (≥ 3.3 kN/m)	≥ 8.0 oz/yd² (≥ 271 g/m2)	≥ 0.25 in (≥ 6.35 mm)	≥ 80% @ 1,000 hrs
5.E *	**Turf Reinforcement Mat**		0.5:1 (H:V)	≥ 2.0 lb/ft² (≥ 96 Pa)	≥ 12.0 lb/ft² (≥ 575 Pa)	≥ 250%	≥ 1,500 lbs/ft (≥ 21.9 kN/m)	≥ 1,500 lbs/ft (≥ 21.9 kN/m)	≥ 8.0 oz/yd² (≥ 271 g/m2)	≥ 0.25 in (≥ 6.35 mm)	≥ 90% @ 1,000 hrs
5.F *	**High Performance Turf Reinforcement Mat**	*A product composed of UV-stabilized, non-degradable, synthetic fibers, filaments, nets, wire mesh and/or other elements, processed into a permanent, three-dimensional matrix.*	0.5:1 (H:V)	≥ 2.0 lb/ft² (≥ 96 Pa)	≥ 14.0 lb/ft² (≥ 670 Pa)	≥ 250%	≥ 3,000 lbs/ft (≥ 43.8 kN/m)	≥ 3,000 lbs/ft (≥ 43.8 kN/m)	≥ 8.0 oz/yd² (≥ 271 g/m2)	≥ 0.25 in (≥ 6.35 mm)	≥ 80% @ 3,000 hrs

** For material Types 5.E and 5.F, property values tested per ASTM D6818 and D6525 are reported as minimum average roll values (MARVs). MARVs are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.*

[b] Required minimum shear stress TRM (unvegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in.) soil loss) during successive, minimum 30 minute flow events in large scale testing.

[c] Acceptable large-scale testing protocol may include ASTM D6460, or other independent testing deemed acceptable by the engineer. Large scale performance testing typically involves limited soil types and vegetative stands, therefore it is recommended that an appropriate factor of safety be used in design and product selection (see Guidance Document for further information).

[d] Typical values are calculated as the average value. Statistically, it yields a 50% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.

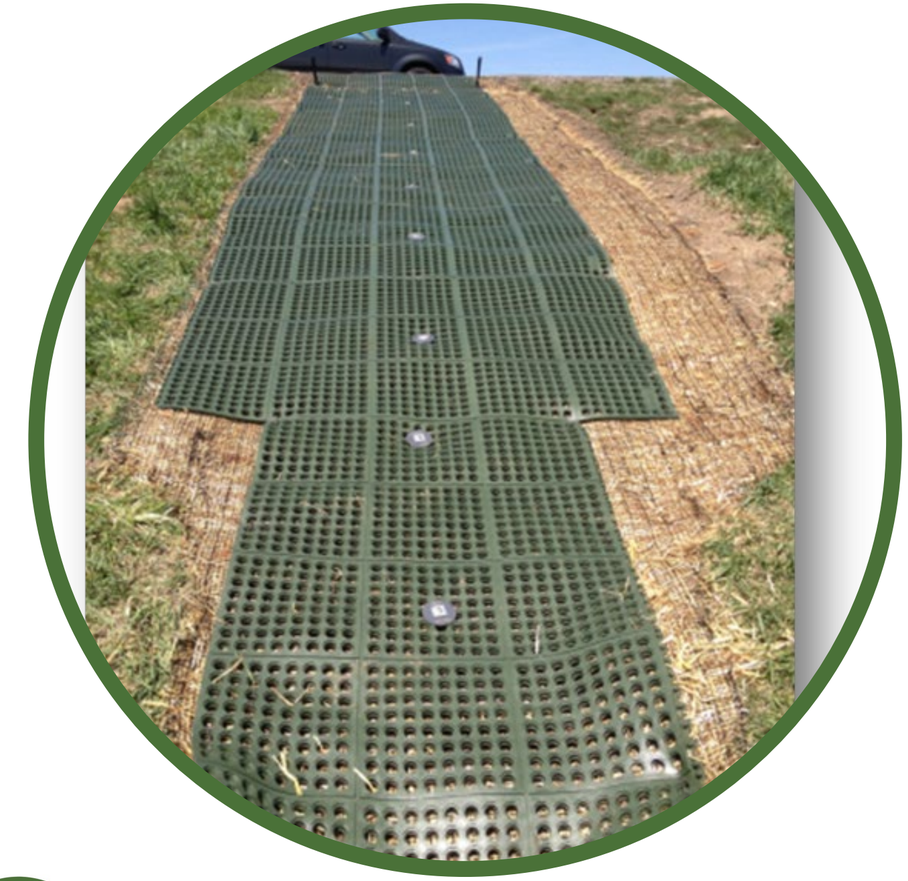
[e] Required minimum shear stress TRM (fully vegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in.) soil loss) during successive, minimum 30 minute flow events in large scale testing.

[f] For TRMs containing degradable components, property values must be obtained on the non-degradable portion of the matting alone.

NOTE: TRMs are typically used in hydraulic applications, such as high flow ditches and channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natura, unreinforced vegetation or in areas where limited vegetation establishment is anticipated.

Specifications & Design

Transition Mat



Highlights

- Transition mat provide protection from turbulent water flow and moderate wave attack.
- Ideal for soil stabilization applications where riprap, articulated concrete blocks or other rigid materials are normally used for erosion control.
- Transition mat dramatically elevates permissible shear stress and velocity protection.
- They typically require underpayments.

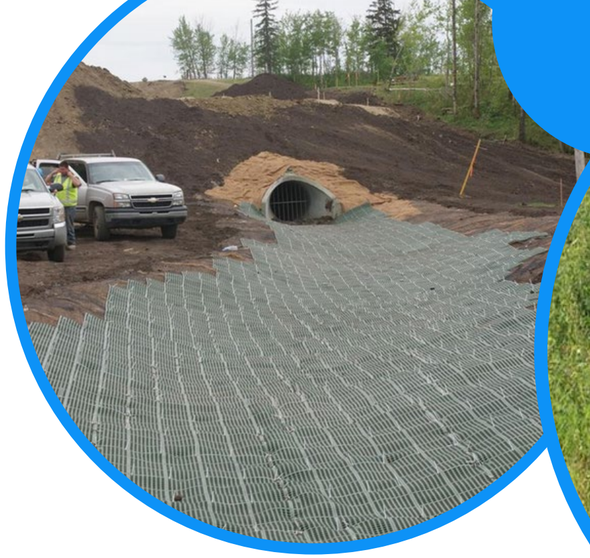
Application

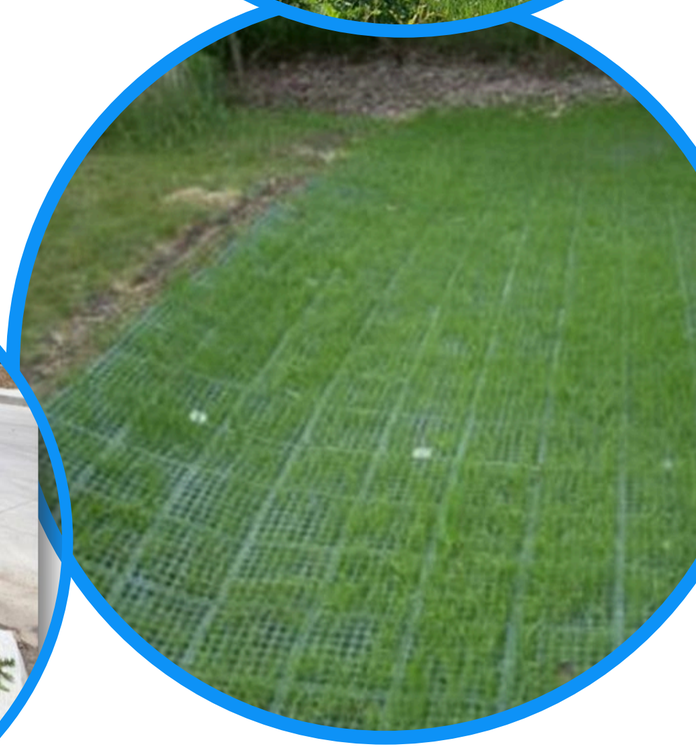
Transition Mats can be used :

- Pipe Outlet
- In conjunction with a TRM
- in areas like curb cuts or anywhere with high, concentrated water flow that’s too strong for turf reinforcement mats to handle alone.
- In place of riprap or concrete apron

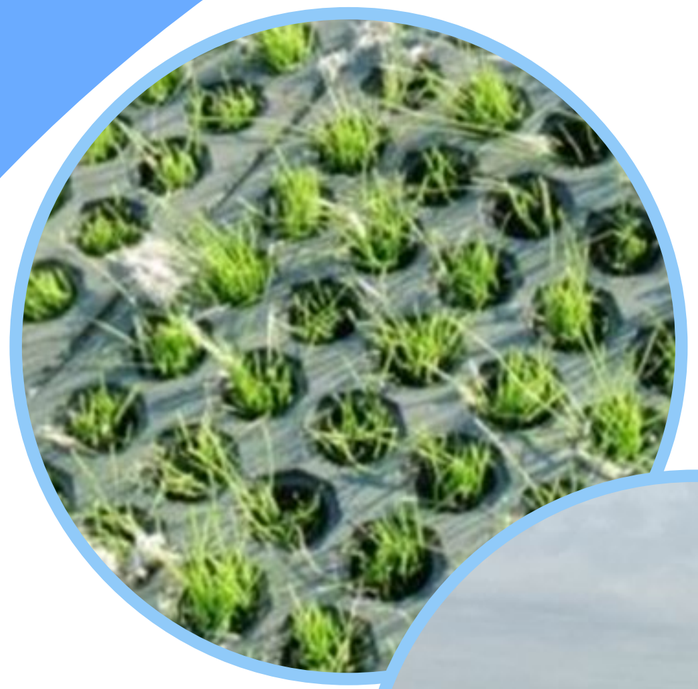
“Soft” Vegetated Green Solution

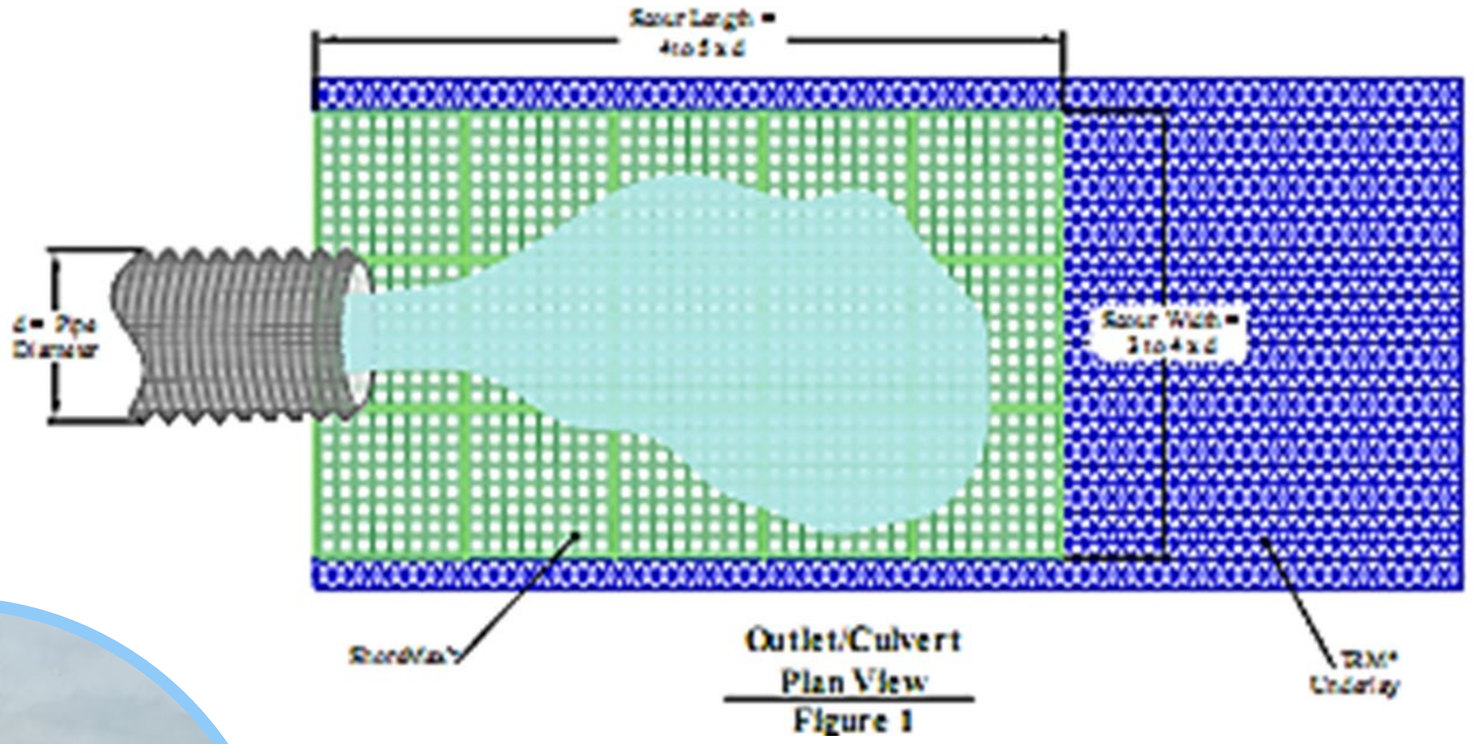
- Increased water filtration compared to rock or concrete
- Requires no heavy equipment to install
- Easier maintenance
- Greater safety for vehicles and pedestrians





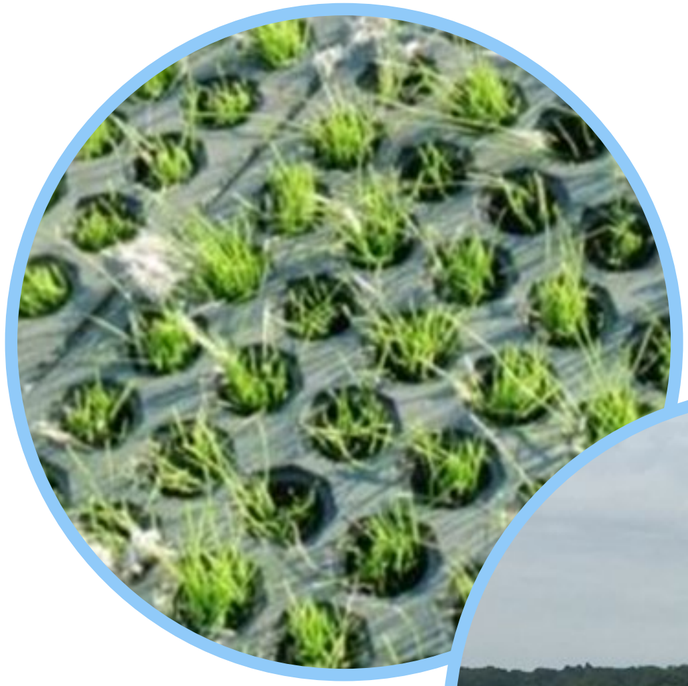
Installation





- Shoreline, Channel, Culvert installation Culvert designs
  - Width = 3-4 times the pipe diameter
  - Length = 4-5 times the pipe diameter

- ASTM currently working on specification.
- Performance properties should be verified by third party testing facilities
- Performance properties used for design.



Specifications

Hydraulic Erosion Control Product (HECP)

Highlights

- HECPs are mixed with water and spray-applied to soil for erosion control and to assist in establishing vegetation.
- HECPs are typically composed of a mulch component such as wood, wood cellulose, recycled newsprint, straw, cotton, and other plant fibers, along with tackifiers and polymers. The tackifier and polymer components are typically incorporated to provide increased viscosity and adhesion of the hydraulic slurry to soil.

Hydro -mulching

HECP without seed and amendments, typical for short-term erosion control where no vegetation is desired.

Hydro -Seeding

HECP with seed and amendments, where vegetation is desired.

Both are applied the same way.

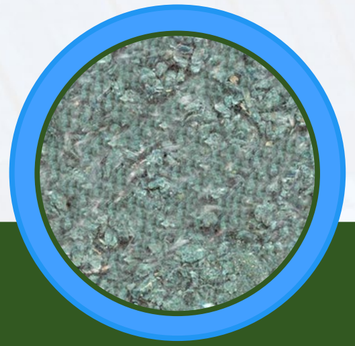
Application

HECP application excels in covering large, hard-to-reach areas quickly and uniformly.
Examples include: post -grading, slopes, roadway embankment, and burned areas

Considerations for HECP application include:

- Slurry can be customized for specific site conditions
- Steepness of Slope
- Quick deployment in a short time
- Water source
- HECP has no growth inhibiting factors
- Easy deployment to remote and dangerous locations.

HECP Types

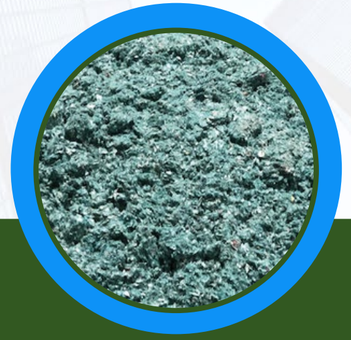


Base Mulch

- Type 1 or 2
- Typical consists of 100% wood fiber, 100% paper fiber or plant-based such as straw, corn, and cotton.
- Short-Term Applications

Blended Base Mulch

- Type 1 or 2
- Typical a blend of the products listed above. (i.e. 70% wood 30% paper.)
- Short-Term Applications



Mulch Plus Tackifier

- Type 3
- Takes one of the 2 above mulches and adds a gum, starch, or polymer to the back typically at about 3%.

Mid level Performance Engineered Mulch

- Type 4
- Bonded Fiber Matrix (BFM)
- Increases additives to provide increased erosion control at a moderate price.
- steeper slopes and longer-term applications.
- Typically pre-packaged

High -Performance Engineered Mulch

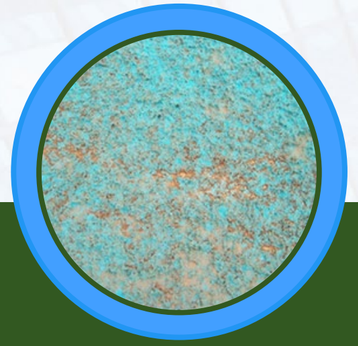
- Type 5
- Top included to provide supreme erosion control at its highest levers tier additives
- suitable for extreme conditions and long-term stabilization
- Typically pre-packaged

Installation
Surface Preperation

- Common Slope Preparation Methods Include:
- “Cat-Tracked” (Recommended for HECP Applications)
- Compacted and Roughened Surface - *Rough graded/tracked sites have up to 42% less erosion potential when compared to compacted/smoothed substrates*
- Loose disc-plow layer

- Installation guidelines are widely available from product manufacturers websites and www.erosioncouncil.org
- Videos available at Youtube channel @erosioncontroltechcouncil

Installation
Application Rate



2,000 lb/acre

3,000 lb/acre

3,500 lb/acre

4,000 lb/acre

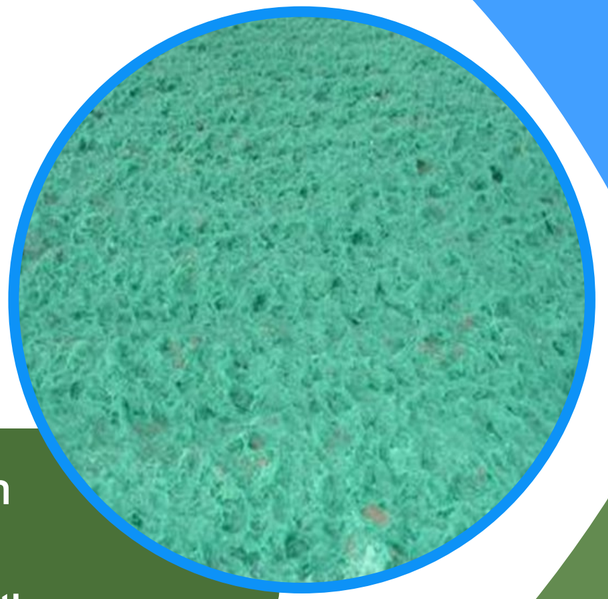
What determines Application Rates?

- Product selection
- Expected service life before vegetation
- Slope Preparation
- Expected weather conditions

Installation -Application

Tower applications

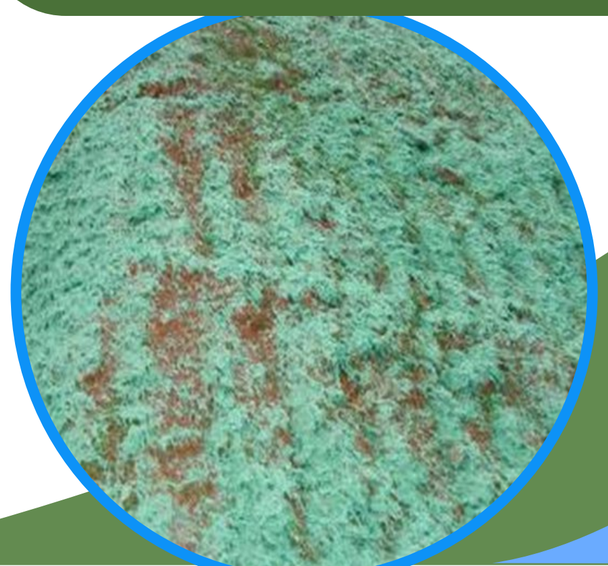
- Most Efficient
- Load, mix and spray from the same spot
- Higher quantity output
- Less risk with workers on terrain



Proper Application Versus Improper Application

Hose applications

- Use when necessary when:
  - Distance exceeds tower “reach”
  - Access is limited
  - Overspray is not tolerable



Hydraulic Erosion Control							
			Typical Application	Typical Maximum Slope	Maximum Uninterrupted	Maximum	Minimum
Type [2]	Term	Functional	Rates	Gradient	Slope Length	C Factor[4, 5]	Vegetation
		Longevity[3]	Lb/acre (kg/ha)	(H:V)	(ft)	(3:1 test)	Establishment[6]
1	Ultra Short Term	1 month	1500–2500 (1700–2800)	≤ 5:1	20	0.3	150 %
2	Short Term	2 month	2000–3000 (2250–3400)	≤ 4:1	25	0.2	150 %
3	Moderate Term	3 month	2000–3500 (2250–3900)	≤ 3:1	50	0.1	200 %
4	Extended Term	6 month	2500–4000 (2800–4500)	≤ 2:1	75	0.05	300 %
5	Long Term	12 month	3000–4500 (3400–5100)	≤ 2:1	100	0.02	300 %

- Budget
- Desired results
- Criteria of the site
  - Near civilization
  - Near waterway
  - Soil type
  - Slope gradient
- Performance properties
  - Select products from chart type 1-5

Specifications & Selection

Top -Soil Replacement:
Hydraulic Biotic Soil Amendment (HBSA)

Highlights

- HBSA is a manufactured, pre-packaged material that is mixed with water and hydraulically-applied as a uniform slurry. HBSAs are engineered to foster the development of topsoil in deficient substrates within the rhizosphere, promote faster seed germination, and provide long term nutrient cycling that enhances sustainable vegetation establishment. HBSAs are designed to be used as topsoil or compost alternatives when topsoil is not present, soil is lacking organic matter, or there is little to no biological activity. In order to meet the criteria of replacing compost or topsoil growth media, HBSAs typically contain a blend of organic and natural fibers with soil building components and soil enhancing chemistry.These materials are manufactured under controlled conditions withspecific formulations thatensure product consistency.The components increase the water andnutrient holding capacityof the soiland create anenvironment for growthof beneficial microorganisms whileallowing seed germination and vegetation establishment.
- In their base form HBSA do not typically include erosion control capabilities and may need additional BMPs to control erosion for example cover with a RECP or high performance HECP.

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2.1 MATERIAL REQUIREMENTS

A. The HBSA to be used shall meet the standards below:

HBSA Property	Test Method	Values
Physical		
Color	Observation	Naturally colored green, brown or black to contrast area.
Organic Matter	ASTM D586	85% minimum
Acute Toxicity	ASTM 7101 & EPA Method 2021.0	Non-toxic
pH	ASTM D1293	5.5 – 8.5
C:N Ratio	ASTM E1508	20:1 minimum 100:1 maximum
Water Holding Capacity	ASTM D7367	400% minimum
Moisture Content	ASTM D2974	10% minimum, 40% maximum
Performance		
Vegetation Establishment	ASTM D7322	400% minimum

Sediment Control

Highlights

- Sediment control devices are designed to prevent or reduce the movement of sediment from construction sites or other disturbed areas, thereby protecting water quality in nearby rivers, lakes, and streams.
- These devices are employed during active construction phases to retain sediment on-site. After construction is complete, it's essential to stabilize the area using vegetation or alternative erosion control measures
- Sediment control BMPs, may still need to be employed as post-construction measures on a construction site, to prevent sediment runoff from leaving the site after the permit has been finalized. i.e. construction may be complete, but vegetation is only at 80%.

Application

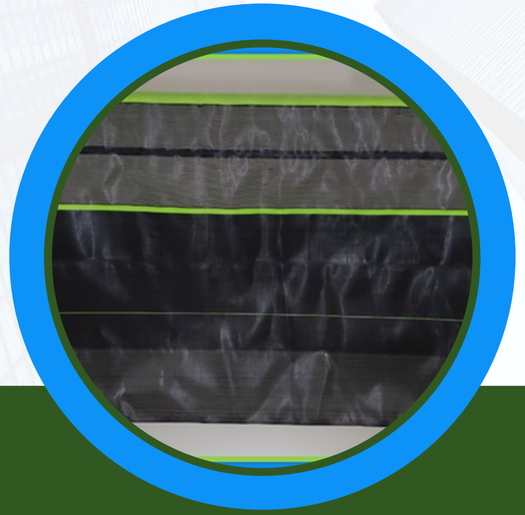
- Perimeter Control
- Slope Interruption
- Ditch Check / Check Dam
- Inlet Protection Devices
- Dewatering and Overflow Outlets
- Site Access

Perimeter Sediment Barriers

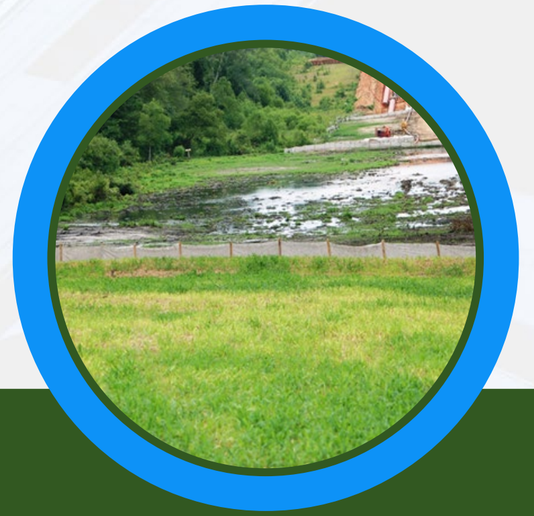
- Design of perimeter sediment barriers most critical to minimize failures and sediment loss
- Hydrologic inputs include drainage area, runoff volume, and peak flowrates
- Barriers should be designed to impound runoff volume from the designed storm event.
- Typically target impoundment depth 12”-18” - not to exceed 24”
- Upslope measures to reduce slope lengths, minimize drainage areas, and control velocity critical to performance of perimeter barriers
- Overflow outlets should be included for runoff that exceeds the design storm event and provides dewatering within 4 to 12 hours.

Perimeter Sediment Barriers

Sediment Retention
Fiber Rolls (SRFRs)



High Strength /Multi -Flow
Silt Fence
High Efficiency Silt Fence



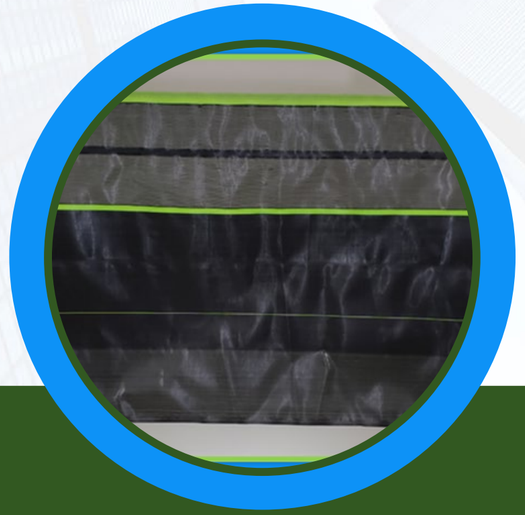
Biodegradable Silt Fence

Slope Interruption

- Nominal spacing for slope Installations dependent on gradient and effective height of device
- Reduces slope length and prevents erosive velocity
- Used in conjunction with RECPs and HECPs to facilitate vegetation establishment

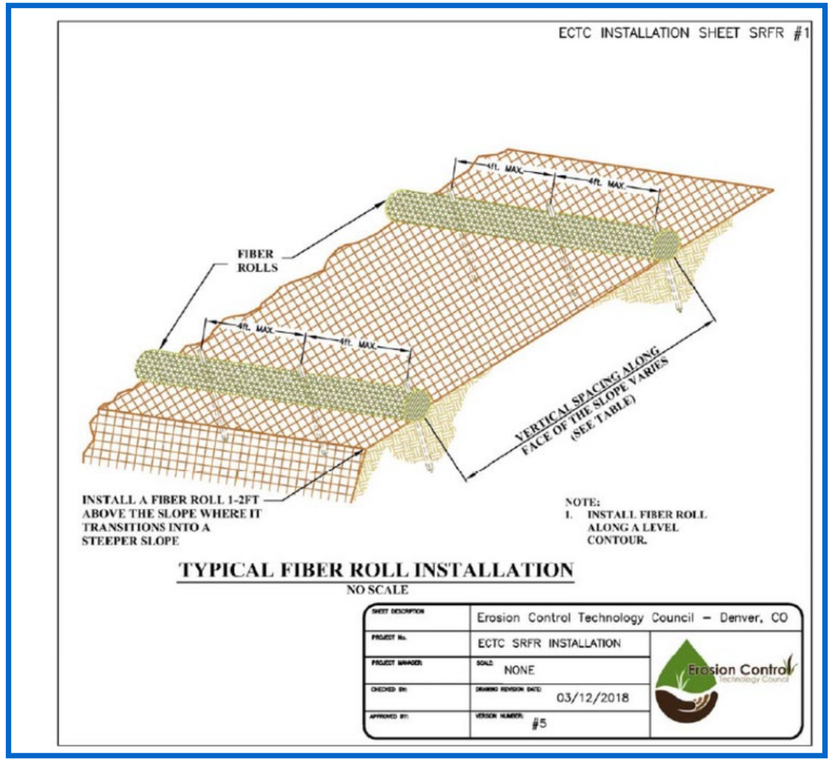
Slope Interruption

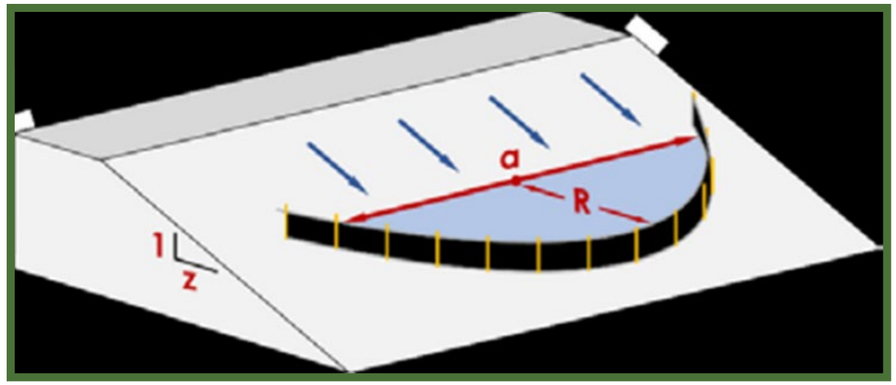
Sediment Retention
Fiber Rolls
wattles, logs, socks,
tubes, fiber rolls

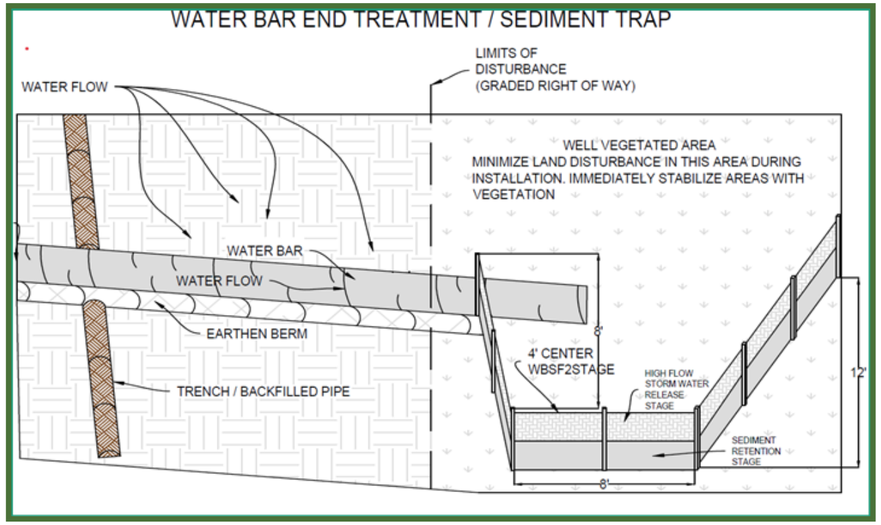


High Flow or Two -Stage
Flow Silt Fence

Water Bars with Sediment
Trap End Treatments







Installation

Slope Interruption

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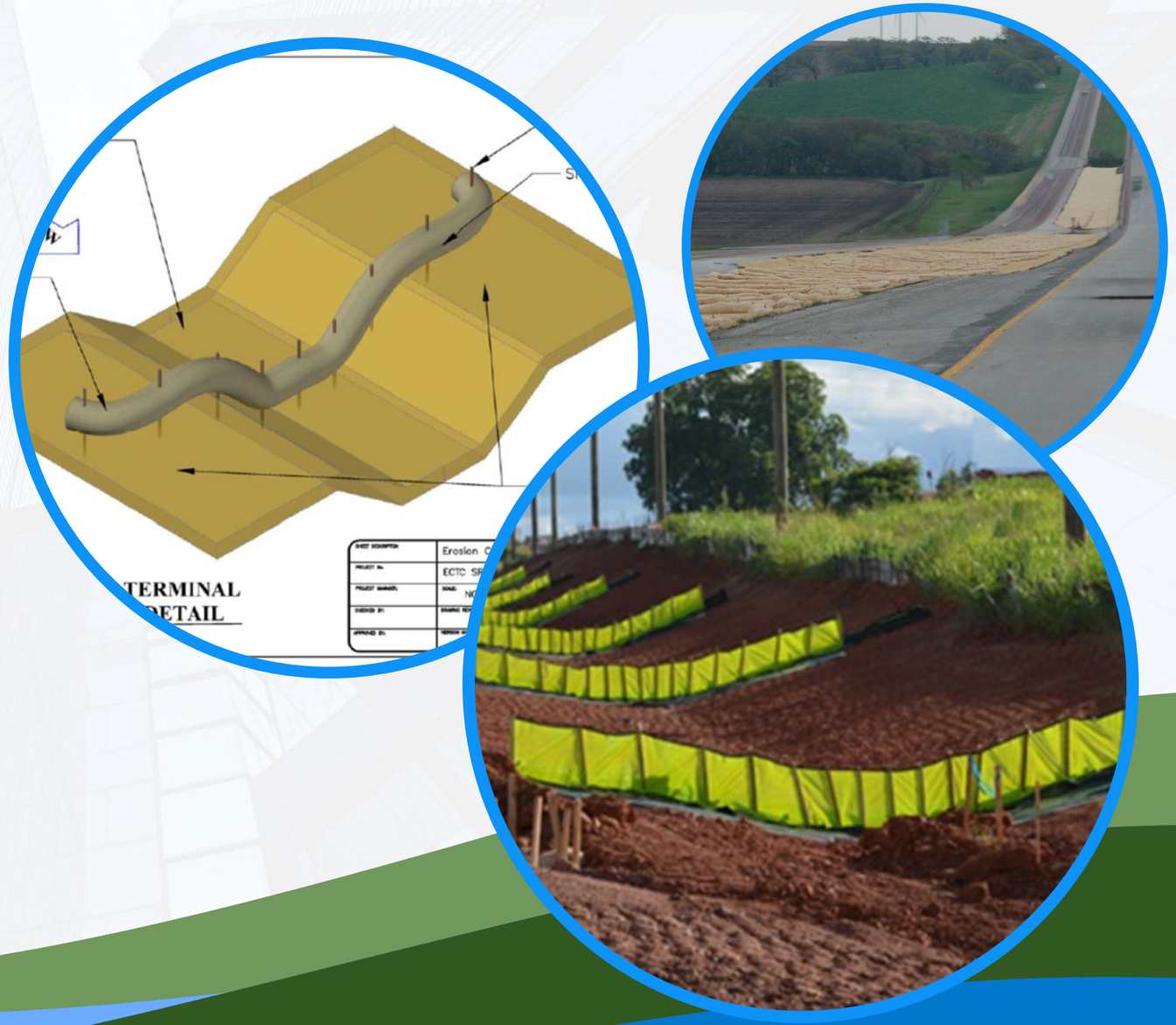
Ditch Check / Check Dam

Alternatives to Rock Checks

- Sediment Retention Fiber Rolls
- Manufactured Geotextile Products
- Controls erosive velocity and minimizes sediment movement
- Used in conjunction with RECPs and HECPs to facilitate vegetation establishment
- Requires fabric underlayment to prevent scour and undermining
- Utilize more dense, weighted SRFRs to control velocity



Above Grade

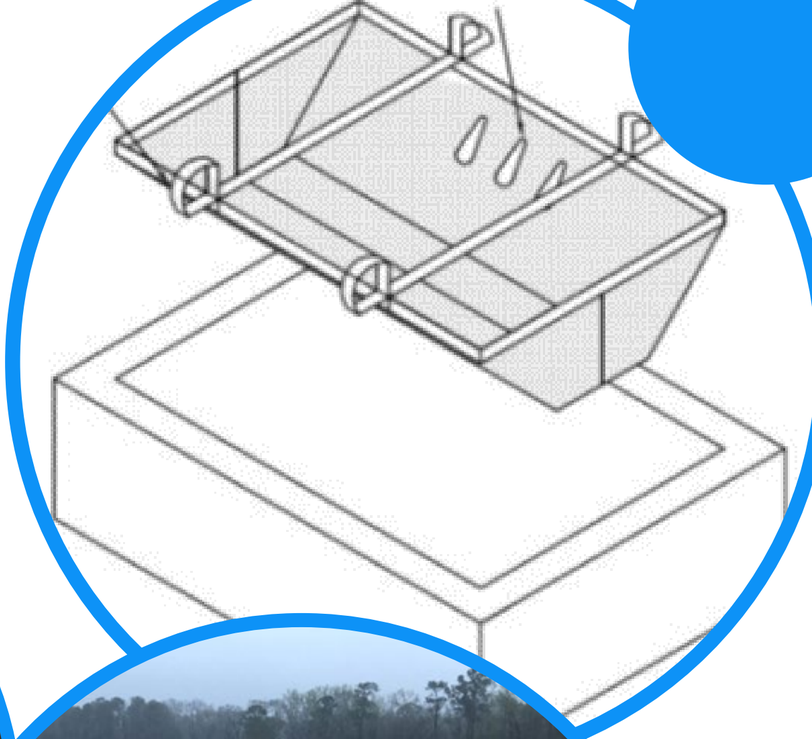
- Sediment Retention Fiber Rolls
- Wattle Fence
- Rigid Inlet Filter

Below Grade

- Under Grate Sediment Bags

Curb Inlets

- Inlet Filters
- SRFRs



Inlet Protection

Dewatering and Overflow Outlets

Weir & Dewatering Board

Rock & Wire Outlets

Two-stage Flow Silt Fence

Manufactured Overflow Outlet

Sediment control devices play a crucial role in collecting discharge of sediment-laden runoff into natural water bodies. Several types of sediment control devices are available on the market, each designed to suit specific environmental and construction needs. These include:

- Silt Fence
- Straw Filtration Roll
- Straw Wattles
- Excelsior Wattles
- Coir Logs
- Compost Socks
- WattleFence

Specifications

Sediment Retention Fiber Rolls (SRFRs) are a manufactured three -dimensional device of a specified filler matrix encapsulated within a flexible containment material utilized in sediment and flow control applications. SRFRs are also known as wattles, logs, socks, tubes, or fiber rolls

ECTC Guidance Values for Sediment Retention Fiber Rolls (SRFRs)

	Straw SRFR[a]		
Nominal Diameter (in)	Diameter (in)[b]	Weight (lb/ft)[b]	Density (lb/ft^3)[b]
6	5.5	0.6	3.1
9	8.0	1.6	3.6
12	11.0	3.0	3.8
20	18.0	6.0	2.7

[a]All Values are measured at time of manufacturing. Values may differ once installed in the field. Most SRFRs are available with either synthetic netting or biodegradable netting. Each net and fiber type has a different functional longevity. Check with the manufacturer to verify functional longevity.

[b]Values are minimums.

	Wood Excelsior SRFR[a]		
Nominal Diameter (in)	Diameter (in)[b]	Weight (lb/ft)[c]	Density (lb/ft^3)[c]
6	5.5	1.2	2.4
9	8.0	1.0	2.2
12	11.0	2.0	2.5
20	18.0	1.5	1.3

	Coir SRFR[a]		
Nominal Diameter (in)	Diameter (in)[b]	Weight (lb/ft)[b]	Density (lb/ft^3)[b]
6	5.5	1.4	7.0
9	8.0	3.1	7.0
12	11.0	5.5	7.0
16	14.5	9.8	7.0
20	18.0	15.3	7.0

[a]All Values are measured at time of manufacturing. Values may differ once installed in the field. Most SRFRs are available with either synthetic netting or biodegradable netting. Each net and fiber type has a different functional longevity. Check with the manufacturer to verify functional longevity.

[b]Values are minimums.

	Compost SRFR[a]		
Nominal Diameter (in)	Diameter (in)[b]	Weight (lb/ft)[b]	Density (lb/ft^3)[b]
5	4.5	4.0	25.0
8	7.2	12.0	25.0
12	11.0	28.0	25.0
18	16.5	58.0	25.0

ECTC is currently working on new Specifications for the proper installation and design of Sediment Contro I Devices.

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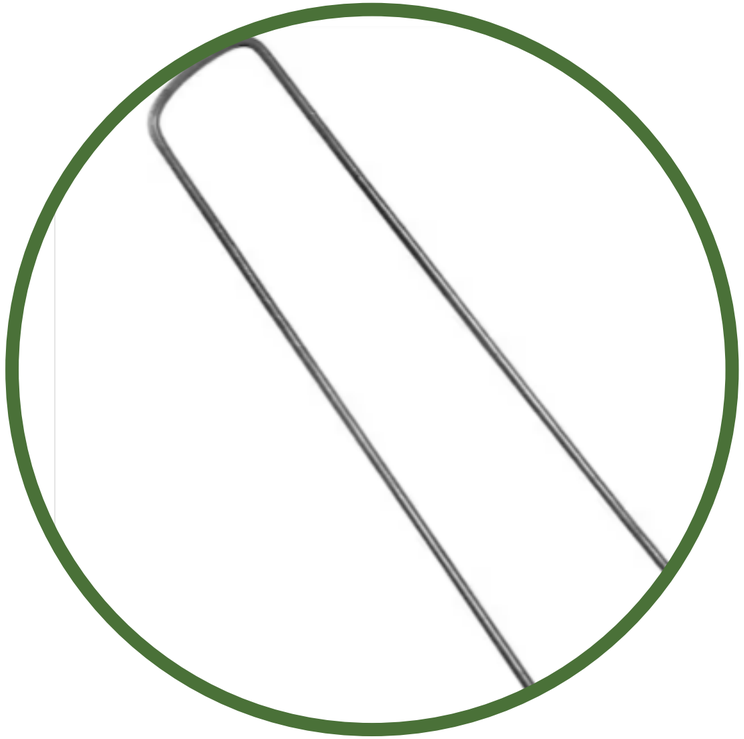
Polymer Water Clarifying Solutions

Highlights

- Polymer water clarifying solutions are often used in erosion control to facilitate the sedimentation of suspended particles in water. These solutions work by binding fine particles together, increasing their size and weight, which makes them settle more quickly when the water is still. This process is known as flocculation.

- In erosion control, specifically on construction sites or in areas with disturbed soil, these polymers can be very effective. They can be applied to stormwater runoff or in sediment basins to prevent fine sediments from leaving the site and entering local waterways, which can be harmful to aquatic ecosystems. By clarifying the water on-site, these solutions can help maintain compliance with environmental regulations regarding water quality.

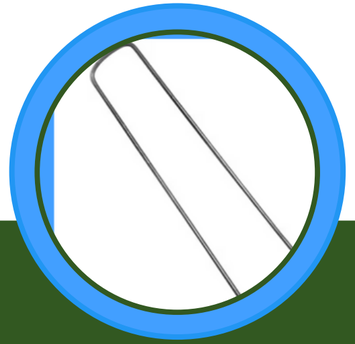
Fasteners & Anchors



Highlights

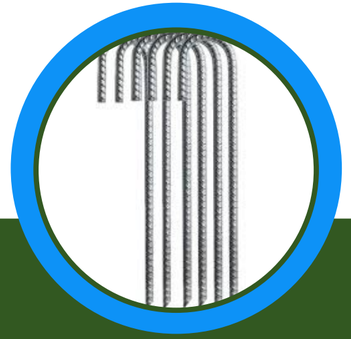
- There are several fastener products commonly available in the market including staples, pins, helical pins, biodegradable fasteners and earth anchors. This guide will serve as a resource to help specifiers and designers decide which fastener best suits their project needs.
- Fasteners are a crucial component of erosion control product installations. They help anchor the products in place, prevent movement, ensure durability, and ensure compliance with regulations, all of which are essential for effective erosion control and environmental protection.
- Fasteners are typically designed for short-term use. They are used to secure erosion control mats during the initial stages of site development or land rehabilitation, ensuring that the mats stay in place while vegetation or other long-term stabilization methods are established. These fasteners are usually less durable and may degrade or become less effective over time.
- Anchors are used for stabilizing a site and are built for long-term performance. They are intended to provide lasting stability to areas prone to erosion, landslides, or other forms of land degradation. These anchors are constructed from more durable materials and are designed to withstand environmental factors over extended periods. Their primary function is to offer a permanent solution to site stabilization challenges, ensuring safety and integrity over the long haul.

Fastener/Anchor Types



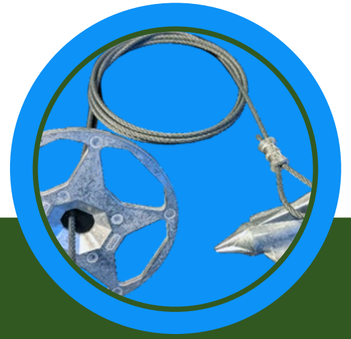
Wire Staples

Biostakes
Ecostakes



Rebar Staple

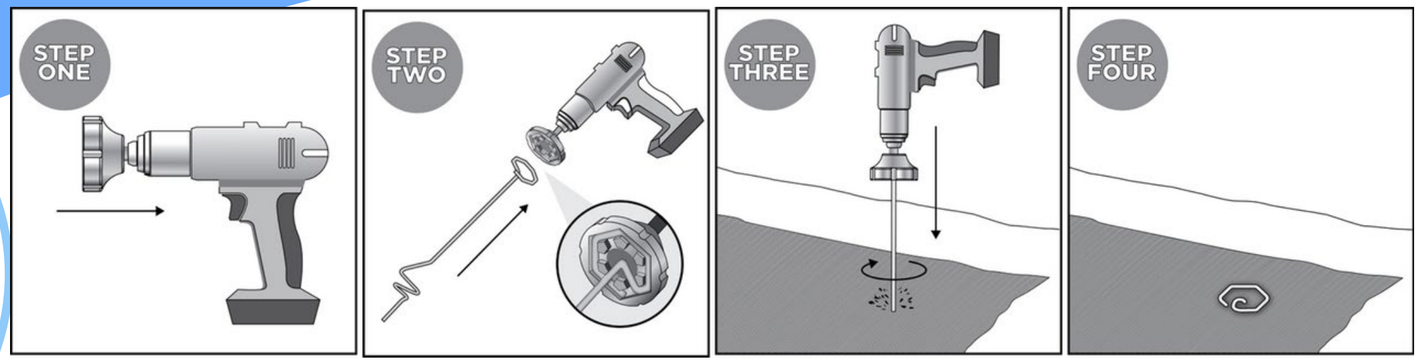
Twist Anchor



Pull -out
Anchor

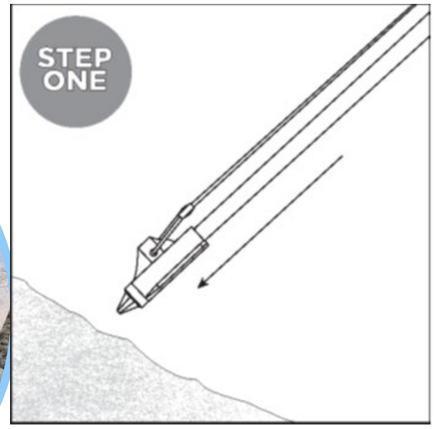
Application

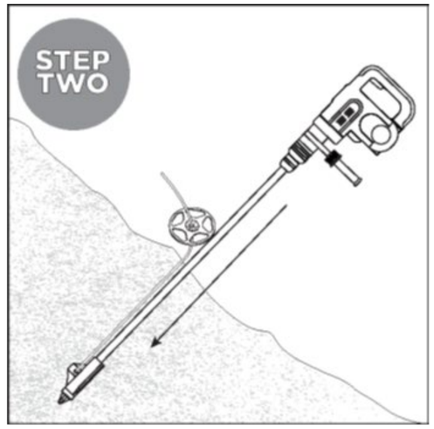
- Sod staples are used the most
- Biodegradable staples should be used with biodegradable blankets
- Permanent anchors are made of galvanized steel to give greater strength and durability
- Earth anchors give the greatest strength

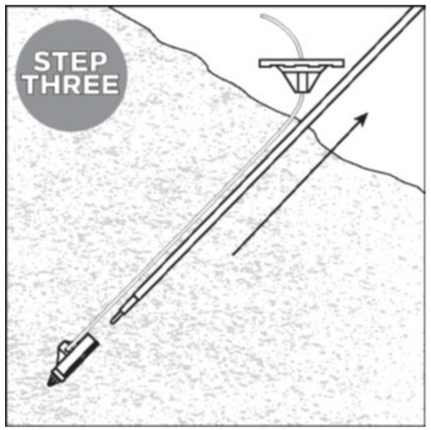


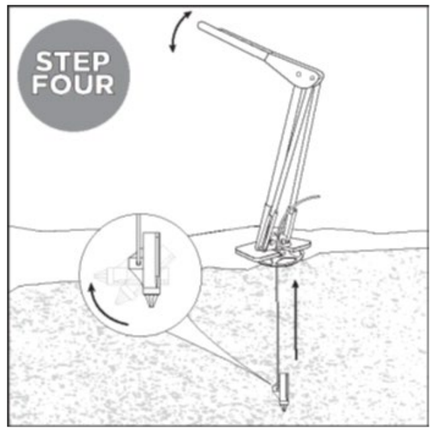
ANCHOR DEVICE								
									
	TL-TA1 (8”)	TL-TA1 (12”)	TL-TA2 (8”)	J-Hook (18”)	Washer Pin (18”)	Washer Pin (12”)	Sod Staple (6”)	Sod Staple (8”)	Wood Stake (8”)
SOIL TYPE									
Clay	189	233	216	45	40	45	24	30	232
Loam	163	198	132	34	14	22	20	48	153
Sand	50	106	59	22	9	10	8	9	34

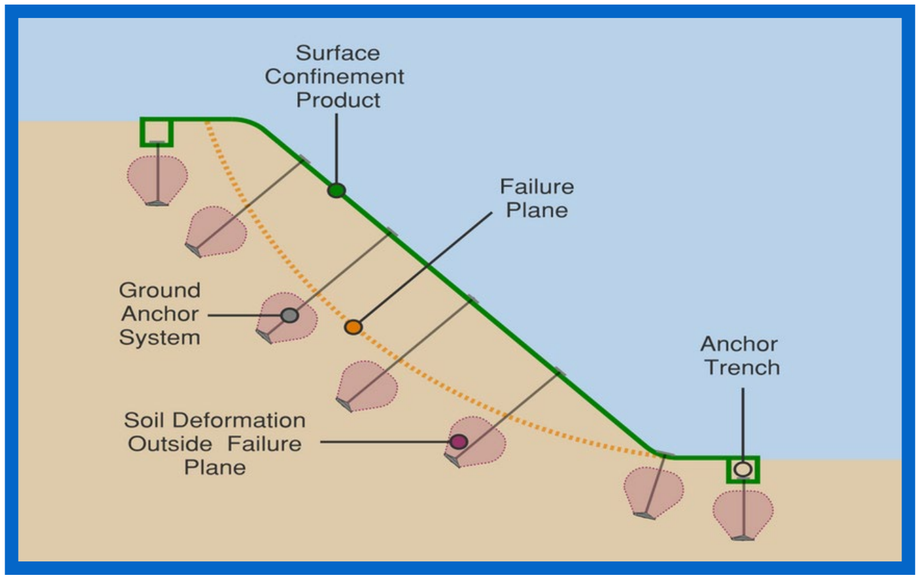
Installation











Anchor Installation

EROSION CONTROL
EST 1992
ECTC
TECHNOLOGY COUNCIL

ECTC Standard Guide for

Rolled Erosion Control Product (RECP) Fasteners

ECTC Designation: [SG01-22]

Specifications

Conclusion

The Erosion Control Technology Council provides many resources:

- Specifications
- CAD Details
- Product selection tools
- Installation Videos
- White Papers
- Training Events

Thank You

For your Attention

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