

Filtrex[®] Severe Slope Stabilization

Vegetated Slope Stabilization Technology

PURPOSE & DESCRIPTION

Filtrex[®] Severe slope stabilization is a system that allows for the stabilization of eroded or damaged slopes while creating attractive vegetated landscapes without the use of hard materials such as concrete and steel. Through the use of Filtrex[®] FilterSoxx[™], the Severe slope stabilization system provides superior soil retention and erosion protection while providing an optimum environment for vegetation establishment.

APPLICATION

Before commencing construction of the Severe slope stabilization, it is recommended that the specification guidelines and standard drawings found in this document be reviewed and that any site documentation and engineering documents be consulted. A decision must be made as to whether the wall will be a ‘critical’ application or ‘non-critical’ structure which will fall under basic design and construction guidelines. Encountering any of the following will require an engineer’s review of the site

and site-specific design prior to construction of a Filtrex[®] Severe slope stabilization:

- Projected wall height exceeds 6 ft (1.8 m) depending on cut/slope situation and local jurisdiction requirements.
- The Severe slope stabilization is to be built on unstable soils such as clays or organic materials.
- There is a possibility of hydrostatic loading or erosion from wave action, drainage or site runoff.
- Loading conditions from slopes or structures on or behind the wall will be exerted on the Severe slope stabilization.
- Geogrid or other mechanical stabilization devices will be incorporated into the Severe slope stabilization.

Constructing a Filtrex[®] Severe slope stabilization involves stacking Filtrex[®] FilterSoxx[™] on top of one another in a recessed fashion on steep slopes to near vertical situations. When required, a variety of grades of geogrid are seamlessly incorporated into the system giving it added structural support and integrity to meet specific environmental and site requirements.

Although the central focus of the Severe slope stabilization system is to stabilize earth and reduce erosion, the secondary objective is to provide for the establishment and sustainability of vegetation and an aesthetic landscape feature. This goal is evidenced through the design and function of the wall fascia of Filtrex[®] FilterSoxx[™] as well as the GrowingMedia[™] that fills the wall fascia.

The Filtrex[®] Severe slope stabilization can be used for a wide variety of non-structural applications including:

- Steep Slope Stabilization



Caption Please

- Streambank Stabilization
- Pond bank stabilization
- Slip Repairs
- Culvert Headwalls
- Bridge Abutments
- Dikes/Berm
- Flood Protection

ADVANTAGES AND DISADVANTAGES

Advantages

The Severe slope stabilization system offers many advantages including:

- Lightweight components
- Highly efficient, certified installation
- No footing or leveling pad required
- Seed injection into FilterSoxx™
- Filtrex® GrowingMedia™
- Easily reinforced for severe applications
- Improved drainage/reduction of hydrostatic pressure
- Customizable vegetation with plants, plugs, live stakes or seed.
- Concrete footings are not required
- Severe slope stabilization may assist in qualification for LEED® Green Building Rating and Certification credits under LEED® New Construction 2.2. Awarded credits may be possible from SS Prerequisite 1, SS Credit 5.1, SS Credit 6.1, SS Credit 6.2, SS Credit 7.1, WE Credit 1.1, WE Credit 1.2, MR Credit 4.1, MR Credit 4.2, MR Credit 5.1, MR Credit 5.2, and MR Credit 6.

Note: LEED® is an independent program offered through the US Green Building Council. LEED® credits are determined on a per project basis by an independent auditing committee. Filtrex® neither

guarantees nor assures LEED® credits from the use of its products.

Disadvantages

- If Severe slope stabilization does not use Filtrex® GrowingMedia™, performance may be diminished.
- If not installed correctly, maintained or used for a purpose or intention that does not meet specifications, performance may be diminished.
- If vegetation does not establish or cover density is low, performance may be diminished.
- Severe slope stabilization should not be the only form of site or watershed storm water management.
- Severe slope stabilization may need to be reseeded or live stakes replaced if establishment is poor.
- Severe slope stabilization performance may be lower prior to vegetation establishment and maturity.
- Severe slope stabilization installation is a land disturbing activity and can increase sediment loading to surface waters if appropriate sediment control measures are not established during construction phase.
- Severe slope stabilization should not be used on bank and shoreline slopes greater than ¼:1
- Severe slope stabilization should not be used on banks where mowing will be performed to maintain vegetation.

MATERIAL SPECIFICATIONS

Filtrex® Severe slope stabilization is comprised of 4 primary components; Filtrex® FilterSoxx™ fascia, Filtrex® GrowingMedia™, geogrid or other anchoring system, and vegetation. These components work together to establish a stabilization system of reinforced vegetation. For Design drawing details of the Severe slope stabilization system see Figures 9.1 and 9.2

Filtrex® FilterSoxx™

The FilterSoxx™ is the tubular mesh netting material specifically designed to retain Filtrex® GrowingMedia™, seed and other materials. This finished product, stacked during construction, promotes healthy vegetation growth. Moisture flows freely to both reduce hydrostatic pressure and increase drainage of subsurface moisture to the vegetated fascia. The openings in FilterSoxx™ are such that they allow for root growth while retaining GrowingMedia™ for healthy vegetation.

ADVANTAGES

	LOW	MED	HIGH
Installation Difficulty			✓
Soil Retention Ability			✓
Vegetation Establishment			✓
Aesthetic Quality			✓
Aesthetic Quality			✓
Drainage			✓



Filtrexx® Soxx™ wall fascia units are available in diameters of 8 in (200mm), 12 in (300mm), 18 in (450mm) and 24 in (600mm) in and are constructed of a variety of materials and characteristics (see Table 9.1). The specific size of the Soxx™ for each site will vary based on intended height of the application, intended batter (backfill), and spacing of geogrid or any other anchoring/tieback system. Generally speaking, Soxx™ will decrease in diameter from the base of the wall to the top, creating a firm footer for the wall while decreasing the load of the successive layers.

Soxx™ are installed in continuous sections, reducing the number of breaks in the system that might occur compared to other block structures. These continuous sections allow the Filtrexx® FilterSoxx™ fascia to act as a solid, seamless beam across the slope, further distributing any acting pressures.

GrowingMedia™ Characteristics

Filtrexx® Severe slope stabilization uses only Filtrexx® GrowingMedia™ which is a composted material that is specifically designed for stability within the system and establishment and sustainability of vegetation growth. Filtrexx® GrowingMedia™ can be third party tested and certified to meet minimum performance criteria defined by Filtrexx® International. Performance parameters include: percent cover of vegetation, water holding capacity, pH, organic matter, soluble salts, moisture content, biological stability, maturity bioassay, percent inert material, bulk density and particle size distribution. For information on the physical, chemical, and biological properties of Filtrexx® GrowingMedia™ refer to Filtrexx® GrowingMedia™ Specifications in Appendix 5.26.

Geogrid Reinforcement

Geogrid is a commonly used component for soil stabilization. Severe slope stabilization may be installed using a variety of brands of geogrid to meet the requirements of the project engineer. In non load-bearing situations, Filtrexx® LockDown™ Netting is recommended to increase the structural integrity of the Severe slope stabilization application. Filtrexx® LockDown™ Netting has numerous characteristics which lends itself to benefit the Severe slope stabilization application. See Table 9.2 and Section 3.0. When utilizing a geogrid with Severe slope stabilization, a wrap is recommended for every one or two courses. Therefore, as geogrid spacing varies for application to application, FilterSoxx™

wall fascia size (8 in or 200mm to 24 in or 600mm) is adjusted to meet the grid-spacing requirements as determined by the site engineer. Table 9.3 provides sample recommendations to assist the site engineer in grid-spacing requirements by wall fascia size. For structural retaining walls, see section 2.10. Severe slope stabilization is not intended to be used for structural applications.

Vegetation Choices

- Turf/Forage Grasses
- Groundcovers
- Live Shrub Cuttings
- Native species
- Vines etc.

Methods for Establishing Vegetation

- GrowingMedia™ incorporated with seed
- Live Staking
- Broadcast seeding
- Plugs

Vegetation Selection

When selecting vegetation for Severe slope stabilization the following should be considered:

- Degree of maintenance required. In general, low maintenance species are desirable.
- Drought resistance
- Freeze tolerance
- Aesthetics
- Degree of Slope



Note: If in doubt regarding vegetation, Filtrexx® International, LLC should be consulted.

INSTALLATION

1. Filtrexx® Severe slope stabilization shall meet Filtrexx® Severe slope stabilization Specifications and use Filtrexx® GrowingMedia™.
2. Contractor is required to be a Filtrexx® Certified™ Installer as determined by Filtrexx® International, LLC (440-926-2607 or visit website at www.filtrexx.com). Certification shall be considered current if appropriate identification is shown during time of bid or at time of application (current list can be found at www.filtrexx.com). Look for the Filtrexx® Certified™ Installer Seal.

Required Tools & Materials

- Safety Equipment



- Rappelling gear/rope tie offs
- Shovel(s)
- Laser level (or hand level)
- Tape Measure
- String Line
- Marking Paint
- Pneumatic blower unit
- Seed blending capability
- Filler cone for filling FilterSoxx™ wall fascia

Materials:

- Approved Filtrex® FilterSoxx™
- Approved Filtrex® GrowingMedia™
- Tie-wraps (8 in or 200mm)
- Sod staples (8 in or 200mm)
- 2 in x 2 in x 24 in (50mm x 50mm x 600mm) wood stakes

Site Preparation

Prior to construction of Severe slope stabilization some preparation of the project area may be necessary. The project area must be clear of rock and debris that could prevent good ground contact or potentially damage the FilterSoxx™. During installation, care should be taken not to disturb excessive areas that will then need to be revegetated. In many cases, the FilterSoxx™ may be installed around existing vegetation and land features which will increase the integrity of the system. It is recommended that an experienced installer be consulted prior to working around questionable terrain (see Image 3).

Drainage

Unlike impermeable, hard-faced walls, a drainage zone behind the face of the Severe slope stabilization may not be required. This is because the FilterSoxx™ fascia is highly permeable. This permeability greatly reduces hydrostatic pressure and facilitates hydration of the GrowingMedia™ and fascia vegetation. Where increased drainage is desired or in high-flow areas, stone may be added in addition to the GrowingMedia™ in the first and/or second FilterSoxx™ course to enhance the movement of interflow, subsurface flow and/or runoff. Additional drainage systems may be installed behind the wall. It is recommended that drainage requirements be addressed by a geotechnical engineer and/or hydrologist on a site-by-site basis.

Installation of Base Course

After initial site preparation, construction of the wall may begin. If utilizing a geogrid reinforcement or Filtrex® LockDown™ Netting, begin by laying

the geogrid or LockDown™ Netting across the base of the wall on contour where the first course of the FilterSoxx™ is to be installed. Place the geogrid or LockDown™ Netting so that it extends sufficiently upslope to be anchored but be sure to leave sufficient material to wrap around the FilterSoxx™ to anchor into the soil above (see Image 4).

After a work plan is reached between the blower truck operator and wall installation team, the base course may be installed. The desired seed mix and/or additives should also be installed in the Seed Injection Unit(s) or otherwise premixed with the GrowingMedia™ (see Image 5).

After the base course of FilterSoxx™ is installed, the LockDown™ Netting may be wrapped around the FilterSoxx™ and stapled with standard sod staples (see Image 6).

Where needed, backfill may be placed either pneumatically or with heavy equipment. (see Image 7).

Installation of Successive Courses

Successive courses will be set upon previous courses in a batter prescribed by the site engineer (1H:2V Typ). Continue placing FilterSoxx™, and backfill as needed. The weight of successive layers will slightly compact the FilterSoxx™. Walking along the courses of FilterSoxx™ or tamping them will ensure consistent settlement as well (see Image 8).

Capping

A number of options exist for capping Severe slope stabilization. In any case, it is important that the geogrid or LockDown™ Netting is sufficiently buried below finished grade. In most cases a single FilterSoxx™ can be placed at the top of the wall and backfilled with topsoil or Filtrex® GrowingMedia™. An application of a Filtrex® Storm water blanket will connect the system with existing vegetation and help to reduce run-on/runoff volume and velocity flowing to the Severe slope stabilization system (see Image 9).

INSPECTION

Field reviews to ensure seed and/or plant establishment should occur at regular intervals after seeding or planting to assure germination and/or coverage of the wall system.

At six months if complete coverage has not occurred it is recommended that reseeding or remedial planting be preformed.

MAINTENANCE

The Severe slope stabilization system requires very little maintenance providing appropriate vegetation



types are selected and drainage is addressed during the design and build stages. In arid climates or for use during the establishment stages, low volume, low pressure drip tape may be installed as part of the Severe slope stabilization system to ensure hydration to the vegetation. For complete information on irrigation systems, refer to Filtrex[®] Support Practices[™] in section 3.0. For specific maintenance requirements in your area please contact Filtrex[®] International, LLC.

METHOD OF MEASUREMENT

Filtrex[®] Severe slope stabilization shall be itemized as 'Supply and Installation of Filtrex[®] Severe slope stabilization'. Bid prices shall be based on a per ft² or m² of fascia and shall include the supply and installation of the following:

- FilterSoxx[™] filled with Filtrex[®] GrowingMedia[™] and vegetated with site specific seed or plantings.
- Filtrex[®] LockDown[™] Netting wrap or equal as approved by site engineer.
- GrowingMedia[™] / aggregate/soil backfill as needed.
- Filtrex[®] Compost Storm water blanket around extremities of system.

Engineer shall notify Filtrex[®] of location, description, and details of project prior to the bidding process so that Filtrex[®] can provide design aid and technical support.

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ADDITIONAL INFORMATION

For other references on this topic, including trade magazine and press coverage, visit the Filtrexx® Website at: <http://www.filtrexx.com/resourcespress.htm>.

For research reports not included in the Appendix, visit: <http://www.filtrexx.com/resourcesreports.htm>.

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TABLES & FIGURES:

Table 9.1. Filtrex® FilterSoxx™ Material Specifications.

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Multi-Filament Polypropylene "SafetySoxx"™
Material Characteristic	Photodegradable	Photodegradable	Biodegradable	Photodegradable	Photodegradable
Design Diameters*	5 in (125mm), 8 in (200mm), 12 in (300mm), 18 in (400mm)	5 in (125mm), 8 in (200mm), 12 in (300mm), 18 in (400mm), 24 in (600mm), 32 in (800mm)	8 in (200mm), 12 in (300mm), 18 in (400mm), 24 in (600mm), 32 in (800mm)	8 in (200mm), 12 in (300mm), 18 in (400mm), 24 in (600mm), 32 in (800mm)	8 in (200mm), 12 in (300mm), 18 in (400mm), 24 in (600mm), 32 in (800mm)
Mesh Opening	3/8 in (10mm)	3/8 in (10mm)	3/8 in (10mm)	3/8 in (10mm)	1/8 in (3mm)
Tensile Strength	ND	26 psi (1.83 kg/cm2)	26 psi (1.83 kg/cm2)	44 psi (3.09 kg/cm2)	202 psi (14.2 kg/cm2)**
% Original Strength from Ultraviolet Exposure (ASTM G-155)	23% at 1000 hr	23% at 1000 hr	ND	100% at 1000 hr	100% at 1000 hr
Functional Longevity**/ Project Duration	6 mo-2 yr	9 mo-3 yr	6-12 months	1-4 yr	2-5 yr

* Tested at Texas Transportation Institute/Texas A&M University (ASTM 5035-95).

** Functional Longevity based on continual UV exposure without vegetation. Once vegetation is established longevity of the system is greatly increased.



Table 9.2. Characteristics of Filtrex® LockDown™ Netting.

Support Practice	LockDown™ Netting	LockDown™ Netting	LockDown™ Netting	Testing Lab
Purpose	Increase stabilization/ erosion control of Slope protection	Increase stabilization/ erosion control of Slope protection	Increase stabilization/ erosion control of Slope protection	
Description	Improves performance and allowable slope steepness	Improves performance and allowable slope steepness	Improves performance and allowable slope steepness	
Material Description	5 mm multifilament polypropylene	5 mm monofilament HDPE	2 mm chain woven 20/2 cotton	
Mesh Description	¾ in (19mm) openings	¾ in (19mm) openings	9/16 (14 mm) x 1 in (25mm) openings	
Color	Black	Green	White	
Tensile Strength (ASTM 5035-95)*	32.8 lbs/in2* (2.3 kg/cm2)	1.2 lbs/in2 (0.08 kg/cm2)	Unknown/Low	Texas Transportation Institute TX A&M.*
Elongation (% relative) (ASTM 5035-95)*	46.5	ND	ND	Texas Transportation Institute TX A&M.*
Functional Longevity	1 – 4 yr	6 mo – 3 yr.	2 mo.	Filtrex International Field Lab
Roll Size (w x l)	30 ft (9m) x 375 ft (114m)	30 ft (9m) x 375 ft (114m)	28 in (700mm) x 3300 ft (1006m), 40 in (1m) x 3300 ft (1006m), 96 in (2.4 m) x 3300 ft (1006m)	
Application Method	Stapled to soil/ Slope protection applied on top	Stapled to soil/ Slope protection applied on top	Stapled to soil/ Slope protection applied on top	

Table 9.3. Severe Slope Stabilization FilterSoxx™ Wall Fascia Sizing.

Prescribed vertical geogrid spacing as per Engineer		FilterSoxx™ wall fascia diameter	
inches	mm	inches	mm
8	200	12	300
12	300	18	450
18	450	24	600
24	600	30	750



Figure 9.1. Engineering Design for Filtrex[®] Severe Slope Stabilization

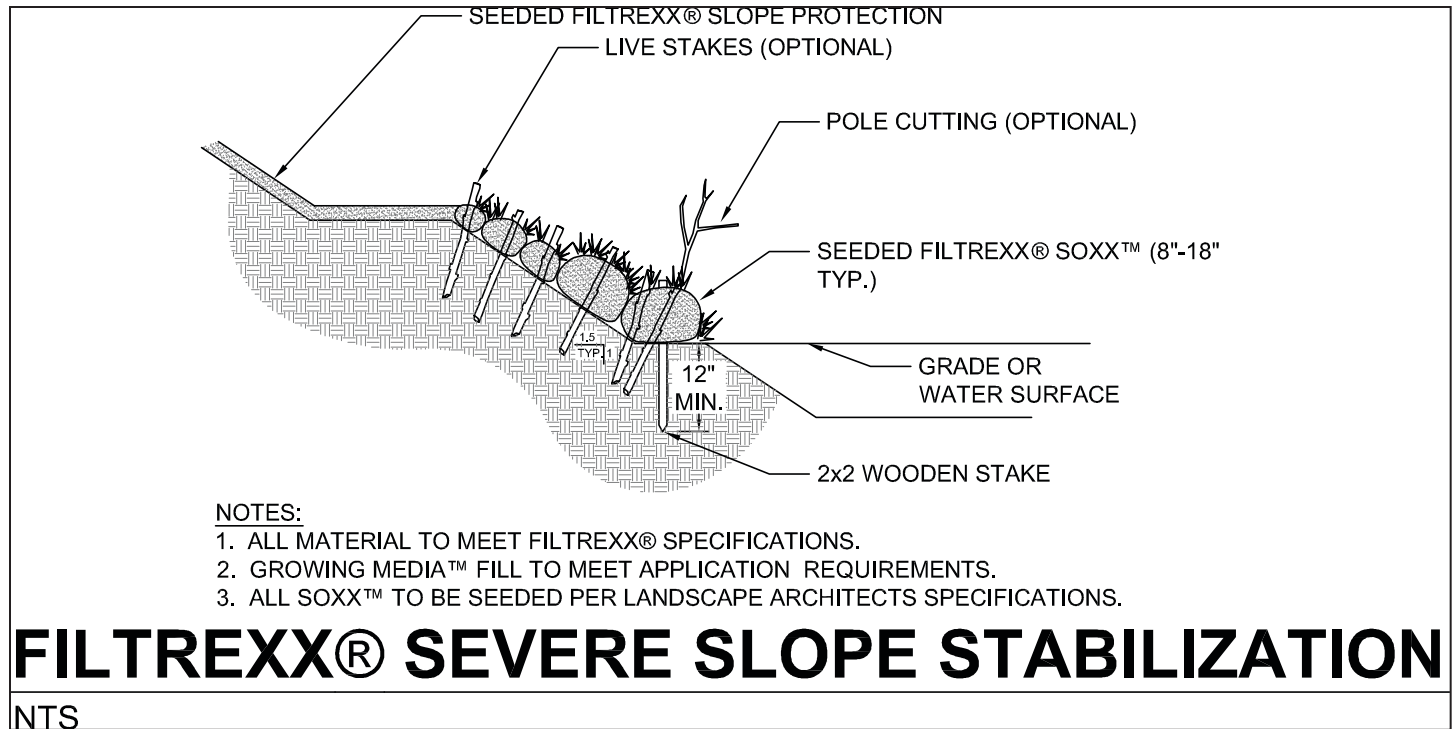


Figure 9.2. Engineering Design Drawing for Filtrex Severe Slope Stabilization

