



The use of organics as part of a coastal resiliency plan

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Dec

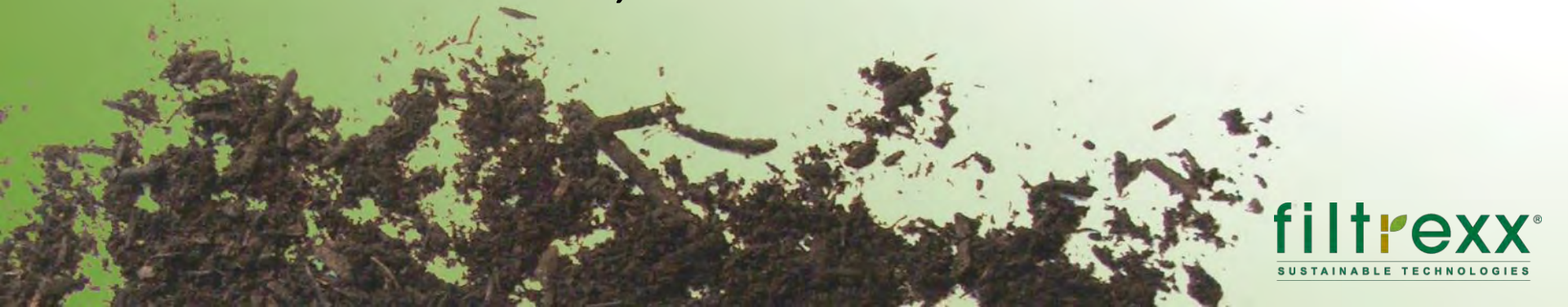
Outline

- What is Coastal Resiliency?
- Taking the watershed approach
- Filtrex Design Tools
- Project Examples
- Project concepts



US Coastline at a glance

- The US has over 12,383 mile of coastline, and 88,633 miles of tidal shoreline.
- The East Coast has over 2,069 miles of coastline, and over 28,673 miles of tidal shoreline. The West coast has 12,383 miles of coastline and 88,633 miles of tidal shoreline.
- The Gulf Coast is comprised of 1,631 miles of coastline and 17,141 mile of tidal Shoreline



What is Coastal Resiliency?

Coastal Resilience means building the ability of a community to “bounce back” after hazardous events such as hurricanes, coastal storms, and flooding - rather than to simply react to the impacts.

Resilience is our ability to prevent short- term hazard event from turning into a long-term community wide disaster -NOAA



COASTAL RESILIENCE

Bouncing back & *building beyond*.

PLAN & BUILD RESILIENCE

Develop and implement plan to become more resilient.



improving forecasts, observation models, computer systems



getting information to decision makers faster



incorporating green infrastructure

DISASTER STRIKES

Disasters can be imminent or strike unexpectedly.



sea level rise



tsunamis



coastal storms and hurricanes

RESPOND

Immediately take action following a disaster.



pollution response



damage assessment imagery



completing hydrographic surveys to reopen ports

RECOVER

Assess resilience and manage adaptively.



assessing damage to communities, economy, and environment



issuing grants to rebuild and restore habitat



providing data and tools for analysis

Assess resilience and begin planning for the next disaster.

Building resilience is an iterative process.



LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES

Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.



One square mile of salt marsh stores the carbon equivalent of **76,000 gal of gas** annually.



Marshes trap sediments from tidal waters, allowing them to **grow in elevation** as sea level rises.



Living shorelines improve **water quality**, provide fisheries **habitat**, increase **biodiversity**, and promote **recreation**.



Marshes and oyster reefs act as natural **barriers** to waves. **15 ft** of marsh can **absorb 50%** of incoming wave energy.



Living shorelines are **more resilient** against storms than bulkheads.



33% of shorelines in the U.S. will be **hardened** by **2100**, decreasing fisheries habitat and biodiversity.



Hard shoreline structures like **bulkheads** prevent natural marsh migration and may create seaward **erosion**.



The National Centers for Coastal Ocean Science | coastalscience.noaa.gov

Some graphics courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/symbols/)



What is Compost?

Composting is a heat dependent, controlled microbiological process of decomposition and recycling of “ORGANIC” material into a stable and humus rich material known as compost.

- Mulch?
- Organic waste?
- Manure?



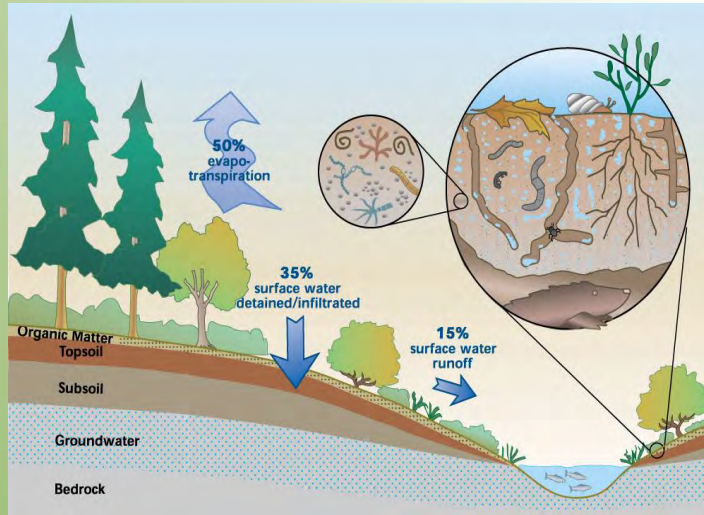
Compost Sock

3-Way Biofiltration

- Physical
 - Traps sediment in matrix of varying pore spaces and sizes
- Chemical
 - Binds and adsorbs pollutants in storm runoff
- Biological
 - Degrades various compounds with bacteria and fungi



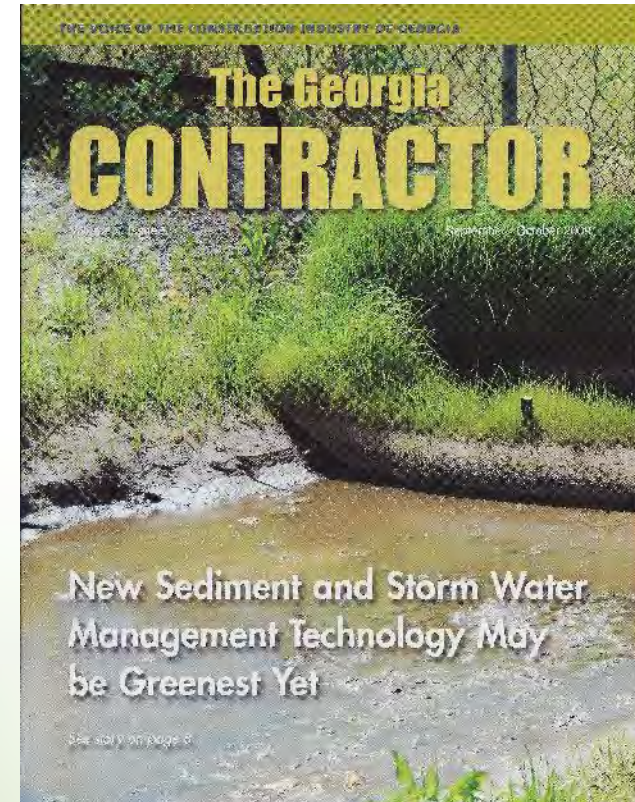
Runoff + Erosion Control



Designed to: 1) dissipate energy of rain impact; 2) hold, infiltrate & evaporate water; 3) slow down/disperse energy of sheet flow; 4) provide for optimum vegetation growth

Compost - The Green BMP

- 100% Recycled
- Bio-based, organic materials
- Locally manufactured
- Reduces Carbon Footprint
- Uses Natural Principles
- Benign to *Restorative*
- High Performance



Compost Tools

Filter Media

- Designed for Optimum Filtration & Hydraulic-flow

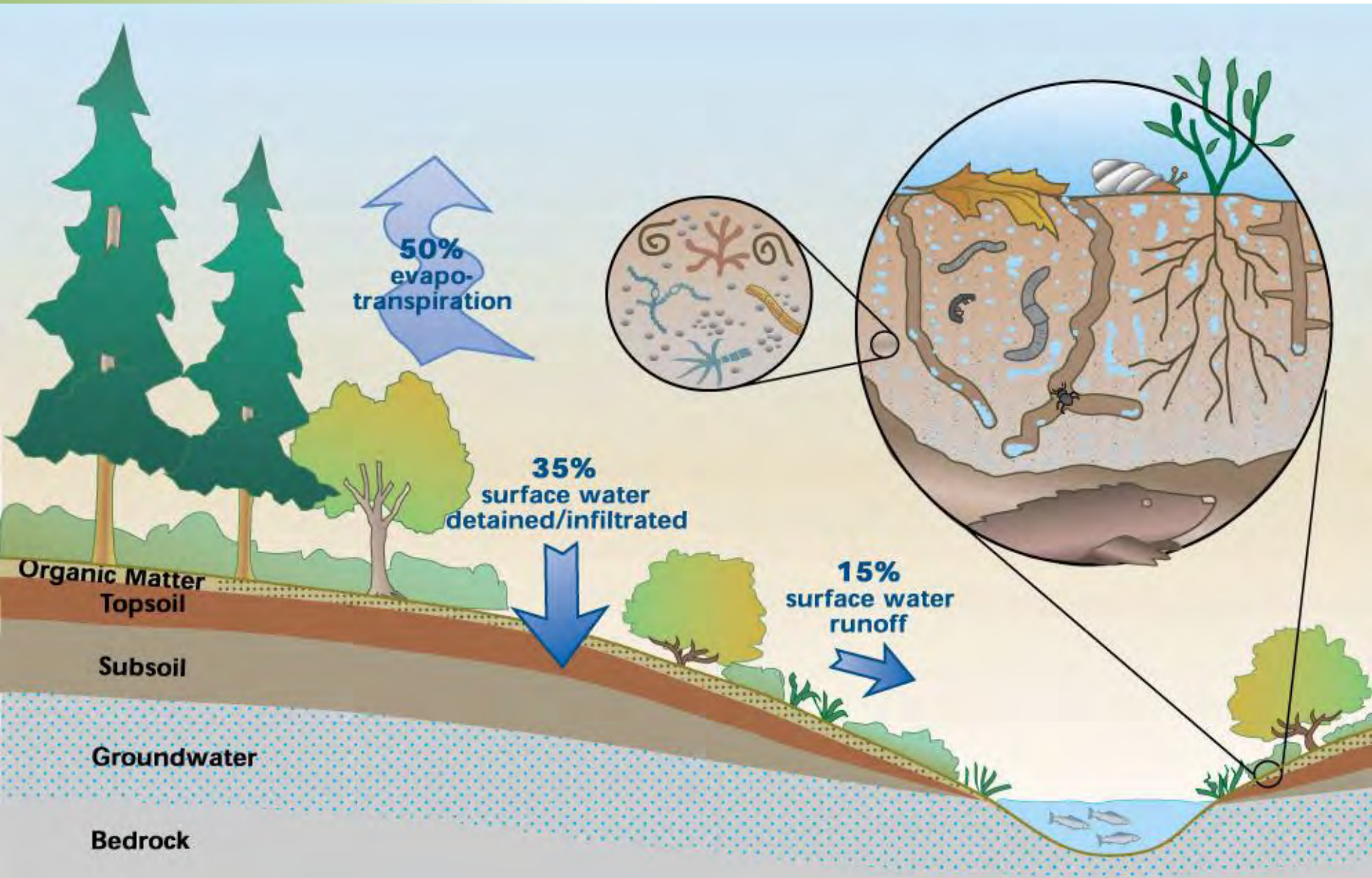


Growing Media

- Designed for Optimum Water Absorption & Plant Growth



Natural Stormwater Management





USEPA Compost Blanket Specifications

Parameters	Units of Measure	Surface to be Vegetated	Surface to be left Unvegetated
pH	pH units	5.0 – 8.5	N/A
Soluble salt concentration (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	Maximum 5
Moisture content	%, wet weight basis	30 – 60	30 – 60
Organic matter content	%, dry weight basis	25 – 65	25 – 100
Particle Size Distribution	% passing a selected mesh size, dry weight basis	- 3 in. (75 mm), 100% passing - 1 in. (25 mm), 90 – 100% passing - ¾ in. (19 mm), 65 – 100% passing - ¼ in. (6.4 mm), 0 – 75% passing Maximum particle length of 6 in (152 mm)	- 3 in. (75 mm), 100% passing - 1 in. (25 mm), 90 – 100% passing - ¾ in. (19 mm), 65 – 100% passing - ¼ in. (6.4 mm), 0 – 75% passing Maximum particle length of 6 in (152 mm)
Stability Carbon dioxide evolution rate	mg CO ₂ -C per g organic matter per day	<8	N/A
Physical contaminants (manmade inerts)	%, dry weight basis	<1	<1

Stormwater BMPs

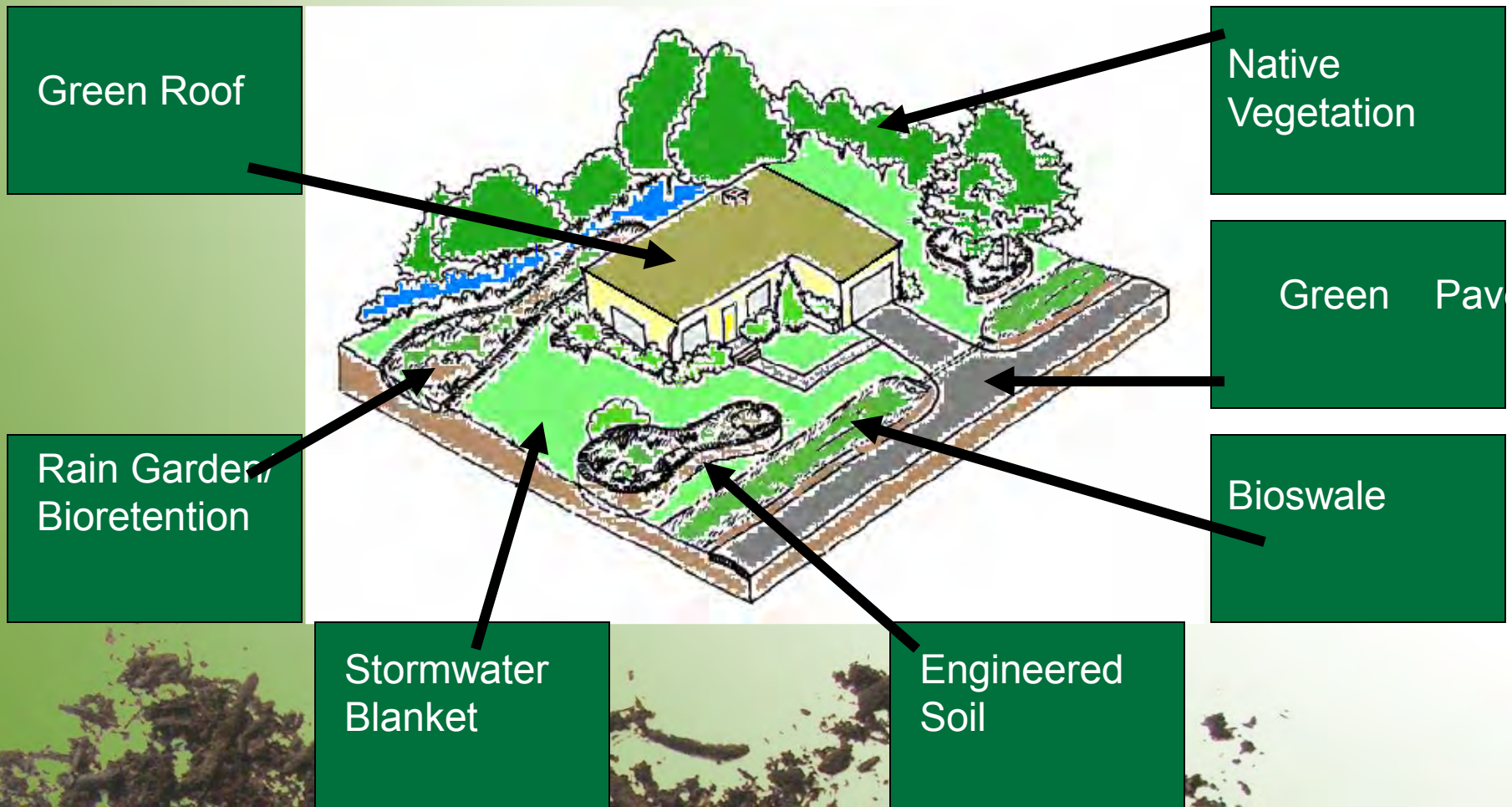
Erosion & Sediment Control

1. Perimeter Control
2. Inlet Protection
3. Ditch Check
4. Filter Ring/Concrete washout
5. Slope Interruption
6. Runoff Diversion
7. Vegetated Cover
8. Erosion Control Blanket
9. Vegetated Sediment Trap
10. Pond Riser Pipe Filter
11. Dune Restoration
12. Stream Restoration
13. Living Shorelines

Low Impact Development

11. Runoff Control Blanket
12. Vegetated Filter Strip
13. Engineered Soil
14. Channel Liner
15. Streambank Stabilization
16. Biofiltration System
17. Bioretention System
18. Green Roof System
19. Living Wall
20. Green Retaining Wall
21. Vegetated Rip Rap
22. Level Spreader
23. Green Gabion
24. Bioswale

A Sustainable Site





 **Southface**


Responsible Solutions for Environmental Living

Eco Office
Grand Opening
August 18, 2009



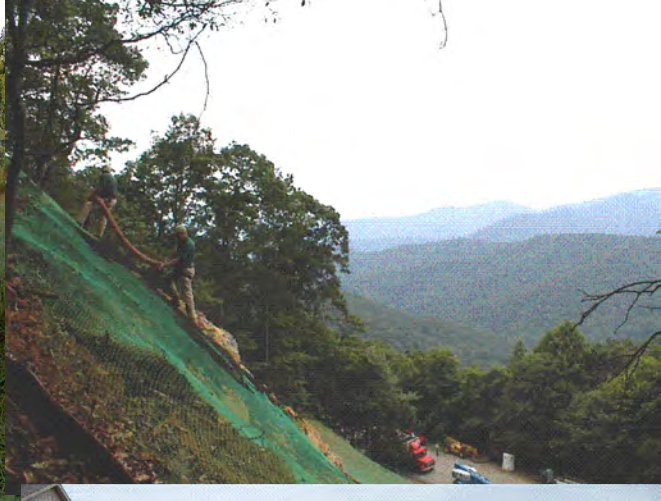
- ✓ 100% rain/stormwater capture
- ✓ Zero discharge
- ✓ 84% Water Savings
- ✓ 130,000 gal/yr



 **Southface**

Responsible Solutions for Environmental Living





10. 30. 2001

Pollutant Load Reduction:

Compost Blanket vs Conventional Seeding



	Total N	Nitrate N	Total P	Soluble P	Total Sediment
Mukhtar et al, 2004 (seed+fertilizer)	88%	45%	87%	87%	99%
Faucette et al, 2007 (seed+fertilizer)	92%	ND	ND	97%	94%
Faucette et al, 2005 (hydromulch)	58%	98%	83%	83%	80%
Persyn et al 2004 (seed+topsoil)	99%	ND	99%	99%	96%

Stormwater Pollutant Removal

	TSS	Turbidity	Total N	NH ₄ -N	NO ₃ -N	Total P	Sol. P	Total coli.	E. coli.	Metals	Oil	Diesel
Filter Sock	80 %	63%	35 %	35%	25 %	60 %	92%	98%	98%	37-78%	99 %	99%

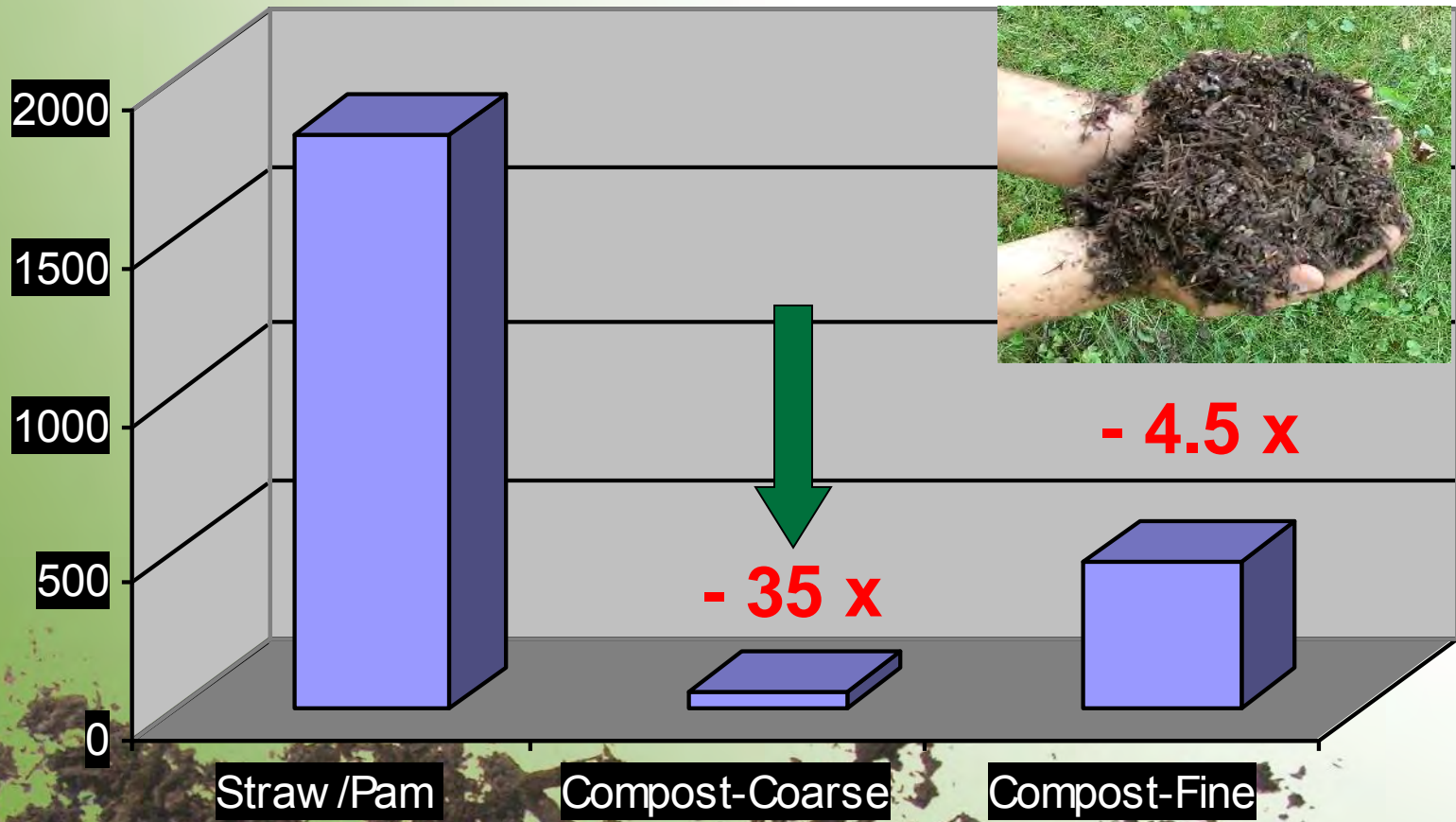




Turbidity (NTU)

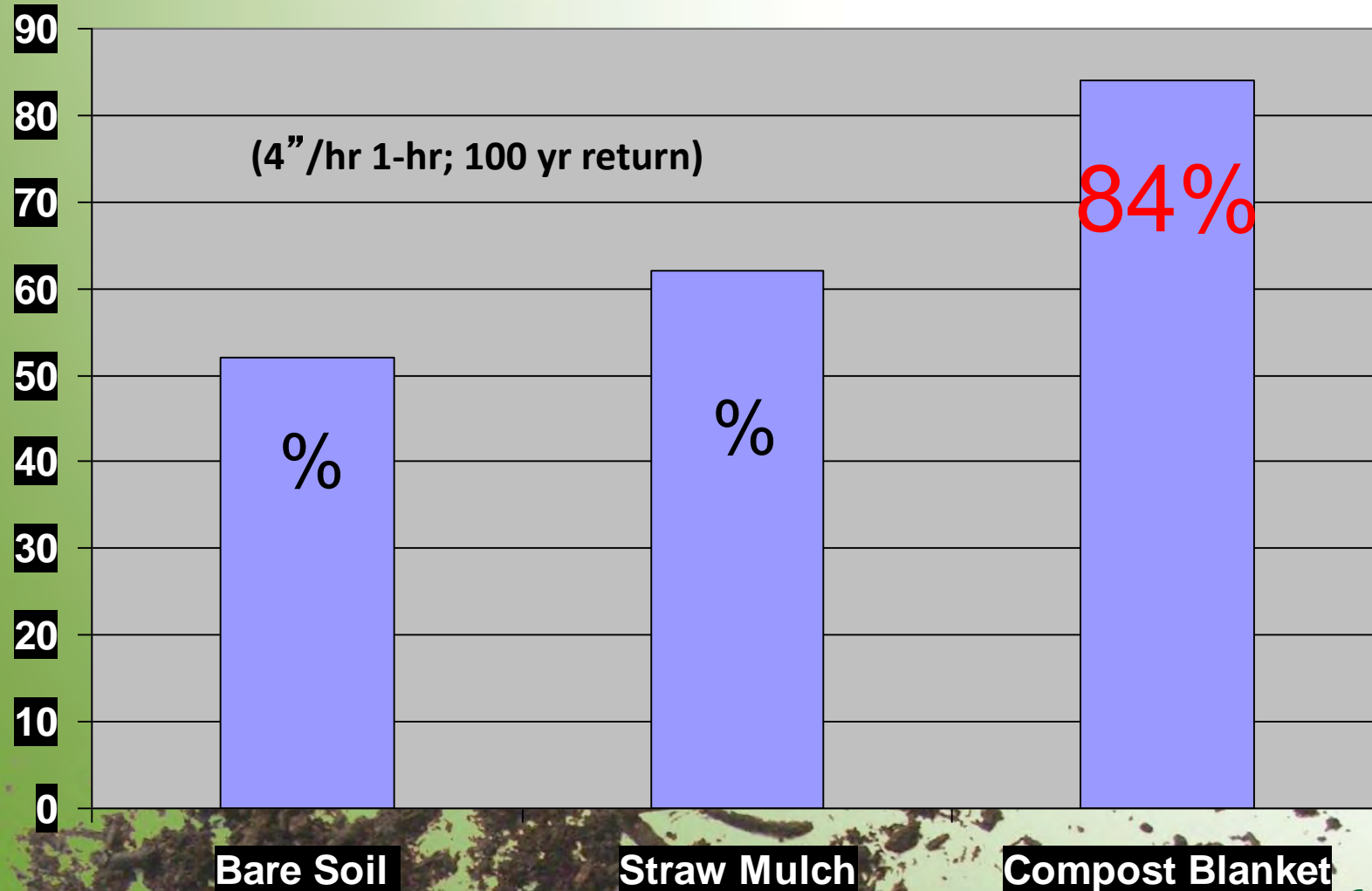


Average from 4-inch Storm Event





LID: Rainfall Absorption





New Tools for Coastal Communities to Manage Dunes, Dredge and Pollutants

Parameter	Value
Dune Height	0.15 m
Dune Length	0.5 m
Flow Velocity	10 m/s
Flow Direction	From Left to Right

FILTREXx REVERSE

L1 L2 L3 L4 L5 L6

FILTREXx REVERSE

Model	FRT-001
Material	Polyethylene Glycol (PEEG)
Dimensions	18mm x 18mm x 18mm
Weight	0.1g
Storage	Room Temperature

BEFORE

AFTER

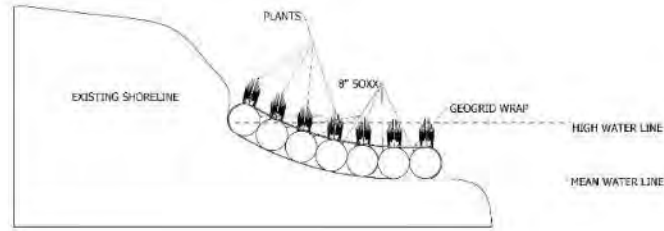
Containment — Diffusion — Diversion — Erosion Prevention — Geotechnical Reinforcement — Vegetation Establishment

Fig. 10. Zirconium and hafnium and their isotopes in the studied samples. The mean $\pm 1\sigma$ values for the studied samples are: Zr = 10.00 \pm 0.02 ppm, ^{90}Zr = 10.00 \pm 0.02 ppm, ^{91}Zr = 0.00 \pm 0.00 ppm, ^{92}Zr = 0.00 \pm 0.00 ppm, ^{94}Zr = 0.00 \pm 0.00 ppm, ^{96}Zr = 0.00 \pm 0.00 ppm, ^{90}Hf = 0.00 \pm 0.00 ppm, ^{91}Hf = 0.00 \pm 0.00 ppm, ^{92}Hf = 0.00 \pm 0.00 ppm, ^{93}Hf = 0.00 \pm 0.00 ppm, ^{94}Hf = 0.00 \pm 0.00 ppm, ^{96}Hf = 0.00 \pm 0.00 ppm.



CADs

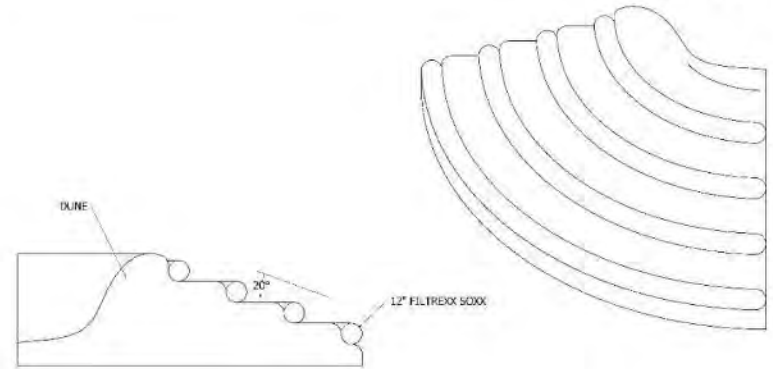
FILTREXX REVETMENT



filtrex
SUSTAINABLE TECHNOLOGIES

DATE	01/11/11	PROJECT	REVENUE
DRAWN	WJL		
CHECKED			
SCALE	1"		

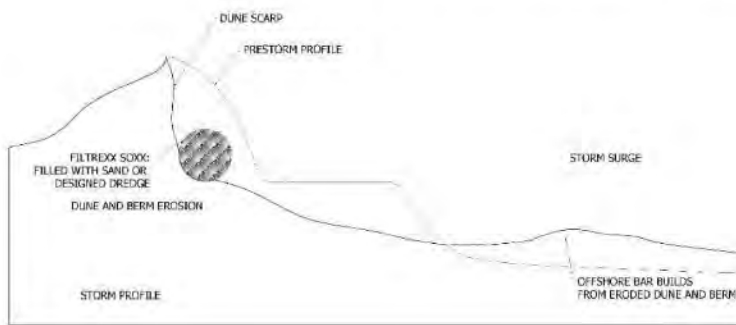
GRADUATED DUNES



filtrex
SUSTAINABLE TECHNOLOGIES

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CHECKED			
SCALE	1" = 10'		

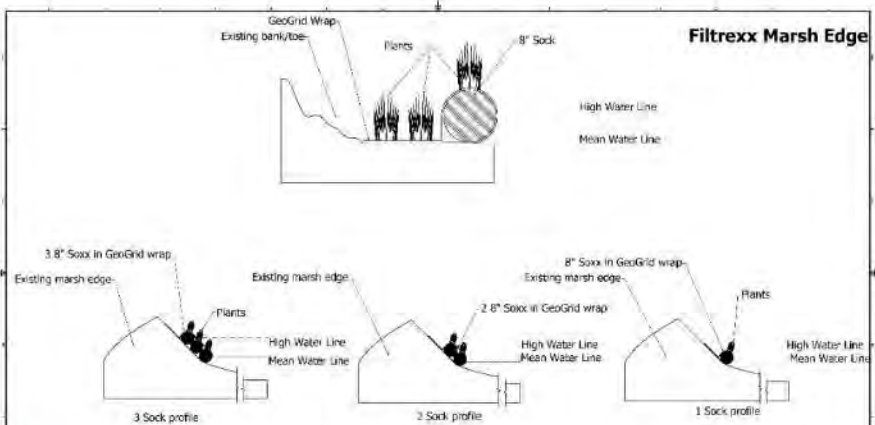
FILTREXX DUNE SCARP PROTECTION



filtrex
SUSTAINABLE TECHNOLOGIES

DATE	01/11/11	PROJECT	REVENUE
DRAWN	WJL		
CHECKED			
SCALE	1"		

Filtrex Marsh Edge



filtrex
SUSTAINABLE TECHNOLOGIES

DATE	01/11/11	PROJECT	REVENUE
DRAWN	WJL		
CHECKED			
SCALE	1"		

Filtrex Shoreline web page



The screenshot shows the homepage of the Filtrex Living Shorelines website. The browser address bar displays "www.filtrex.com/en/applications/living-shorelines". The header features the Filtrex logo with the tagline "SUSTAINABLE TECHNOLOGIES" and a navigation menu with links: ABOUT, APPLICATIONS, INDUSTRIES, PRODUCTS, TECHNOLOGY, RESOURCES, SHOP, and CONTACT. A large hero image shows a coastal scene with a green overlay containing the text "LIVING SHORELINES" and "FILTREXX SUSTAINABLE TECHNOLOGIES". Below this, the heading "FILTREXX LIVING SHORELINES" is followed by the text "We help protect shorelines and maintain the natural interface between land and water." A paragraph describes Filtrex as the leading developer of sustainable technologies for stormwater management, sediment control, and pollutant removal, highlighting the "Soxx™ technology". It states that shorelines are affected by storms, waves, and sea level changes, and that Filtrex Living Shorelines systems are alternative stabilization techniques that help maintain the natural interface while preserving the habitat. A "Contact our team" link is provided. The section "WHAT IS A LIVING SHORELINE?" defines it as "any shoreline management system that is designed to protect or restore natural shoreline ecosystems through the use of natural elements and, if appropriate, man-made elements. Any elements used must not interrupt the natural water/land continuum to the detriment of natural shoreline ecosystems."¹

Filtrex Living Shorelines, ... X

www.filtrex.com/en/applications/living-shorelines

Search

filtrex
SUSTAINABLE TECHNOLOGIES

ABOUT APPLICATIONS INDUSTRIES PRODUCTS TECHNOLOGY RESOURCES SHOP CONTACT

LIVING SHORELINES
FILTREXX SUSTAINABLE TECHNOLOGIES

FILTREXX LIVING SHORELINES

We help protect shorelines and maintain the natural interface between land and water.

Filtrex is the leading developer of sustainable technologies for stormwater management, sediment control, pollutant removal and living walls. Our **Soxx™ technology** can be used alone or in combination with other erosion control solutions in living shoreline applications. Shorelines are affected by storms, waves and sea level changes. **Filtrex Living Shorelines** systems are alternative shoreline stabilization techniques that help maintain the natural interface between land and water while preserving the habitat, protecting the environment and enhancing coastal resilience to reduce erosion.

Contact our team and let us collaborate on your next living shoreline stabilization project.

WHAT IS A LIVING SHORELINE?

Living Shoreline is "any shoreline management system that is designed to protect or restore natural shoreline ecosystems through the use of natural elements and, if appropriate, man-made elements. Any elements used must not interrupt the natural water/land continuum to the detriment of natural shoreline ecosystems."¹



The screenshot shows the "LIVING SHORELINE - DESIGN PRINCIPLES" page. The browser address bar displays "www.filtrex.com/en/applications/living-shorelines". The page defines "Living Shoreline" as a "broad term that encompasses a range of shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries. A living shoreline has a footprint that is made up mostly of native material. It incorporates vegetation or other living, natural soft elements alone or in combination with some type of harder shoreline structure (e.g., oyster reefs or rock sills) for added stability."². The section "LIVING SHORELINE - DESIGN PRINCIPLES" states that Filtrex has a full team of experts ready to help identify, design, implement and install the most suitable living shoreline solution for each specific project. It lists basic design principles to consider, including Containment, Retention, Diffusion, Energy dissipation, Vegetation establishment, Diversion, Filtration, Adsorption of invisible pollutants, and Detention, and Encapsulation. Below this, three columns showcase different applications: BEACHES (with an image of a beach and text "Prevent dune scarps and enhance new beach dune establishment."), LAKES & PONDS (with an image of a pond and text "Long-term protection against the elements with native vegetation."), and RIVERS & STREAMS (with an image of a river and text "Maintain native vegetation and reduce erosion impact with Soxx technology."). Each column has a "Download Project Profiles" link. The "REFERENCES" section lists two sources: "¹ Source: Restore America's Estuaries 'Living Shorelines: From Barriers to Opportunities'" and "² National Oceanic and Atmospheric Administration (NOAA) - 'Guidance for Considering the Use of Living Shorelines'".

Filtrex Living Shorelines, ... X

www.filtrex.com/en/applications/living-shorelines

Search

Living Shoreline is also considered a "broad term that encompasses a range of shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries. A living shoreline has a footprint that is made up mostly of native material. It incorporates vegetation or other living, natural soft elements alone or in combination with some type of harder shoreline structure (e.g., oyster reefs or rock sills) for added stability."²

LIVING SHORELINE - DESIGN PRINCIPLES

Filtrex has a full team of experts ready to help you identify, design, implement and install the most suitable living shoreline solution for each specific project. Among the basic design principles to consider, our products can help with the following:

- Containment
- Retention
- Diffusion
- Energy dissipation
- Vegetation establishment
- Diversion
- Filtration
- Adsorption of invisible pollutants
- Detention
- Encapsulation

BEACHES
FILTREXX LIVING SHORELINES

BEACHES

Prevent dune scarps and enhance new beach dune establishment.

Download Project Profiles

LAKES & PONDS
FILTREXX LIVING SHORELINES

LAKES & PONDS

Long-term protection against the elements with native vegetation.

Download Project Profiles

RIVERS & STREAMS
FILTREXX LIVING SHORELINES

RIVERS & STREAMS

Maintain native vegetation and reduce erosion impact with Soxx technology.

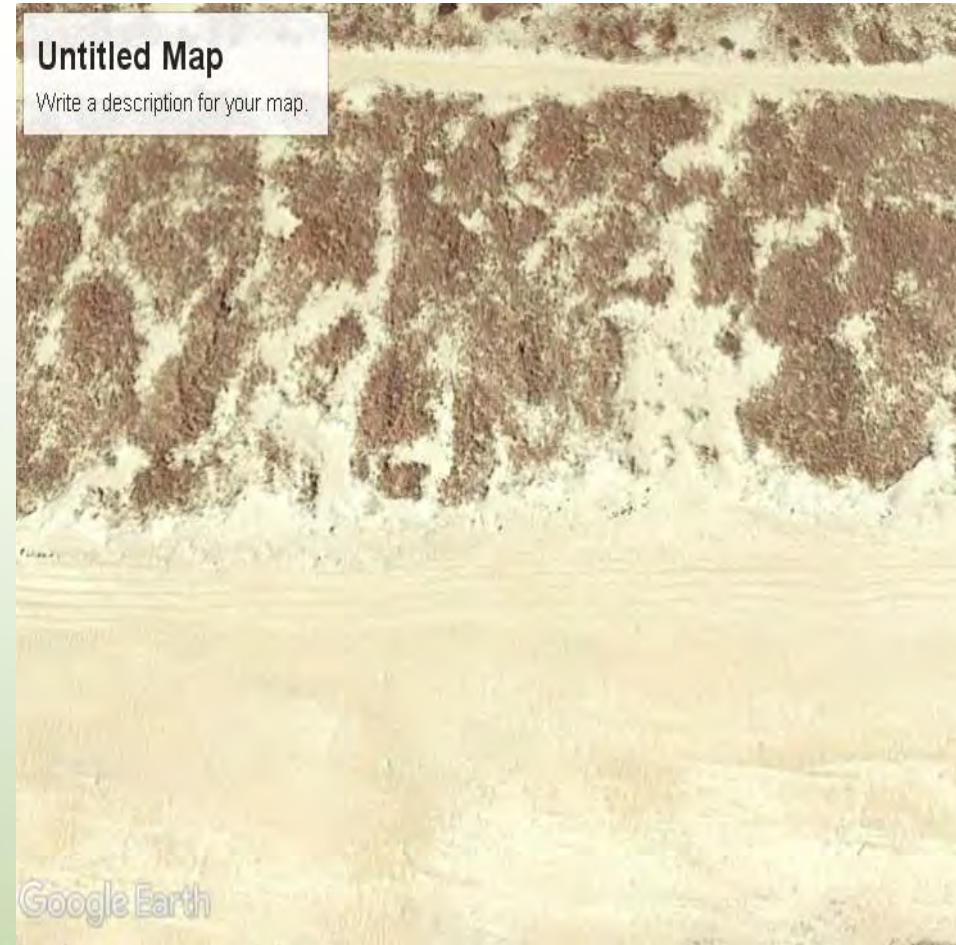
Download Project Profiles

REFERENCES

¹ Source: Restore America's Estuaries "Living Shorelines: From Barriers to Opportunities"

² National Oceanic and Atmospheric Administration (NOAA) - "Guidance for Considering the Use of Living Shorelines"

Dunes-Will this work?



Stafford Point dune restoration



During construction
Before covering with
Sand and planted

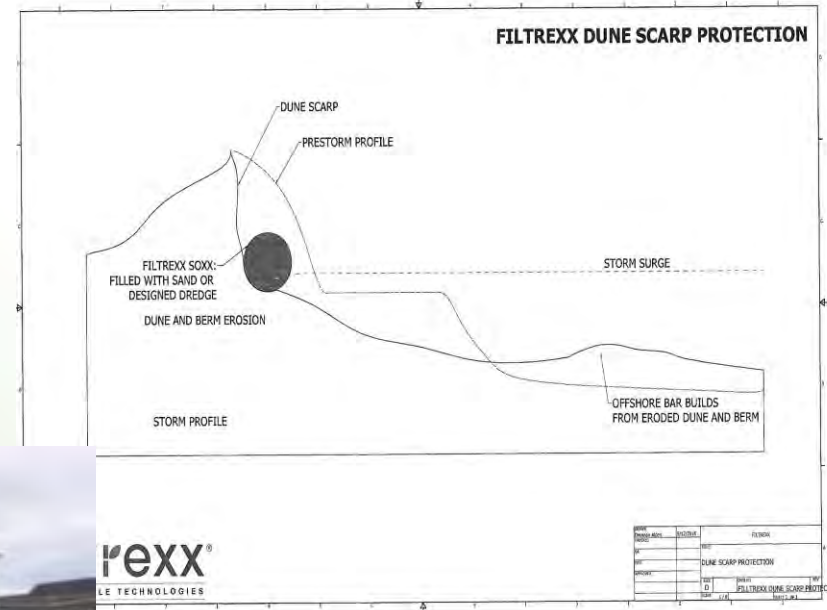
After hurricane
Sandy



The embankment at Stratford Point on the low energy side photographed on 11-26-2012. The embankment consisting of sand/organic filled geotextile socks held up well from the effects of Hurricane Sandy. The plants and cover material that was placed a year ago was lost along with upland sediment behind the constructed embankment. The tube filled socks, with the exception of 10 feet at the very westerly end, were not damaged and remained sand filled, very firm and intact.

(Source: NCSU)

Dune Scarp Protection



Repair of undercut shoreline

After completion in
spring 2016



Fall of 2016

Virginia DOT Coastal Project



Assessing Filtrexx Environmental impact.

LivingWall Environmental Impact

Project Profile

Project Details

The homeowners of a historic lakefront property had slope stability concerns as well as a desire to access the sandy beach at the water's edge. From the view from the back porch windows, the home was right at the edge of the slope. The project site is located on a 115 foot 2:1 bluff overlooking Lake Michigan. It was determined by the geotechnical engineer that the site required stabilization.

Marek Landscaping, LLC, based in Milwaukee, WI, designed and implemented the project, selecting a Filtrexx GreenLoxx living wall for the upper portion of the bluff.

This would stabilize the area directly adjacent to the home, adding eight feet of yard to the upper terrace. The living wall would be the foundation from which the deck and stairs would be anchored, providing access to the beach and a sweeping view of the coast. A low impact trail created a rustic but navigable route to the base of the slope.

This low impact solution promotes the growth of native plants for both a natural aesthetic as well as stabilization properties.

Wisconsin Lakefront Bluff Stabilization Shorewood, Wisconsin



The living wall consists of lightweight geo-fabric block backfill material, soil anchors, and 3" galvanized pipe tied to layers of geogrid wrapped around every two layers of the GeoGrid® at the face of the wall. A native plant and seed mix was created specifically for the cultural needs and stabilization properties of the plants on the site.

This environmental impact statement is for a 1,500 facial square foot wall on a lakefront repair project in Wisconsin. The project utilizes 2,000 linear feet of Filtrexx® 12" GroSoxx® filled with Filtrexx Certified™ GrowingMedia™.

- 320,000 lbs. of Organics Diverted from Landfills
- 8,000 gallons of Potential Rainfall Absorption
- 560,000 lbs. of CO₂e Methane Avoidance
- 75 lbs. of CO₂ Sequestered in Vegetation
- 54,000 lbs. of CO₂ Sequestered in Soil

The calculated numbers are based off of Filtrexx TechLink Research Summary #3335, Ecosystem Service Benefits of Filtrexx Compost Based Sustainable Management Practices (SMPs).

filtrexx
LivingWalls™

314-287-4470
livingwalls@filtrexx.com
www.filtrexx.com/livingwalls



We're looking for sustainability leaders.

- Many companies have sustainability goals they strive to reach—EcoPractices is a third-party verification company that helps to market your sustainability practices by providing proof practices were implemented and produced scientifically-proven environmental benefits.
- EcoPractices helps companies create, reach, and market sustainability goals with a variety of services and product solutions.
- EcoPractices identifies, collects, verifies, documents, and generates positive environmental impacts produced from simply implementing Sustainable Best Management Practices (SBMPs) on your projects.



Make your BMP an SBMP.

- Project owners, municipalities, and power & utility industries commonly use conventional BMPs that are unsustainable and low-performing.
- EcoPractices is proud to work with Filtrexx®, a trailblazer in the industry with nationwide-compliant SBMP solutions supported by private research, public university research, and government agencies.
- EcoPractices is committed to offering a library of SBMPs from Filtrexx that not only comply with project permits, but are proven to outperform conventional, unsustainable products.

What is an Ecotag?

- Ecotags are a metric generated from an environmental impact assessment and represent the positive environmental benefits of their sustainable practices.
- Ecotags offer companies the unique opportunity to support conservation practices that have verified beneficial impacts on the environment.
- In 2015, 66% of people reported willingness to pay more for a product from a company that committed to environmental responsibility [Source: Nielsen].
- Utilize Ecotags in your Corporate Social Responsibility Reports and to communicate your sustainability story and goals.



5280
CERTIFIED
ECOTAGS
(1 MILE OF SOXX®)

— WHAT DOES THIS OFFSET? —



10 CARS OFF THE ROAD/YEAR
- AND -



14 DUMP TRUCKS OF
WOOD CHIPS DIVERTED

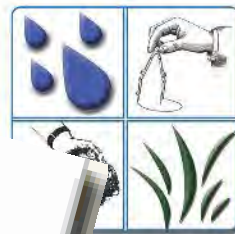
1 Ecotag = 1 ft of Soxx implemented

Contact us for a complimentary discovery meeting to find out how EcoPractices can assist with reaching your sustainability goals & telling your story.

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A Sustainability Partners Brand



The Sustainable Site

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Compost-
Based BMPs
Inside

“....an essential tool for engineers, designers, architects, regulators, planners, managers, contractors, consultants, policymakers, builders, and water resource managers.” –

Forester Press

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