



# Working with Nature: Stormwater Quality Treatment with Filtrex EnviroSoxx

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# Outline

- Stormwater: Gray to Green Infrastructure (LID)
- Compost & Stormwater Volume and Quality
- Compost Applications (BMPs)
- Research, Performance, & Design
- Case Study
- Q/A





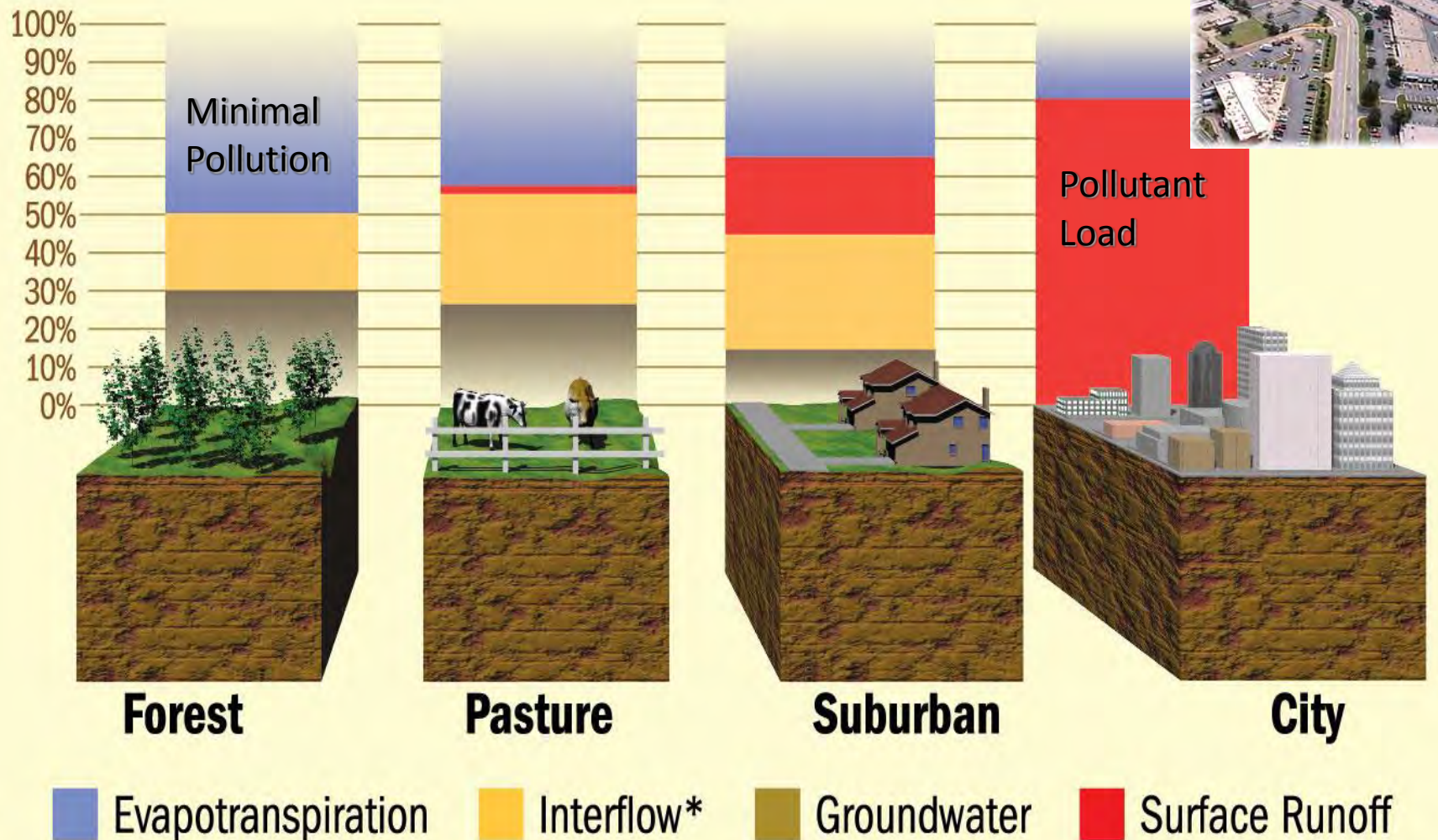
# Stormwater Impact



- 850 - US cities w/ outdated & under-designed SWM infrastructure
- 75% of Americans live near polluted waters
- 48,800 TMDL listed (impaired) water bodies
- \$44,000,000,000 – annual total cost to society



# Land Use = Hydrology = Pollutant Load = Water Impairment



Source: Sego Jackson, 2001

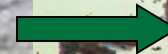
\*water that travels just below the surface



# 75% of Us Live Near a Polluted Water



- Coliform bacteria (10,900 streams)
- Metals – Cu, Cd, Cr, Ni, Pb, Zn (8600 streams)
- Nutrients – N & P (5300 streams)
- Turbidity/TSS - Clay & Fine Silt Sediment (5100 streams)
- Petroleum Hydrocarbons - Motor Oil, Diesel Fuel, Gasoline (polycyclic aromatic hydrocarbons)



# Storm Water Pollution Areas

What

- Parking Lots, Highways/Streets, Rooftops
- Golf Courses, Lawns, Pet Parks

Who

- NPDES Stormwater Permits:
- MS4s, Industrial, Construction
- CAFOs

Sources



- ✓ Trout/Salmon bearing
- ✓ Endangered species
- ✓ Eutrophic water bodies
- ✓ Beaches/Recreational
- ✓ TMDL designated streams

Priority Areas

# Stormwater Treatment BMPs

- Biofilters
- Passive Treatment Systems
- Active Treatment Systems
- Vaults/Black Box
- Chemical Treatment
- Stormwater Ponds

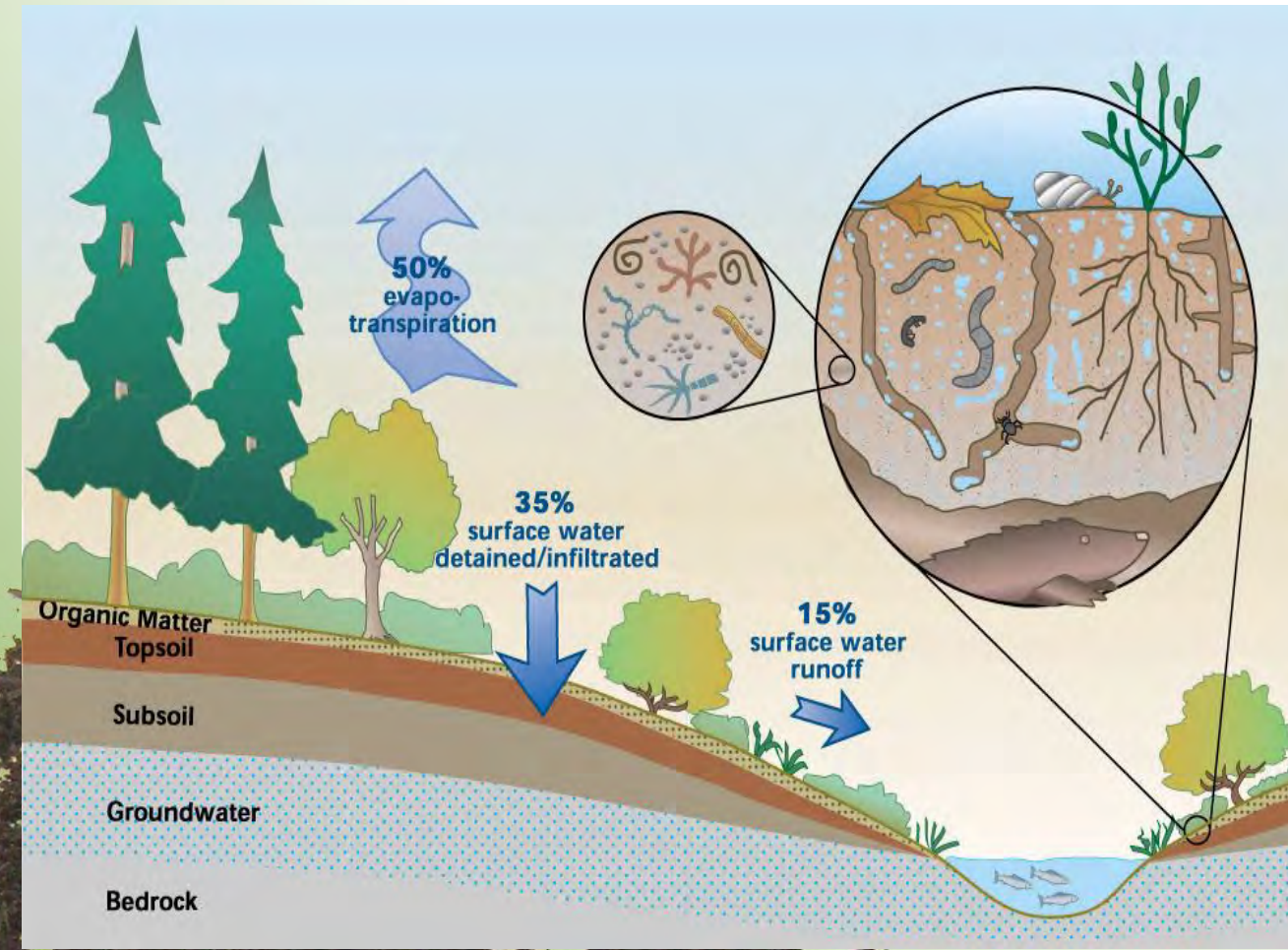




# LID/Green Infrastructure *Design*

## How?

1. Interception
2. Transpiration
3. Infiltration
4. Evaporation
5. Surface Roughness
6. Flow Path Disruption
7. **Biofiltration**





# Compost Tools

## Filter Media

- Designed for Optimum Filtration & Hydraulic-flow



## Growing Media

- Designed for Optimum Water Absorption & Plant Growth









# 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. Sediment Trap
10. Pond Riser Pipe Filter

## Low Impact Development

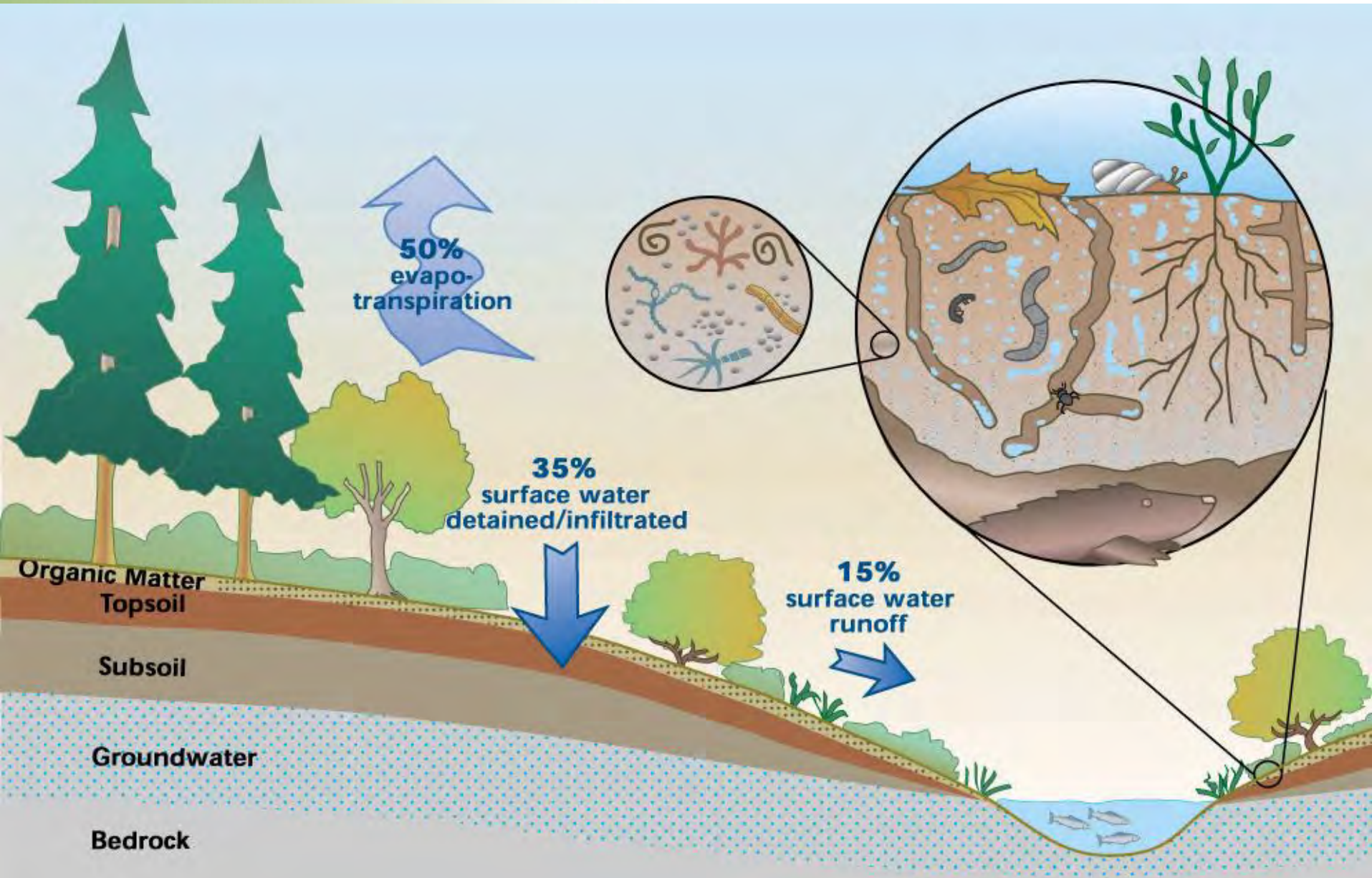
11. Runoff Control Blanket
12. Vegetated Filter Strip
13. Engineered Soil
14. Channel Liner
15. Streambank Stabilization
16. Biofiltration System
17. Bioretention System
18. Green Roof System
19. Living Wall
20. Green Retaining Wall
21. Vegetated Rip Rap
22. Level Spreader
23. Green Gabion
24. Bioswale

# Sock Specifications

Diam.	8 in	12 in	18 in	24 in	32 in
Weight	13 lbs/ft	32 lbs/ft	67 lbs/ft	133 lbs/ft	200 lbs/ft
Flow	7.5 gpm/ft	11.3 gpm/ft	15 gpm/ft	22.5 gpm.ft	30 gpm/ft
Mesh openings	1/8 – 3/8 in	1/8 – 3/8 in	1/8 – 3/8 in	1/8 – 3/8 in	1/8 – 3/8 in



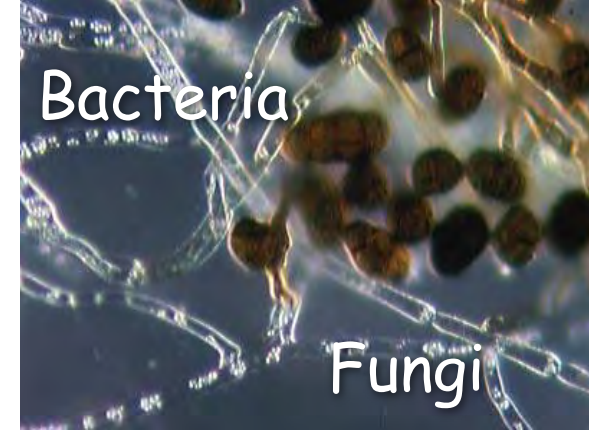
# Natural Stormwater Management



# Compost Sock

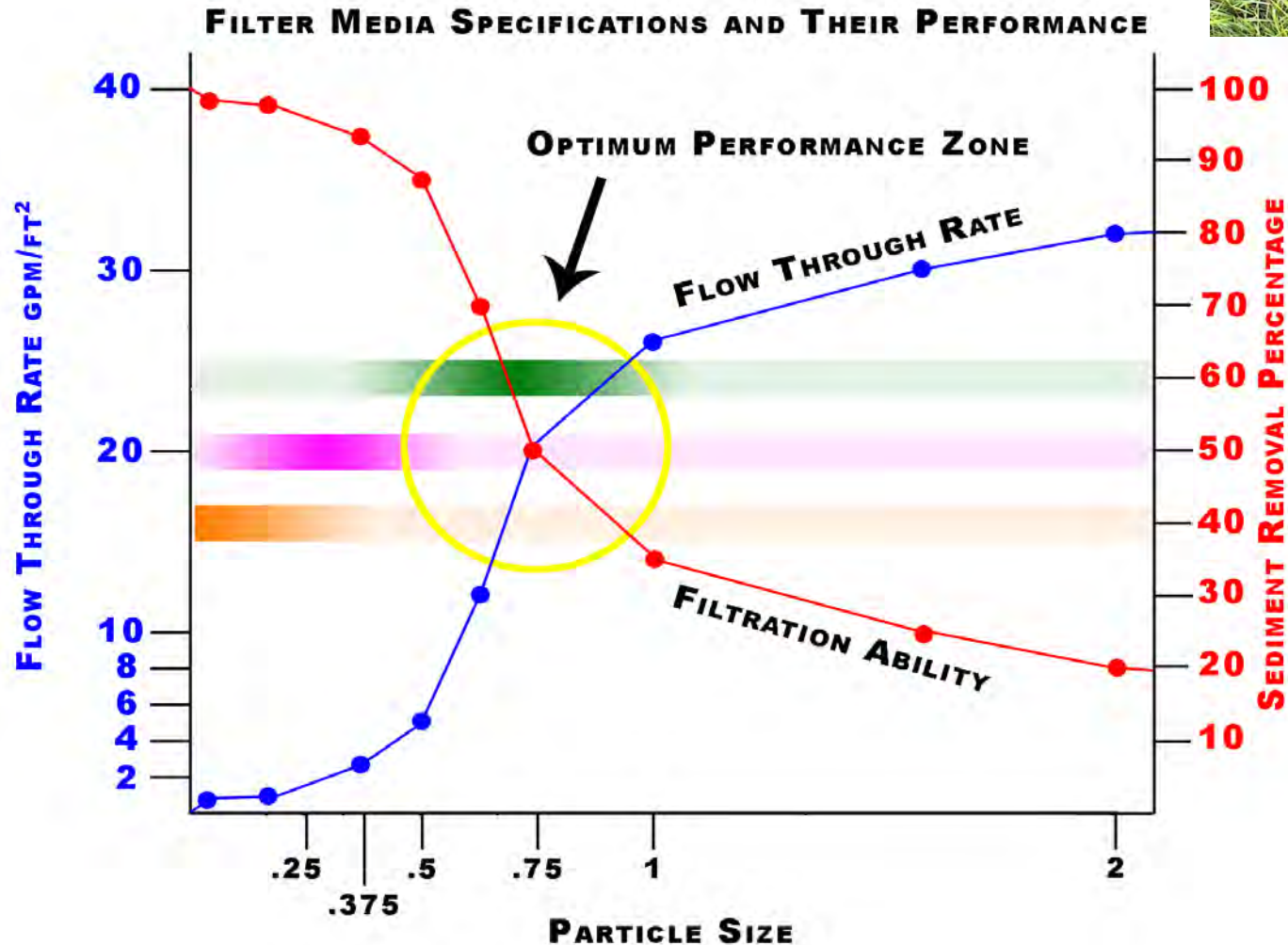
## 3-Way Biofiltration

- 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





# Particle Size Specifications








(Bio) Filtration  
Devices use  
Filter Media



# TS Reduction of Sediment Barriers

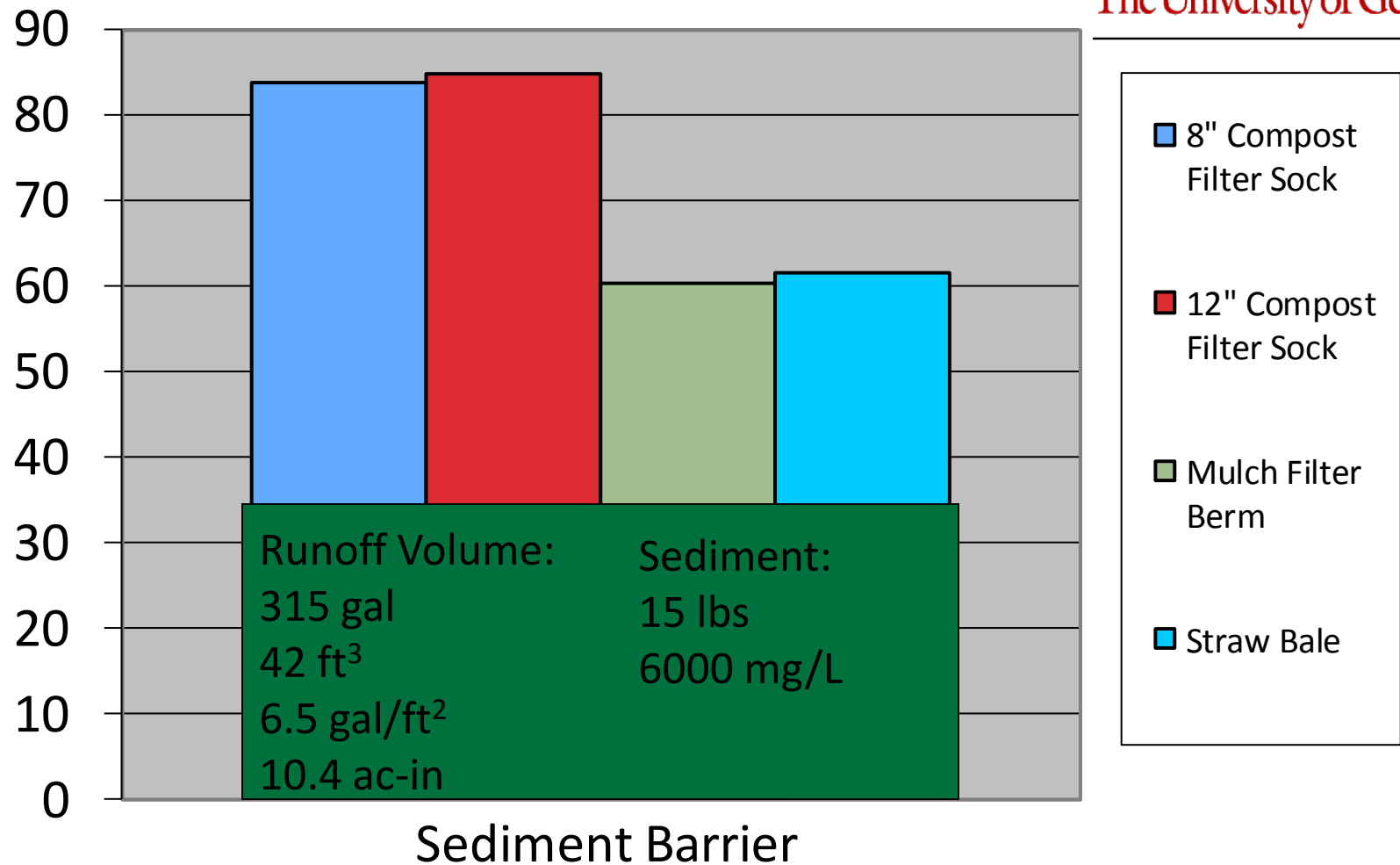
 SAN DIEGO STATE UNIVERSITY	Runoff Exposure	Sediment Exposure	Removal
Filter Sock	<ul style="list-style-type: none"><li>•260 gal</li><li>•1.7 g/ft<sup>2</sup></li><li>•2.75 ac-in</li></ul>	<ul style="list-style-type: none"><li>•850 lbs</li><li>•150 lbs/ft<sup>2</sup></li><li>•125 t/a</li></ul>	77%
Silt Fence	<ul style="list-style-type: none"><li>•260 gal</li><li>•1.7 g/ft<sup>2</sup></li><li>•2.75 ac-in</li></ul>	<ul style="list-style-type: none"><li>•850 lbs</li><li>•150 lbs/ft<sup>2</sup></li><li>•125 t/a</li></ul>	72%
Straw Wattle	<ul style="list-style-type: none"><li>•260 gal</li><li>•1.7 g/ft<sup>2</sup></li><li>•2.75 ac-in</li></ul>	<ul style="list-style-type: none"><li>•850 lbs</li><li>•150 lbs/ft<sup>2</sup></li><li>•125 t/a</li></ul>	59%

ASTM 6459 for RECPs

# % TSS Reduction of Sediment Barrier



The University of Georgia



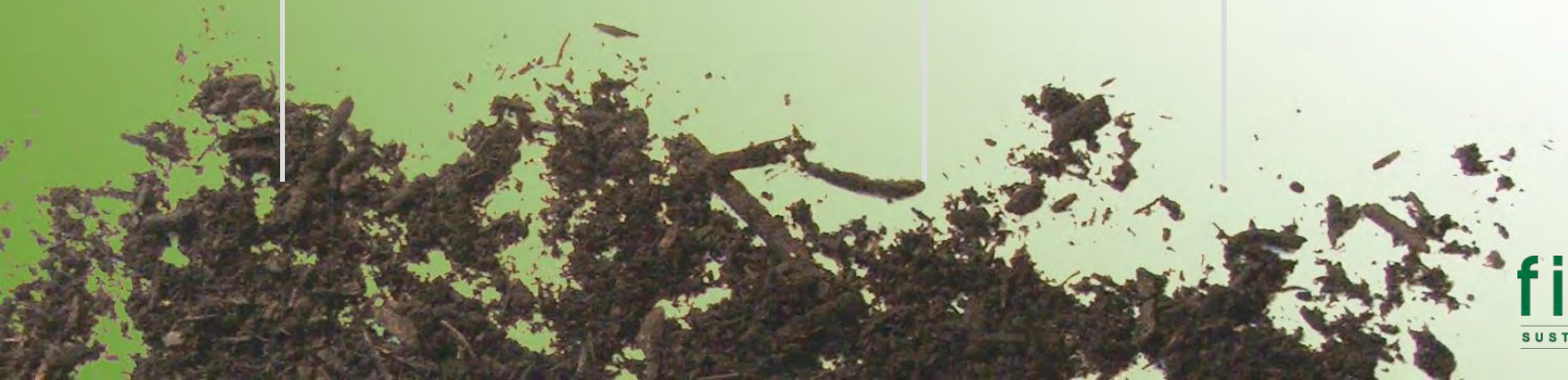
# Sediment Summary



## % Reduction of TSS & Turbidity

Treatment	TSS	Turbidity
Silt Fence	67	52
Filter Sock	78	63

\* Based on rainfall of 3.0 in/hr for 30 min; runoff sediment concentration (sandy clay loam) of 70,000 mg/L.





# Stormwater Pollutant Removal w/ Filter Socks

- Britt Faucette<sup>1</sup>, Fatima Cardoso<sup>1&2</sup>,  
Eton Codling<sup>2</sup>, Carrie Green<sup>2</sup>, Dan Shelton<sup>2</sup>,  
Yakov Pachepsky<sup>2</sup>, Gregory McCarty<sup>2</sup>, Andrey  
Guber<sup>2</sup>

1. Filtrex International, Atlanta, GA;
2. USDA-ARS, Beltsville, MD



# Compost + Additives

- To target specific runoff pollutant
  - Fine Sediment
  - Nutrients (N & P)
  - Bacteria
  - Metals
  - Petroleum Hydrocarbons

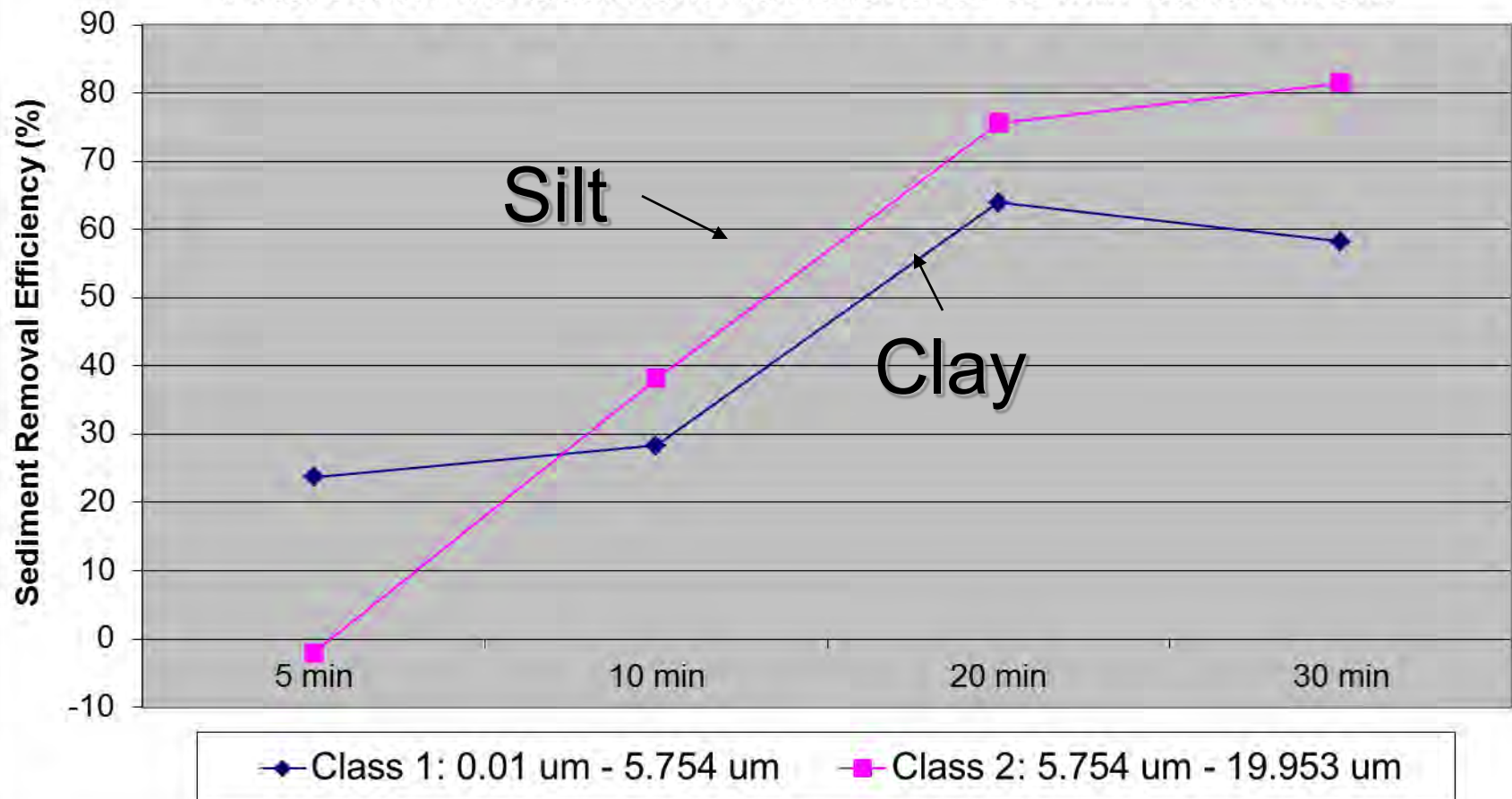




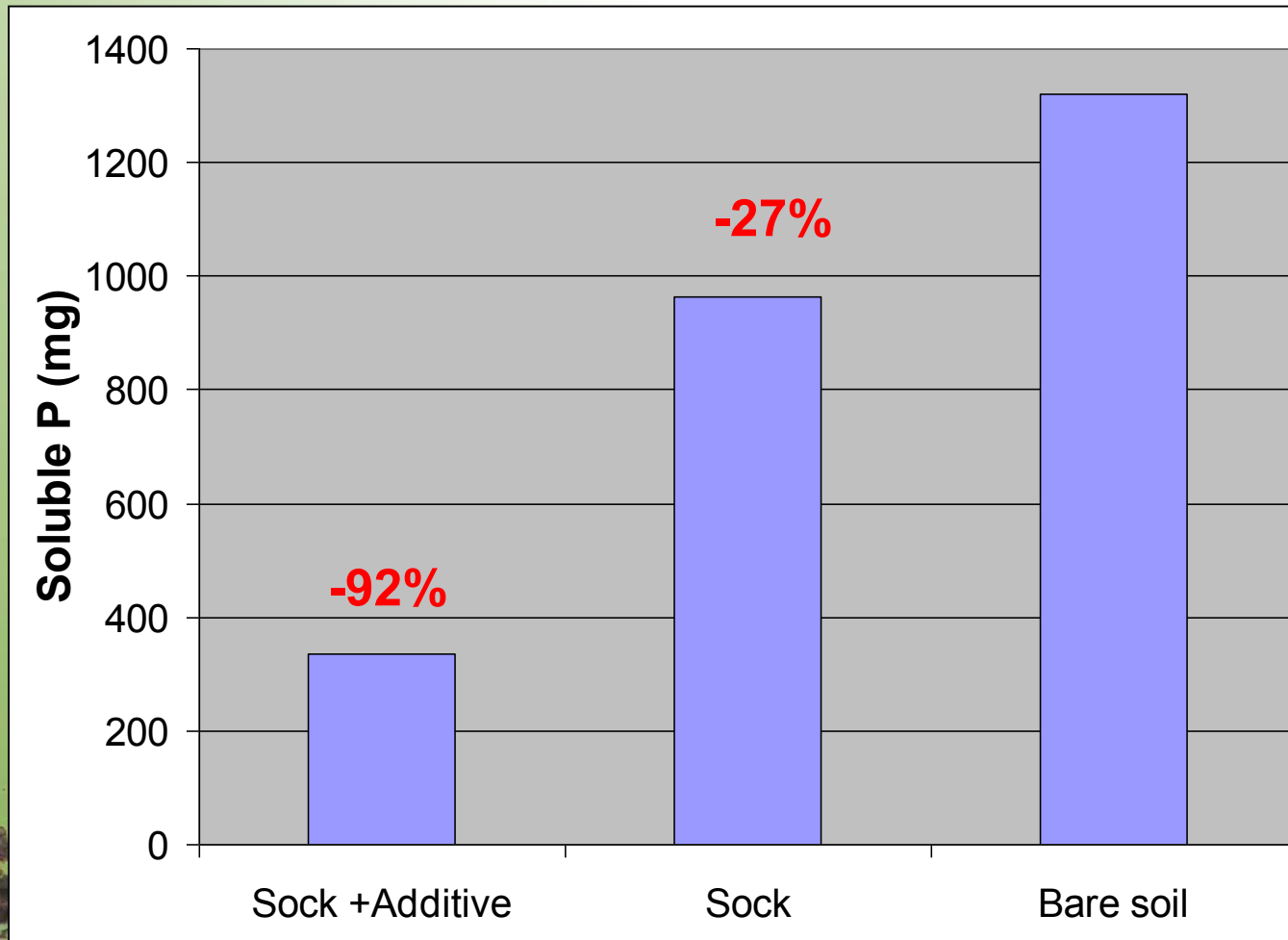
# Fine Sediment Removal



FilterSoxx Fine Sediment Removal over 30 min Runoff Event



# Soluble P



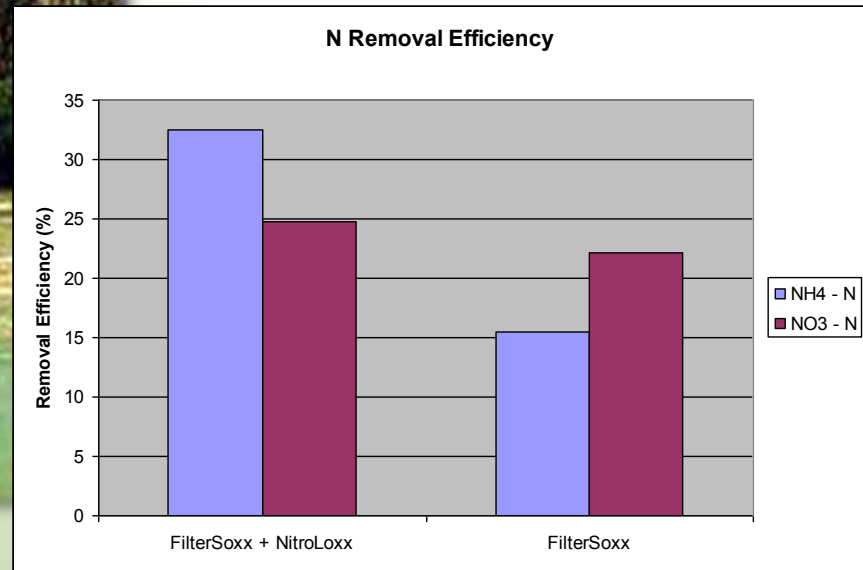


# Nitrogen Removal

## Runoff N

**NH<sub>4</sub>-N =  
85 mg (5.6 mg/L)**

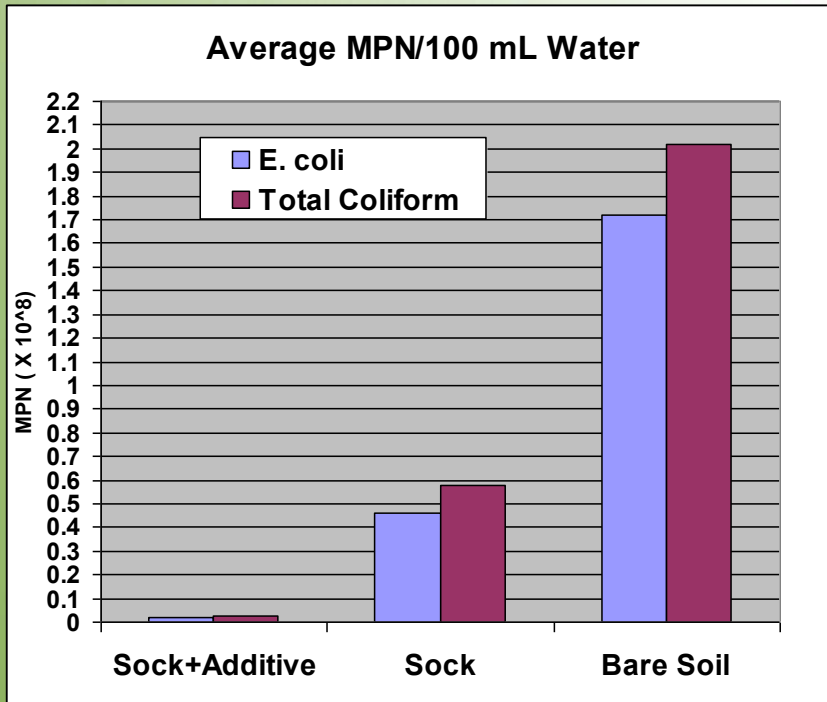
**NO<sub>3</sub>-N =  
72 mg (4.8 mg/L)**



+ Additive

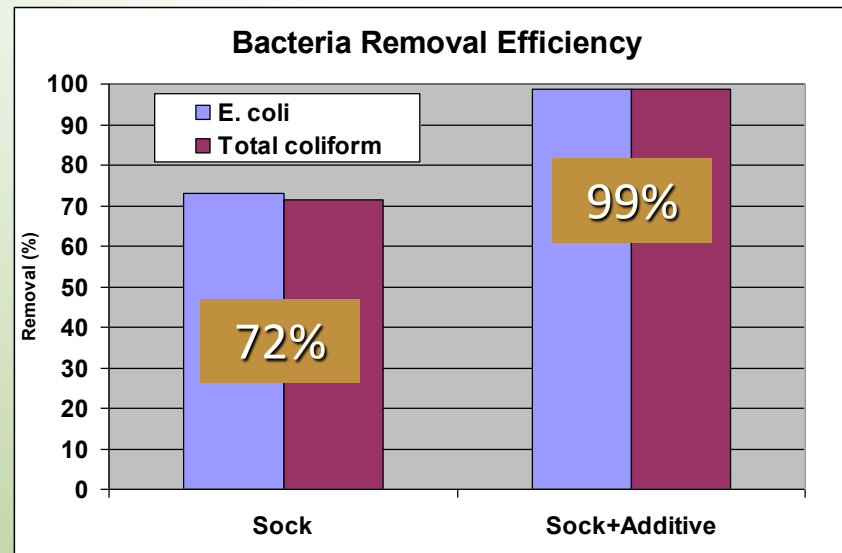
Filter Sock

# Bacteria Removal



## Bacteria (MPN) Exposure

- Total coliform – 200 million/100 mL
- E. coli – 170 million/100 mL
- *Typical* – 50,000/100 mL

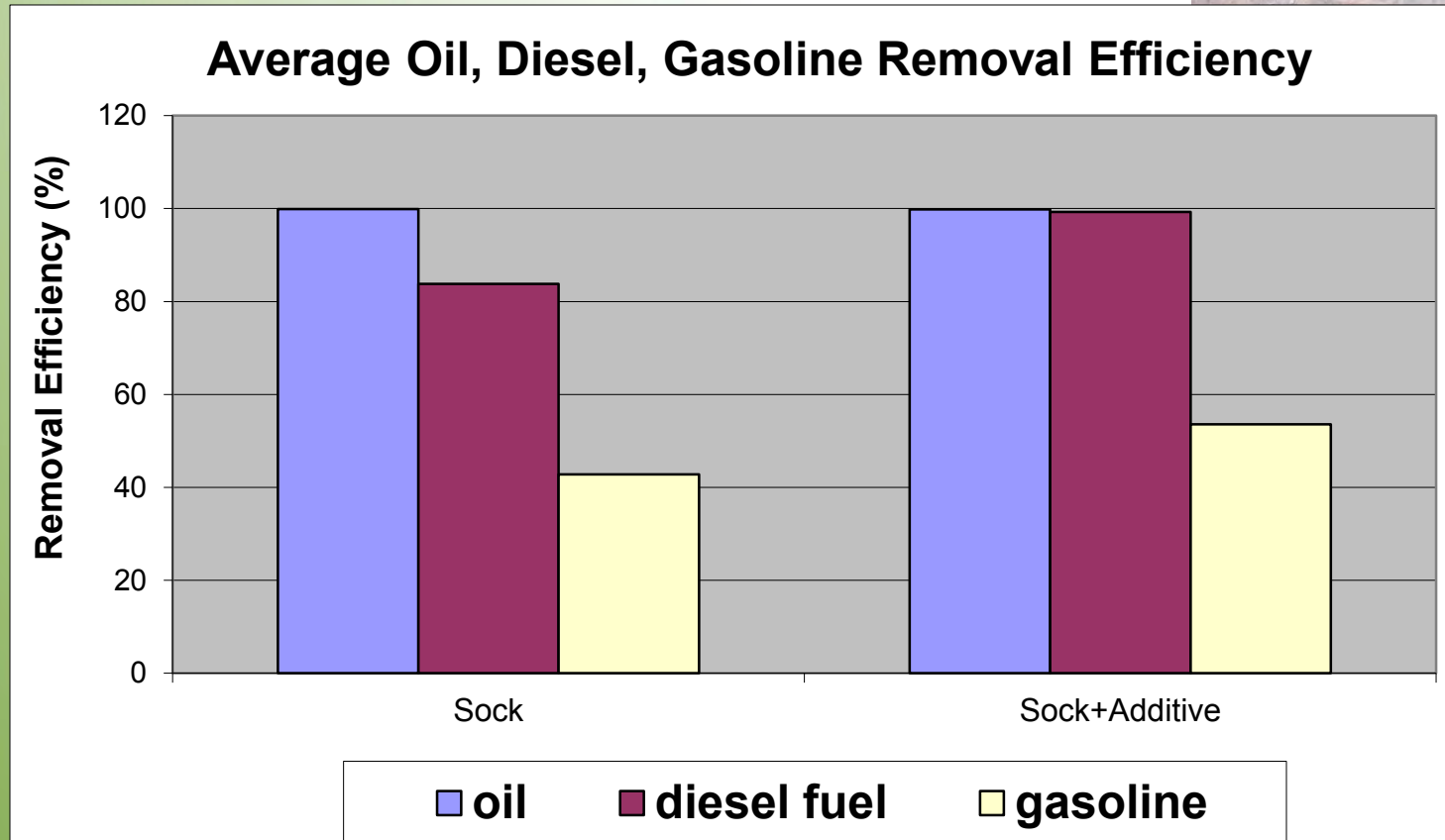




# Metals Removal

		METALS (water extractable)					
Treatment	Parameters (mg)	Cd	Cr	Cu	Ni	Pb	Zn
FS + MetalLoxx	Applied	7.915	6.740	7.320	8.070	6.025	6.545
	Soil Surface	0.004	0.019	6.491	0.144	0.154	2.028
	Total	7.919	6.759	13.811	8.214	6.179	8.573
	Transported to Soxx	0.812	0.490	1.640	1.056	0.937	1.669
	Runoff Water	0.210	0.221	0.383	0.301	0.144	0.621
	Removal Efficiency*	72	29	70	69	79	57
	Runoff Sediment	0.014	0.039	0.122	0.029	0.105	0.161
	Removal Efficiency*	77	78	45	63	61	47
	Total Runoff	0.224	0.260	0.505	0.330	0.249	0.782
	<b>Removal Efficiency (%)</b>	<b>73</b>	<b>47</b>	<b>70</b>	<b>69</b>	<b>73</b>	<b>53</b>
*Relative to Bare Soil w/out Treatment							

# Petroleum Hydrocarbons



- Runoff Concentrations = 1,400 mg/L (motor oil), 5,400 mg/L (diesel), and 74 mg/L (gasoline)
- Runoff Loads = 20,820 mg (motor oil), 77,440 mg (diesel), and 1070 mg (gasoline)



# City of Chattanooga



Analysis	2-1-2007 (Pre-retrofit)	6-8-2007	8-30-2007	12-13-2007	3-19-2008	1-28-2009	7-28-2009	% Reduction
COD	1600 mg/L	259 mg/L	255 mg/L	125 mg/L	125 mg/L	405 mg/L	214 mg/L	75-93
TSS	1370 mg/L	208 mg/L	38 mg/L	18 mg/L	24 mg/L	249 mg/L	177 mg/L	82-99
Oil/Grease	107 mg/L	27 mg/L	N/A	N/A	5 mg/L	18 mg/L	37 mg/L	65-95

Diagram illustrating a laboratory filtration system. The components labeled are:

- (1) with arrow (1)
- (2) with arrow (2)
- Filtered liquid
- Support system
- Overflow
- H<sub>2</sub>O<sub>2</sub> housing
- Filter Cartridge
- Extractor (under filter)
- Filter holder (under filter)
- Capillary sediment cover
- Track and return
- Filtered liquid (out)



- Filter max flow rate = 35 gpm
- Designed overflow system = > 500 gpm
- Uses Compost Filter Media
- Replaceable filter cartridge



# The *Sustainable* BMP

- 100% Recycled (compost)
- Bio-based, organic materials
- Locally manufactured
- Reduces Carbon Footprint
- Uses Natural Principles - *Biomimicry*  
(Natural Capital & Ecosystem Services)
- High Performance



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