Erosion Control Solutions for Soil Management and Vegetative Establishment

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Key Erosion Control Objectives

1. Soil stabilization
2. Establish sustainable vegetation
3. Minimize environmental impact of site development

Holistic Approach to Erosion Control

1. Understanding soil profile
   - "P" factor
2. Site conditions – elevations, timing & weather
   - Plant selection
3. Correct product selection for stabilization and vegetation
   - Site maintenance

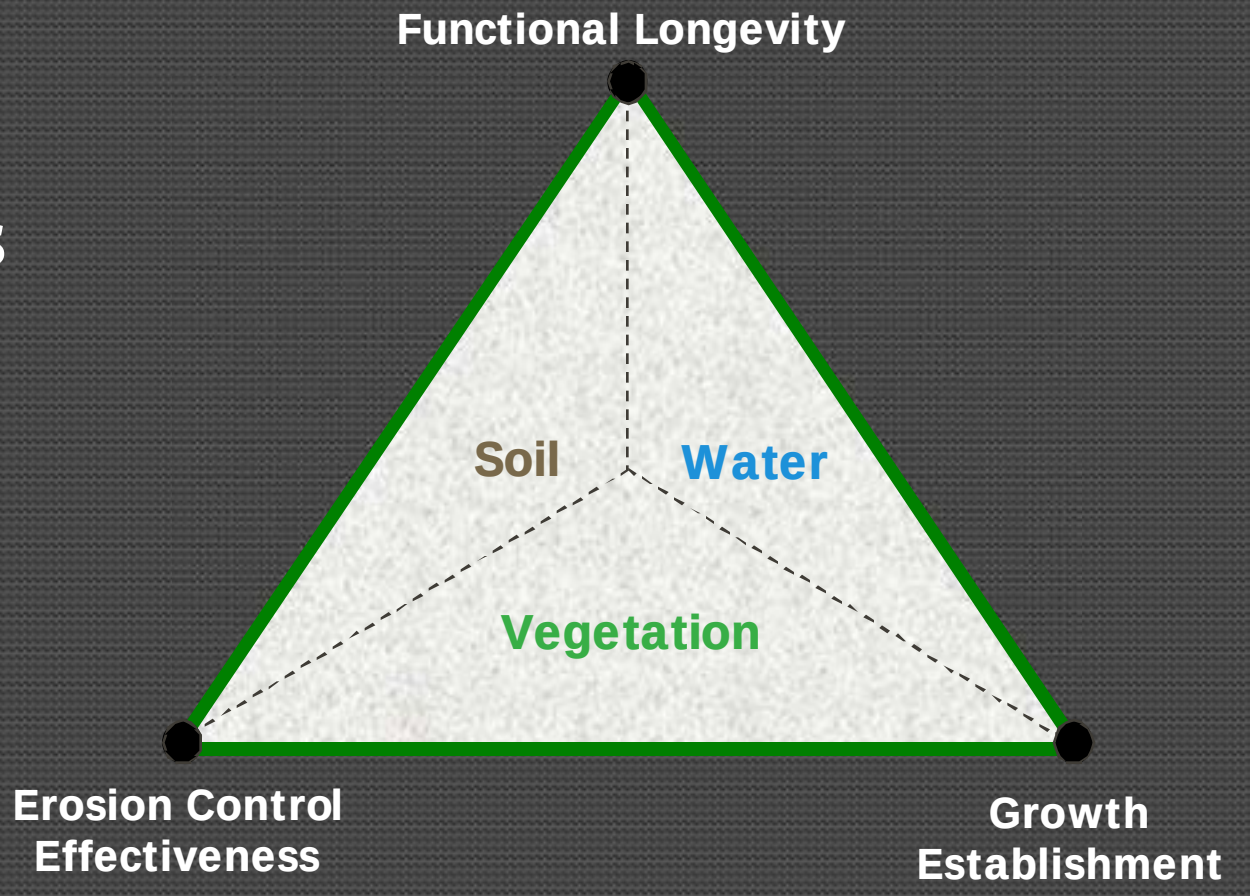
Establishing vegetation requires balancing

NATURAL VARIABLES

and

PRODUCT BENEFITS

to create the best environment for the plants



"Product Selection Triangle"


Environmental accountability
by implementing proactive BMP's

Basic Erosion Control Product Terminology

RECP – Rolled Erosion Control Products
HECP – Hydraulic Erosion Control Products
TRM- Turf Reinforcement Mats
HM – Basic Hydraulic Mulch Products
SMM – Stabilized Mulch Matrix
BFM – Bonded Fiber Matrix
EFM – Engineered Fiber Matrix
FRM – Fiber Reinforced Matrix
ET-FRM – Extended Term Fiber Reinforced Matrix

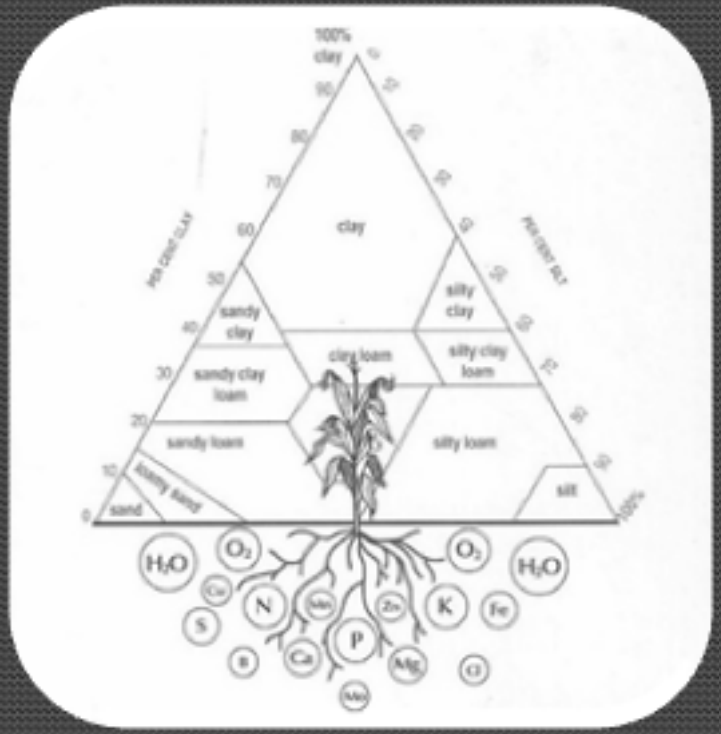
Agronomic Considerations

- Vegetation is critical to long-term erosion control
- Enhance germination by providing the plant what it needs during first stages of growth
- Assure long-term plant survivability
- Establishment of healthier vegetation and less nutrient run-off

Soil Analysis

Critical for establishing sustainable vegetation

Soil Test – Key Factors



- Organic Matter
- pH
- Electrical Conductivity
- Total Dissolved Salts
- Sodium Absorption Ratio
- % Organic Acids
- Cation Exchange Capacity (CEC)
- Nitrogen, Phosphate & Potassium (N, P, and K)

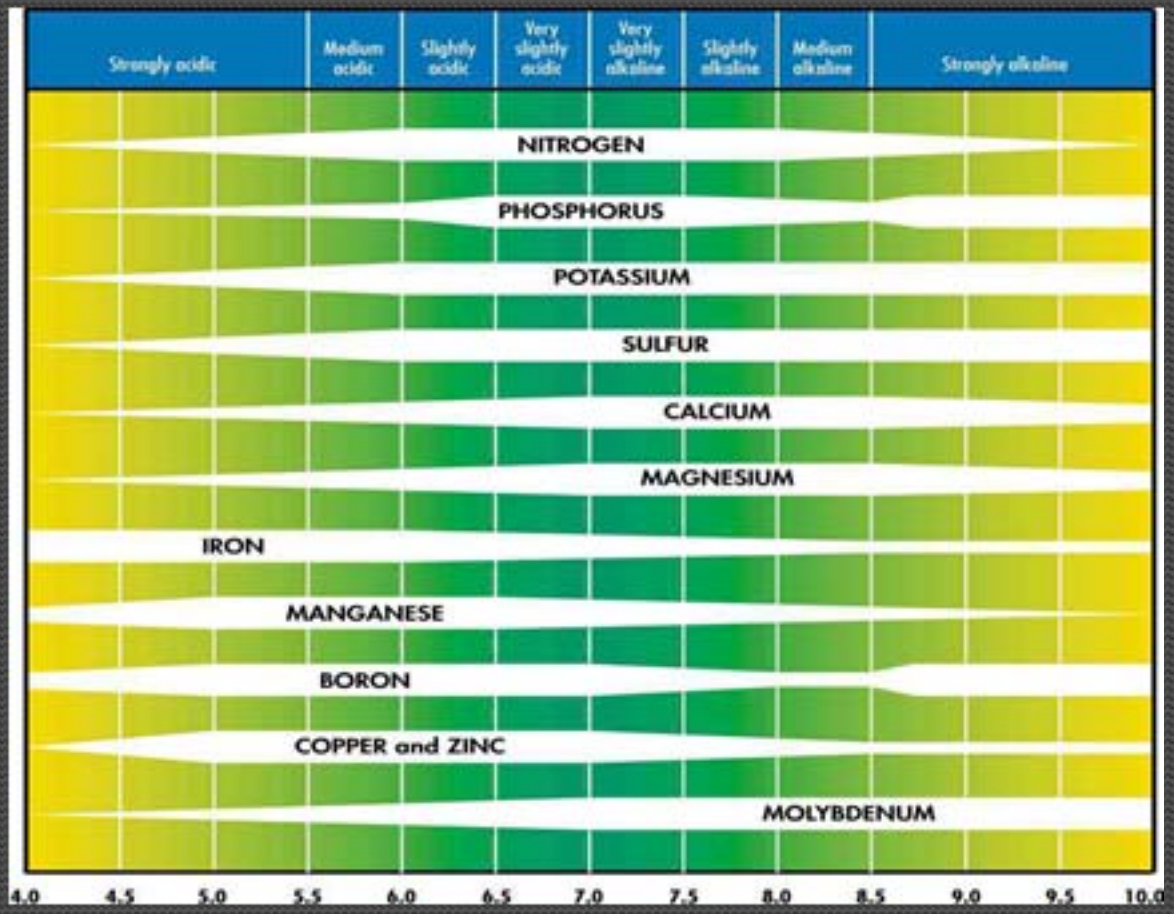
Benefits of a Soil Test

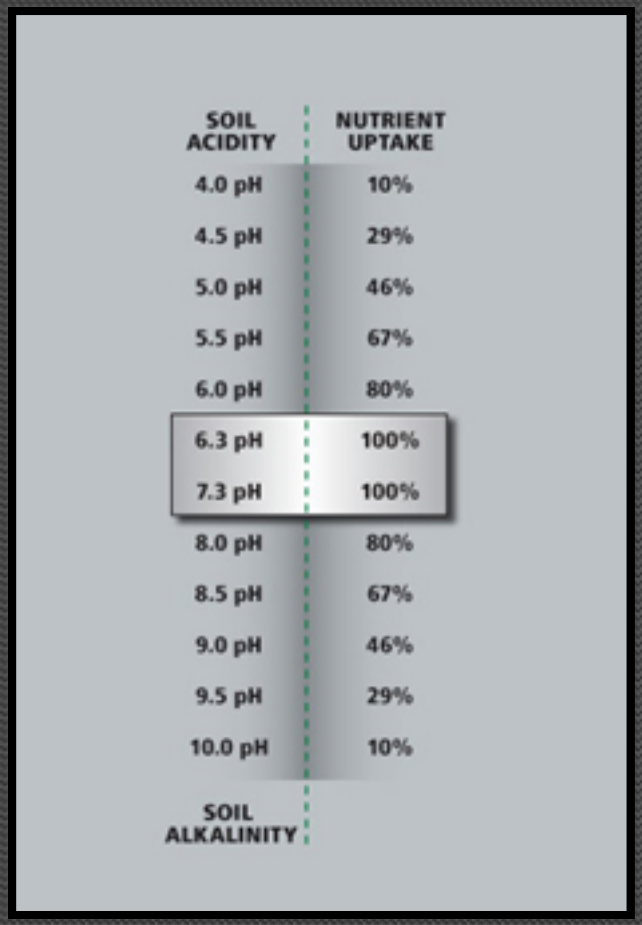
- Evaluate soil fertility
  - Measure soil's ability to supply essential elements
- Provide a basis for amendment recommendations
- Help ensure appropriate plant species selection
- Predict probability of desired outcome
  - optimal vegetation growth!

pH

- As pH deviates farther away from neutral, either to the acidic or alkaline side, less nutrients are available for plant uptake
- Calcium, Magnesium, Potassium uptake significantly decreased at less than 5.5 pH
- Aluminum Toxicity negatively impacts root growth Less than 5.0 pH
- Manganese Toxicity – plant tissue
- Iron Toxicity– can cause stunted growth

How pH Affects Nutrient Uptake





Grass Species pH Tolerance

	Minimum pH	Maximum pH
Fescue	5.0	8.5
Bentgrass	5.0	7.5
Creeping Bentgrass	5.0	7.5
Bluegrass	5.0	8.4
Bermudagrass	5.0	8.0
Perennial ryegrass	5.2	7.5
St. Augustine	6.5	7.5
Paspalum	6.4	10.5

Relationship between pH and fertilizer utilization

Acidity	Fertilizer wasted
4.5 pH	71%
5.0 pH	54%
5.5 pH	33%
6.0 pH	20%
7.0 pH	0%

Organic Matter

- Soil organic matter is a complex and varied mixture of organic substances
- Soil organic matter, can be divided into two components:
  - The recognizable organic material
  - Humus
- For our purposes soil organic matter is defined as the percent of humus in the soil

Organic Matter

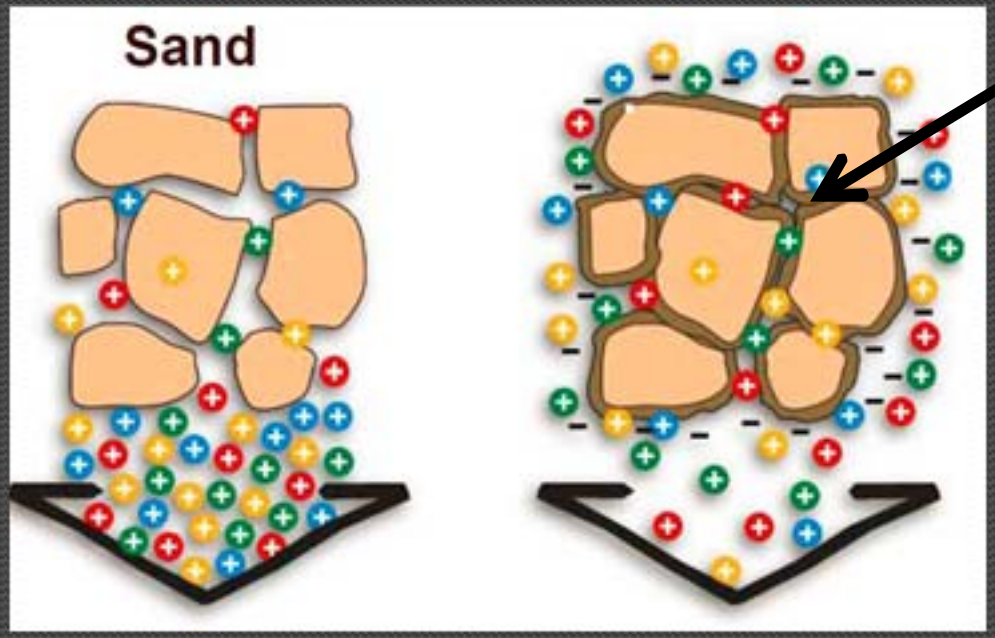
Should be greater than 2%

Can be chemically modified and/or import top soil

Humic Acid

- Helps break up clay and compacted soils
- Enhances water retention, reducing soil solution evaporation
- Improves root development and penetration through soil
- Improves transfer of macro & micro nutrients
- Stimulates the development of micro-flora populations

Humic substances provide the Cation Exchange Capacity (CEC) that a Sand, Sandy Loam or Loamy Sand may lack.

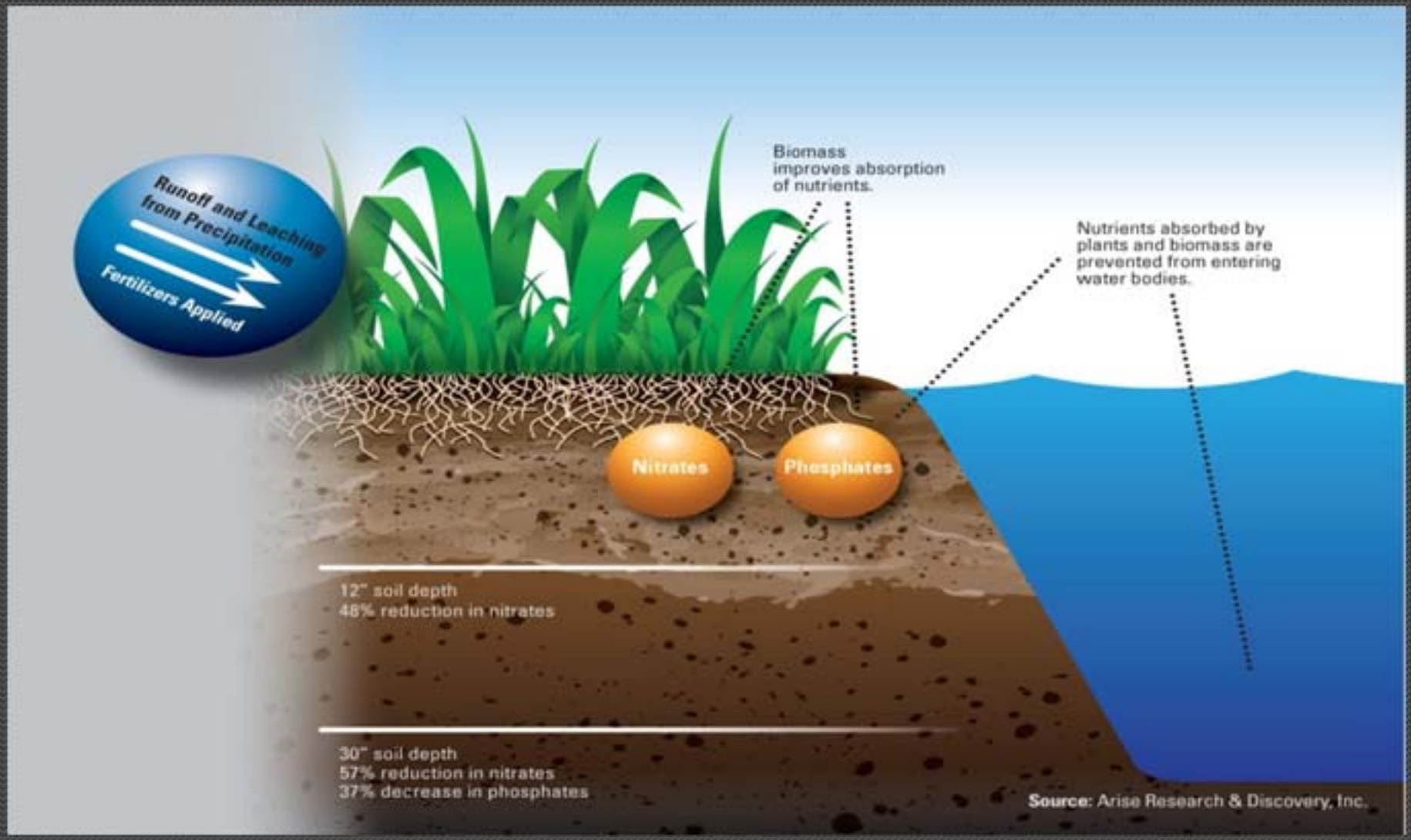


Biological growth stimulants can help

Fertilizer Alone

Fertilizer plus growth stimulant

Proactive Soil Modification is a BMP



Key Objectives in soil management for site development

- Focus on erosion control measures / backfilling with sediment management BMP's
- Understanding hydraulic flows - designing cost effective conveyances – stabilizing shorelines and channel flows
- Systems to minimize turbidity in transference – critical discharge points
- Stabilizing soils and effective vegetation establishment – understanding soil profile / plant selection

Past erosion practices – will not meet today's standards

Revised Universal Soil Loss Equation (RUSLE)

A = R x K x LS x C x P

A = computed soil loss per unit area per unit time for a given storm period and intensity

R = rainfall factor

K = soil erodibility factor

L = slope length factor

S = steepness factor

C = vegetation or cover factor

P = erosion control practice factor

"C" FACTOR IS CRITICAL FOR EROSION MANAGEMENT

The lower the "C" Factor or (Cover Factor) an erosion control medium has better control of soil loss

High "C" Factor

Low "C" Factor

“P” Factor can significantly impact soil loss

Practice	“P” Factor
Compact and Smooth	(1.2)
Loose disked plowed	(1.2)
Loose with rough surface 12” depth	(.8)
Raked with Bulldozer across slope	(.9)
Rough surface tracks all directions	(.9)
Tracked up and down slope	(.7)
Loose disked plowed	(1)

What is good and bad about this picture?


Proper soil preparation can reduce sediment loss greater that 50 percent.

Grassing Options

Straw Mulch

<u>Advantages</u>

Low cost seeding practice

Fast way of distributing seed and mulching

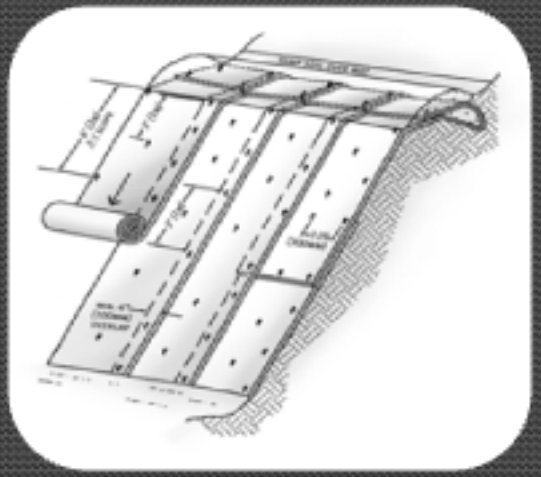
<u>Disadvantages</u>

Poor erosion control qualities

Weed seed contamination

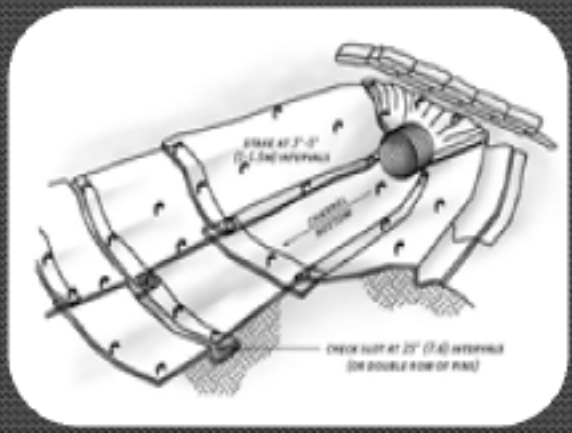
Messy and can blow away

Erosion Blankets – Picking the right one is critical



Slope Applications

Wide range of choices: strength, longevity and materials



Channel Applications

Proper installation, staple patters and grading are critical for success

Good soil to blanket contact is critical!

Turf Reinforcement Mats that grow grass can be a great green alternative to traditional rip rap

Hydraulically applied blankets like FRM's, FGM's, BFM's and SMM's are a very effective way to stabilize slopes

Hydraulically-Applied Erosion Control Products

- Customized to site specific conditions
- Minimal labor required
- Economical way to control erosion and establish vegetation
- Wide range of performance platforms
- Safe for environment

Varity of Hydraulically Applied Mulch Products

Seeding Mulches

- Cellulose
- Cellulose / tack
- Blend
- Blend with tack
- Pelletized fiber
- Straw fiber
- Wood Fiber
- Wood with Tack

Erosion Control Mulches

- Stabilized Mulch Matrix (SMM)
- Bonded Fiber Matrix (BFM)
- Engineered Fiber Matrix (EFM)
- Fiber Reinforced Matrix (FRM)

NOT ALL PRODUTS PERFORM THE SAME

Two major types of Hydraulic Seeding Machines

- Mechanical agitated machines
  - Have paddles to mix slurry in the tank. Can apply a wide range of fiber mulch materials

- Jet agitated machines
  - Generally smaller machines that mix slurry with jets. They have difficulty pumping paper-based mulch materials

Common Hydroseeding Equipment

Mix HECP's into hydro-seeder, add seed, fertilizer and soil modifiers then shoot from hose or cannon

HECP categories Requirements:

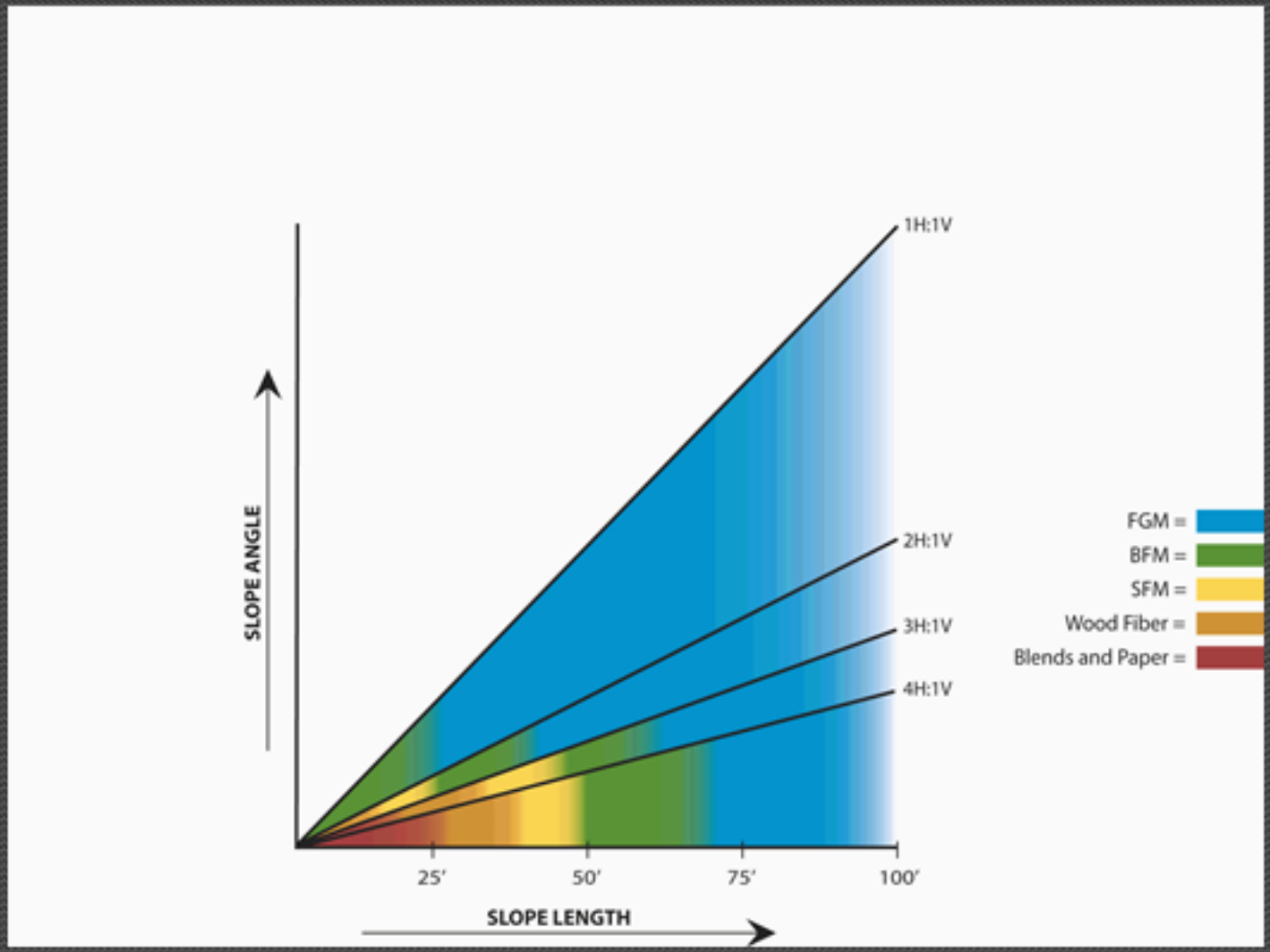
A. The selected HECP shall be 100% biodegradable via ASTM D5338, non-toxic with an LC50 > 100% via EPA 2021.0 and conform to the property values presented in Table 1.

Table 1: HECP Property Values

Type	Minimum Functional Longevity[3] (months)	Slope App. Limit (_H:1V)	Slope Interruption Limit (ft, m)	Minimum Erosion Control Percent Effectiveness (%)	Minimum Vegetation Establishment (%)	Minimum Water Holding Capacity (%)	Minimum Wet Bond Strength (lb/ft, N/m)	Thickness (in, mm)
Test Method	*ASTM D5338*	*UWRL[2]*	*UWRL[2]*	*UWRL[2]*	*ASTM D7322[1]*	*ASTM D7367*	*ASTM D6818[1]*	*ASTM D6525[1]*
HM	1	3	25, 7.6	50	200	1000	0	n/a
SS	2	1	30, 9.1	65	100	1200	3.0, 44	0.03, 0.8
SMM	3	2	50, 15	85	400	1300	4.5, 66	0.1, 2.5
BFM	6	1	75, 22.9	90	600	1400	6.0, 88	0.12, 3.0
FGM-HP	12	0.25	100, 30.5	99	800	1700	9.0, 131	0.22, 5.6
ET-FGM	18	0.25	125, 38.1	99	500	1600	7.5, 110	0.23, 5.7

1. ASTM test methods developed for Rolled Erosion Control Products and have been modified to accommodate Hydraulically-Applied Erosion Control Products.
2. Large scale testing conducted at Utah Water Research Laboratory. For specific testing information please contact a Profile technical service representative at 866-325-6262.
3. Functional Longevity is the estimated time period, based upon ASTM D5338 testing and field observations, that a material can be anticipated to provide erosion control and agronomic benefits as influenced by composition, as well as site-specific conditions, including; but not limited to – temperature, moisture, light conditions, soils, biological activity, vegetative establishment and other environmental factors.

Slope Protection Guidelines by Product Category



Confirm HECP Performance Base/Criteria for a QPL

Physical Properties*	Test Method	Units	Minimum Value
Mass/Unit Area	ASTM D6566[1]	g/m^2 (oz/yd^2)	407 (12)
Thickness	ASTM D6525[1]	mm (in)	5.6 (0.22)
Wet Bond Strength	ASTM D6818[1]	N/m (lb/ft)	131 (9)
Ground Cover	ASTM D6567[1]	%	99
Water Holding Capacity	ASTM D7367	%	1700
Material Color	Observed	n/a	Green
Performance Properties*	**Test Method**	**Units**	**Value**
Cover Factor[2]	Large Scale[4]	n/a	< 0.01
Percent Effectiveness[3]	Large Scale[4]	%	> 99
Cure Time	Observed	hours	0 - 2
Vegetation Establishment	ASTM D7322[1]	%	800
Environmental Properties*	**Test Method**	**Units**	**Typical Value**
Functional Longevity[5]	ASTM D5338	n/a	Up to 18 months
Ecotoxicity	EPA 2021.0	%	96-hr LC50 > 100%
Effluent Turbidity	Large Scale[4]	NTU	< 100
Biodegradability	ASTM D5338	%	100

Drilling down even more for better specifications

Third Party Testing Labs

- 6 ft x 30 ft test beds / Adjustable slopes
  - 2H:1V & 3H:1V
- Sand & clay soils
- Test both RECPs & HECPs

Third party testing can help verify product performance to help create performance driven specifications

Note effects from rainfall impact

Mulch Rate Makes a Big Difference in Results

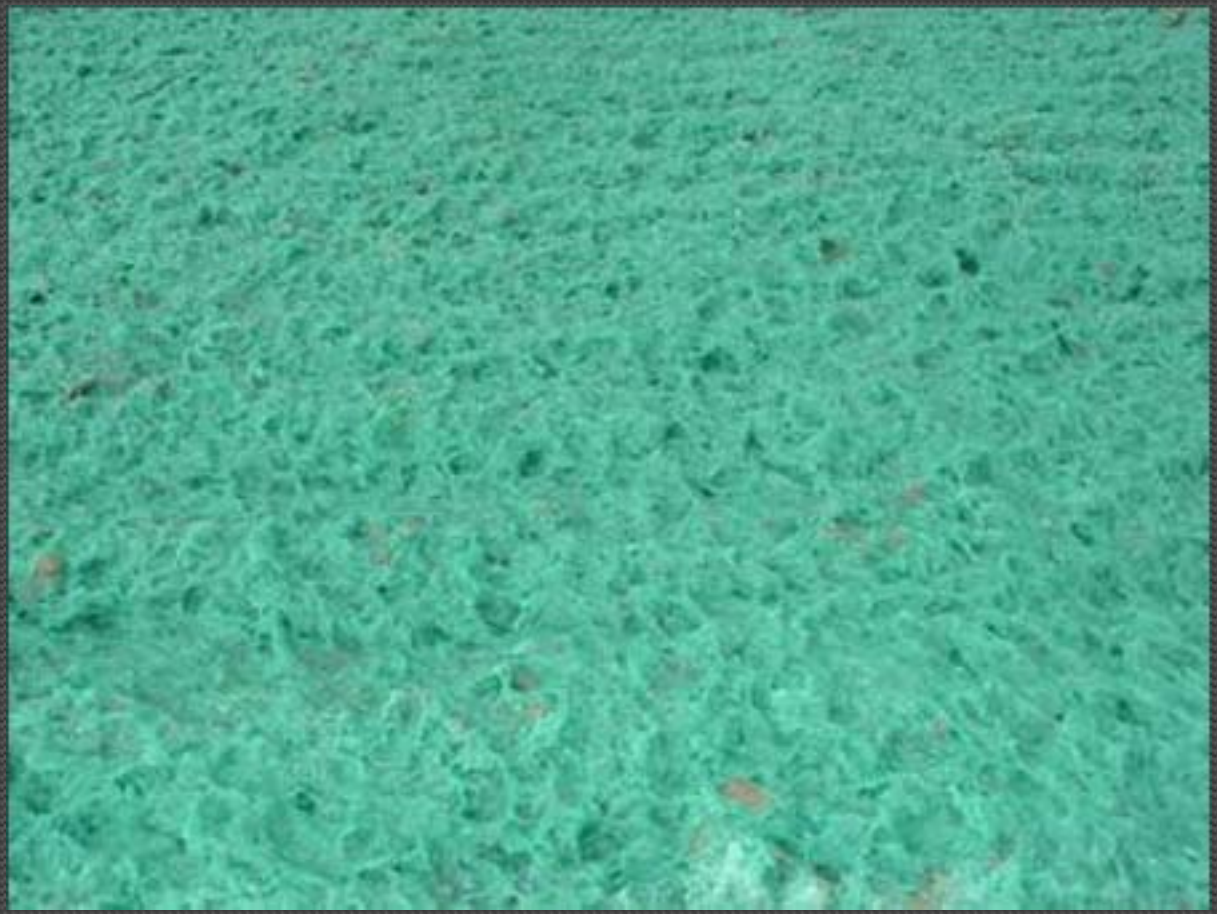
Test Plot 1 After 18 Days
(1,500 lbs. mulch)

Test Plot 2 After 18 Days
(2,250 lbs. mulch)

Test Plot 3 After 18 Days
(3,000 lbs. mulch)

HECP's are a very small part of the over-all project cost

Example of 3000 lb application rate



Good hydraulic specifications and product application = Great Results


03/22/2007

Golf Courses

Arial Seeding – Fire Restoration

Surface Mine Projects

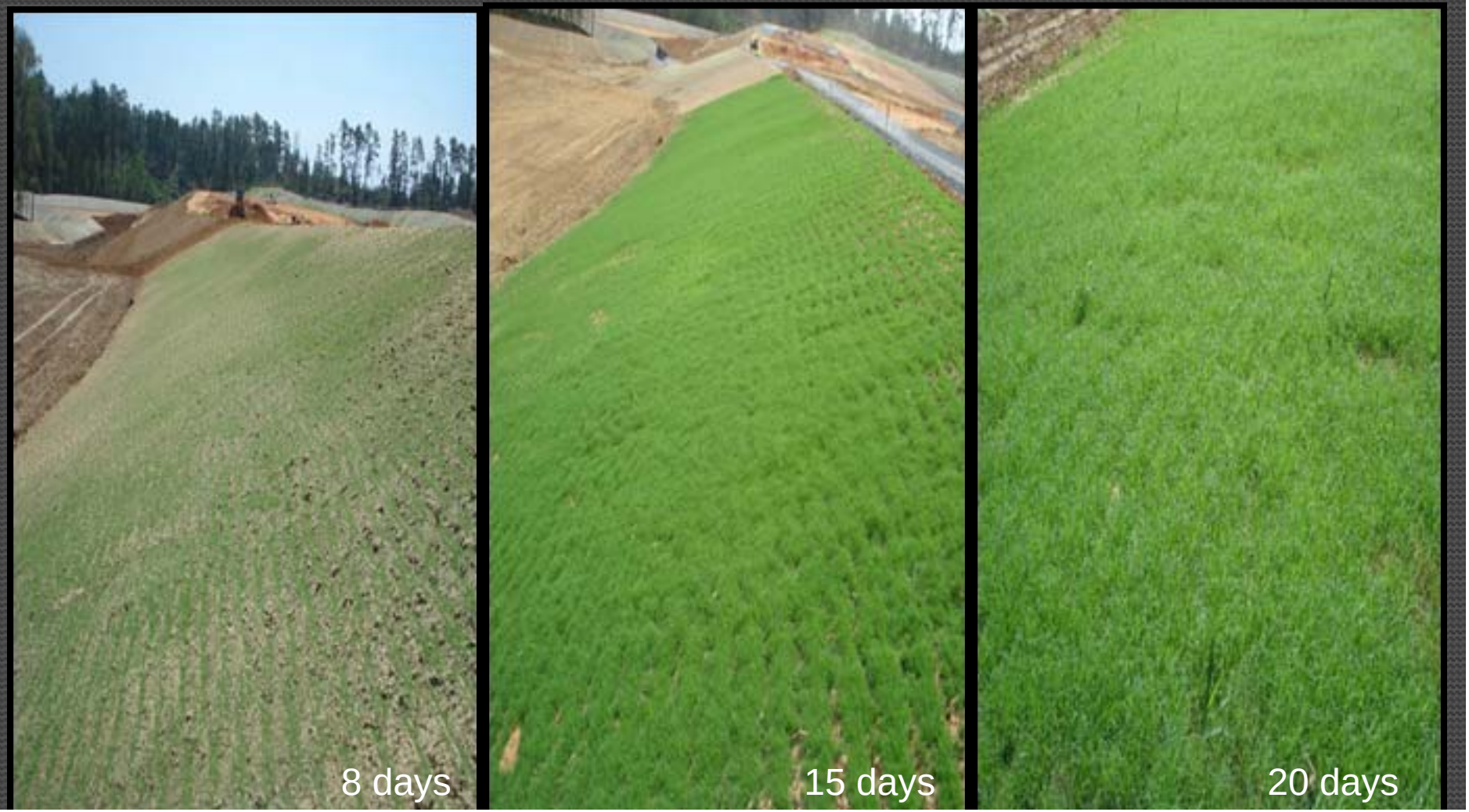
Bad specifications
Wrong seed mixes
Unfavorable soils
Poor applications

lead to disappointing and costly results!

More examples of poor planning and execution

Side by side testing of products can really show you what works best

Right grass, right hydraulic erosion control product and right soil preparation



Construction activity and nature can live in harmony with a little planning

QUESTIONS

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