Implementing and Maintaining Best Management Practices

Jonathan Koepke, CPESC, LEED-AP
Vice President, General Manager

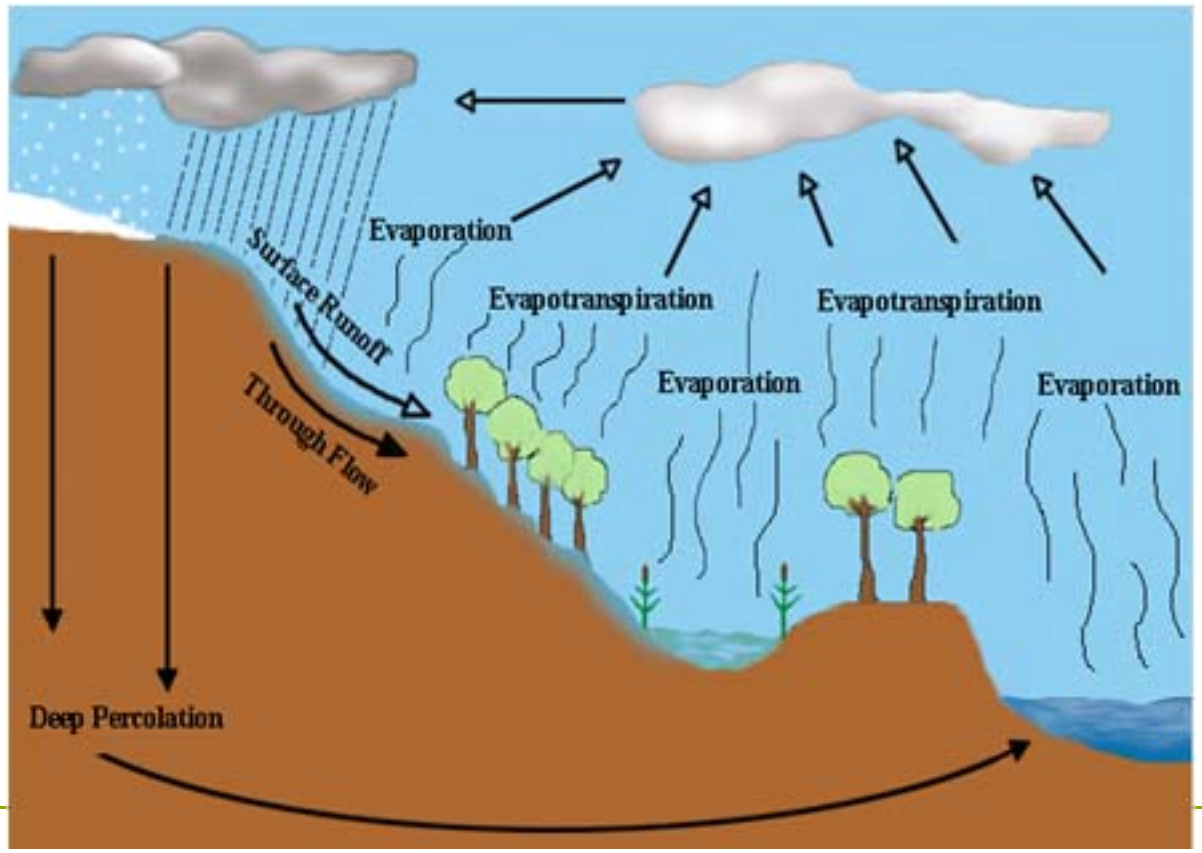
ENCAP, Inc.
Practical Land Improvement Solutions for Over 35 Years

Overview

- Understanding the Basics
  - Erosion Control Vs. Sediment Control
  - BMP Selection
  - Proper Installation
- Sediment Control BMPs
- Erosion Control BMPs
- Strategies for Problem Solving

The Basics

- **To understand how we impact and are impacted by water, the concept of the water cycle is key**



Graphics credit: Delaware Dept. of Natural Resources

Consistent Terminology – Erosion Vs. Sedimentation

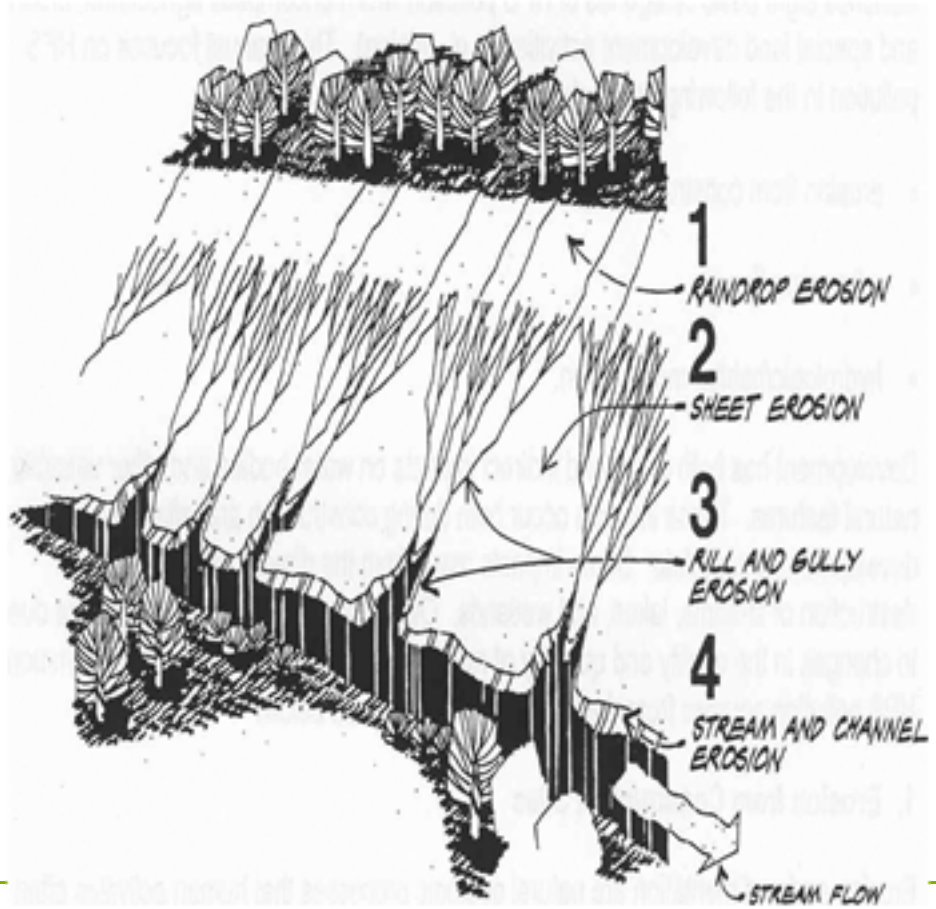
- Soil **erosion** is the process by which soil particles become detached by water, wind, or gravity and are transported from their original location.

Consistent Terminology – Erosion Vs. Sedimentation

- Sedimentation is the deposition of the eroded material

Understanding Types of Erosion Impacts BMP Selection

1. Raindrop erosion
2. Sheet erosion
3. Rill and gully erosion
4. Streambank and bed erosion
5. Wind erosion



Graphics credit IL Urban Manual

BMP Selection - What can this site teach us?

- Incorrectly applied erosion control can actually increase erosion
- For example: Silt fence should not be installed up and down slope
- Fiber rolls may have been used to break-up slope length

BMP Selection - Planning and Phasing

- Many erosion and sediment control practices are temporary, and are designed to be installed at different periods of the construction activity.
- Practices should be installed as they become appropriate and should not be delayed so that all measures can be installed at the same time.

BMP Implementation - Installation of Practices

- Ensure that you have a knowledgeable and reliable contractor installing erosion and sediment control measures

- Make sure that contractors are using products appropriately

The Two Most Important BMPs

- **Proper Communication and Coordination**
  - ✓ Engineer, Contractors, Sub-Contractors, Land Development, House Line, Utility Employees, Regulators, and Permitting Agencies must all understand SESC objectives

- **Proper Installation and Maintenance**
  - ✓ Structural, mechanical, vegetative, and chemical SESC measures must be properly installed/applied and maintained in order to be effective and comply with permits

Sediment Control BMPs

Sediment Control BMPs

Intended to capture sediments and remove them from suspension

- Function best in cooperation with erosion control practices
- High maintenance
- Very temporary

Sediment Control BMPs

MAINTENANCE

Rule of Thumb –

Perform maintenance when sediment holding capacity is $^1/_3$ to ½ full

MOST SITES – Every significant rainfall event

Sediment Control BMPs

- Silt fences
- Ditch checks
- Polymer Enhanced BMPs
- Street and curb protection
- Storm sewer inlet protection
- Concrete washout
- Sediment traps/basins
- Skimmers / Outlet Risers
- Dewatering / Pump Discharge Filtration
- Polyacrylamides

Silt Fence

Installation

- Trenched into ground, backfilled and compacted, or static sliced and compacted
- 6 Inch (15.25cm)
- Stake Spacing—5 Feet (1.5m)
- Wire Backing (if required)

What do you mean there is a problem with my silt fence?

Silt Fence

Installation

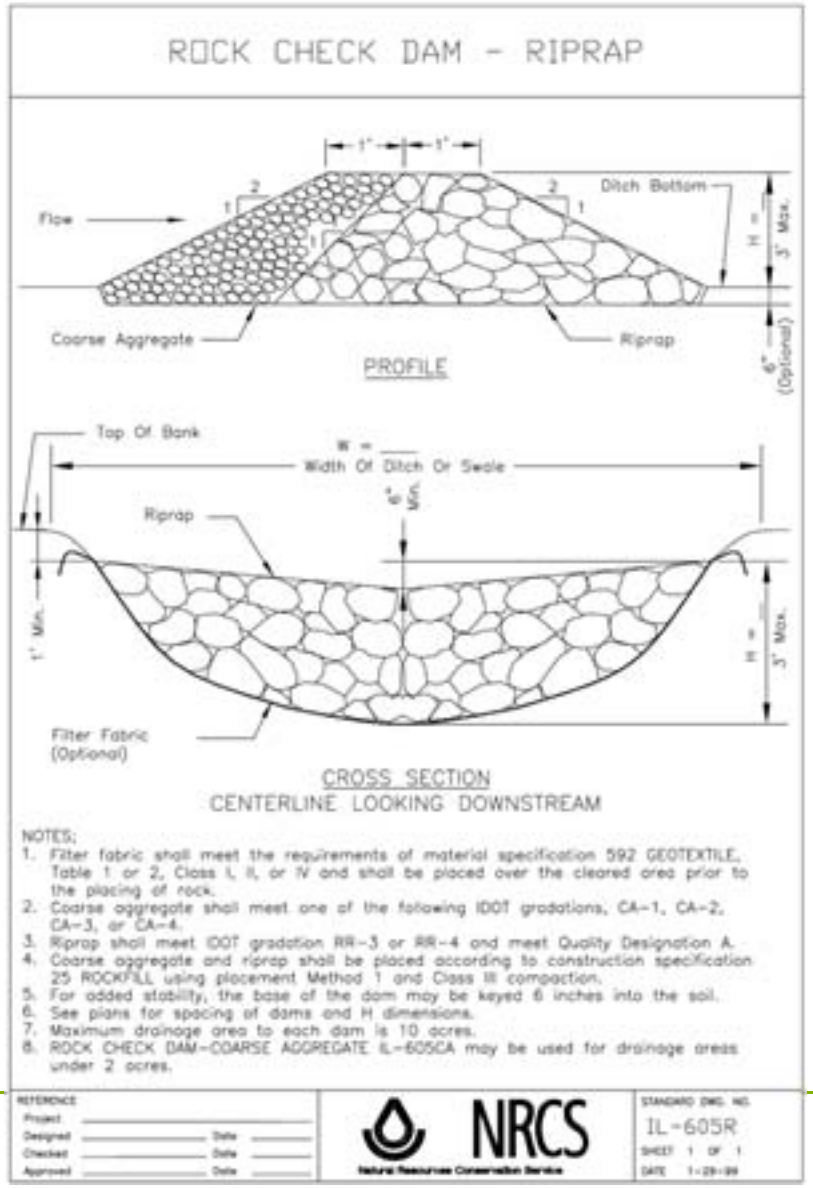
- Static Slicing Method
- Preferred method by EPA and ASCE

Silt Fence

Maintenance

- Repair compromised areas
- Remove accumulated silt
- Ensure fence is properly intercepting all drainage routes

Ditch Checks



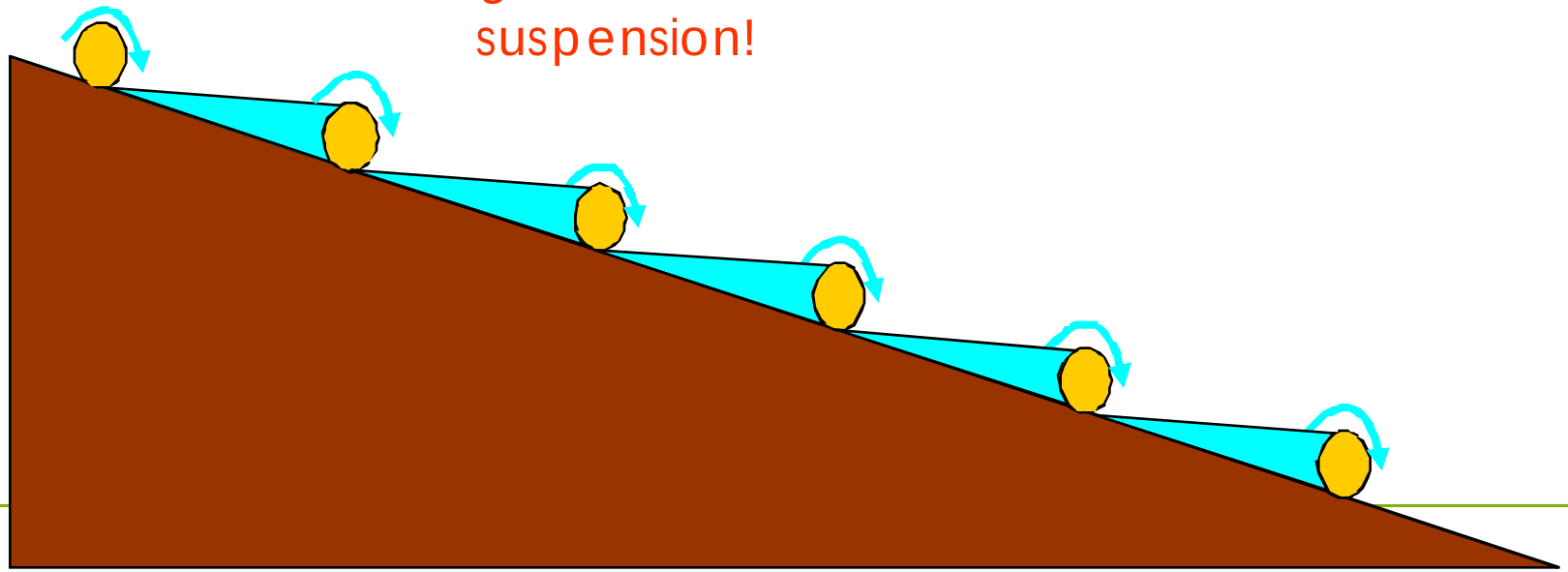
Installation

- Intercept flow of entire ditch or swale
- Direct contact with soil
- Spacing
- Center lower than sides

Ditch Check Spacing Guidelines

- Ditch checks should be spaced in a manner that runoff discharges from "pool to pool"

This slows water velocity down and gives more time for water to infiltrate into the ground and causes sediment to fall out of suspension!



Ditch Checks

Installation

- Geometry

Ditch Checks

Installation

- Geometry

Ditch Checks

Maintenance

- Replace or repair failed checks
- Repair rills and gullies
- Remove accumulated silt
- DO NOT USE STRAW BALES

Ditch Checks

Use Alternative Measures to Straw Bales

Ditch Checks

??????

Ditch Checks

Use Alternative Measures to Straw Bales

Don't just count on a better product solving the problem!

Make sure sized appropriately and it is installed properly!

Ditch Checks

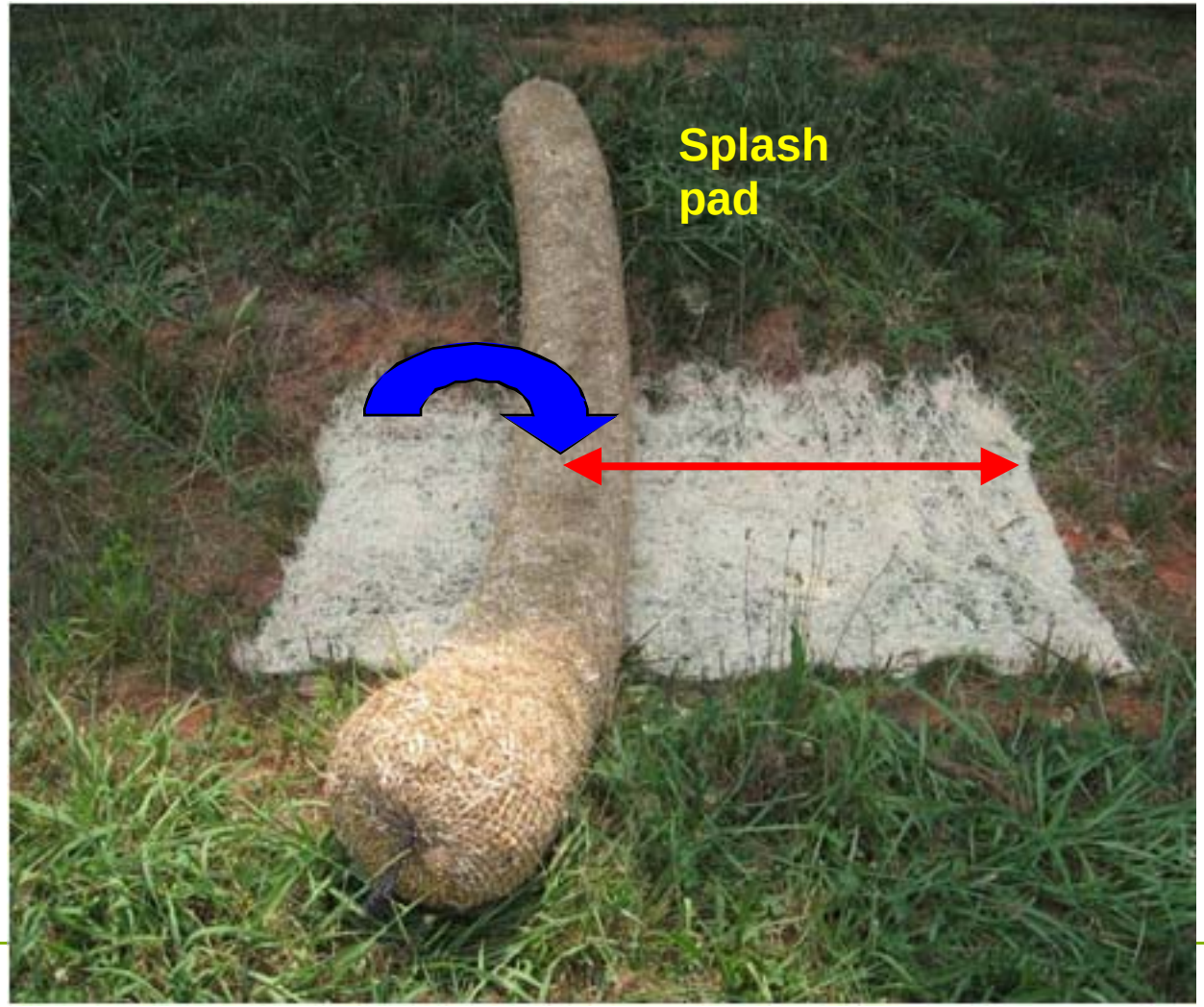
Geotextile Encased Urethane Foam – Silt Dike

Ditch Checks

Polyethelene Ridges –

Allow Vegetation to Establish Underneath

Fiber Log (Sediment Log)Ditch Checks



Polymer Enhanced Ditch Check

Polymer Enhanced Ditch Check

Polymer Enhanced BMPs

- Initial Installation of PAM on Rock Check Dam
- Additional grading of the ditchline actively taking place

Polymer Enhanced BMPs (PEBMPs)

- Temporary Seeding in ditchline
- Reactivation of Ditch Check
- Note Water Clarity Downstream of PAM Enhanced Ditch Check
- New Jute “Layered” on Top – Cleanout accumulated sediment above check dam

Streets and Curb Inlets

Primary Goal is to Prevent Sediment from Entering the Roadways

Streets and Curb Inlets

Primary Goal is to Prevent Sediment from Entering the Roadways

- Provide silt fence or barriers at curb cuts
- Prohibit the use of soil for ramping curbs
- Overexcavate area behind curb until final grade can be established

Streets and Curb Inlets

- Ensure entire curb inlet is protected
- Replace or repair inlet protection as necessary
- Inspect streets and gutters daily and clean and scrape at least weekly

Streets and Curb Inlets

Primary Goal is to Prevent Sediment from Entering the Roadways

Storm Sewer Inlets – Area Drains

Use all the tools in the toolbox

Explore all alternative measures

Storm Sewer Inlets – Curb Side

Explore all alternative measures

Storm Sewer Inlets – Curb Side

Good

Bad and Ugly

Streets and Curb Inlets

Primary Goal is to Prevent Sediment from Entering the Roadways

Streets and Tracking

- Once sediment enters roadways then it becomes increasingly difficult to control.
- Sedimentation Issues
- Safety Issues

Concrete Washout Areas

- Designated areas to store, pool, filter, and allow easy removal of concrete wash

GOOD!!

BAD!!

Concrete Washout Areas

- Designated areas to store, pool, filter, and allow easy removal of concrete wash

Silt Curtain or Turbidity Curtain

- Temporary floating "silt fence"
- Designed to be installed in-line with flow NOT across flow
- Used when working on streambanks

Silt Curtain or Turbidity Curtain

- Should be anchored at upstream and downstream end
- “Hooked into bank at limits of disturbance
- Anchor posts in flow line to “guide” fence and prevent it from “flapping” in current

Sediment Traps / Basins

- Traps designed for 5 acre (2 Ha) or less drainage area; Basins designed for 5+ acre (2 Ha) drainage areas

Sediment Traps / Basins

- Minimum Sediment Trap/Basin Storage Requirements (per USEPA requirements):
  - Composed of equal volumes of wet (below permeable fill) and dry detention storage
  - Must be sized to accommodate sediment storage for the expected soil loss over the course of the project (minimum of 1 Year)
  - Sized for the runoff from greater of:
    - **2-year, 24-hour** storm event during maximum runoff conditions
    - **134 yd^3/acre (253 m^3/Hectare)** of drainage area

Sediment Basin/Trap Outlet Protection

Culvert Inlet Protection – Keeps Sediment in Trap or Basin

Temporary Perforated Stand Pipes

Make sure they are properly anchored

Skimmers

- Typically PVC
- Linked into manhole
- Temporarily bypass outlet pipe
- Float or fixed
- Draw off of the top of the water column
- Remove before winter

Skimmers

Dewatering Activities

- Intake floated or placed in Sump Pit

Dewatering Activities

- Intake floated or placed in Sump Pit

Sump Pit

Dewatering Activities

- Outlet onto impervious, energy-dissipating surface
- Filter placed on outlet
- Dewating to Sediment Basins or silt traps – NOT DIRECTLY TO STREAM or STORMWATER FACILITIES

Filter Bags

- Geotextile fabric bag
- Traps large particles
- Place on stabilized ground
- Use pretreatment measures
- Monitor, monitor, monitor

Dewatering Activities

- Dewatering to Sediment Basins or silt traps – NOT DIRECTLY TO STREAMS or STORMWATER FACILITIES

Polyacrylamides (PAM)

- Cationic – Positively Charged
- Anionic – Negatively Charged

- Anionic PAMs have not been proven to be toxic to aquatic, soil, or plant species when used as directed
- Cationic PAMs on the other hand and toxic to fish and must not be used for surface water applications
- Any polymer used should have all MSDS information available and documentation of acute and chronic toxicity for appropriate aquatic vertebrates or invertebrates (Work with Local, Provincial, & National Regulatory Bodies)

Polyacrylamide (PAM)

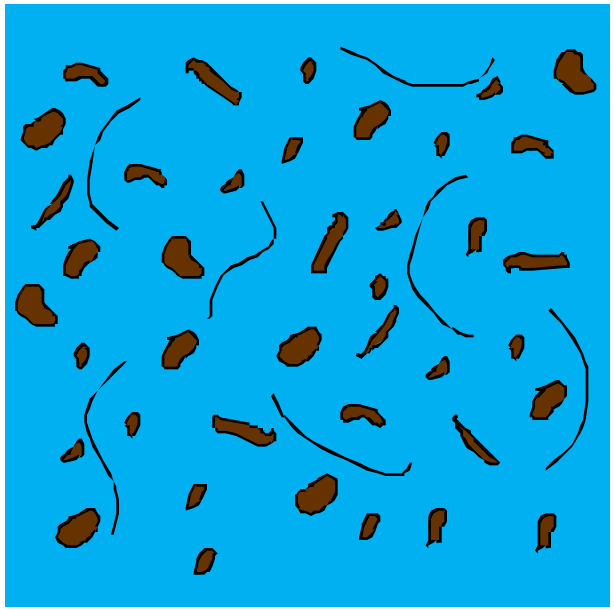
- Forms: dry powder, solution, emulsion, logs

PAM Use for Sediment Control

- Clarification of turbid discharge water
  - Active introduction of PAM
  - Mixing of PAM and Discharge Water
  - Capture of Flocculants
- Polymer must be selected based on site specific soils testing, or tested on site specific soils
- Adequate time must be given for PAM to reach adequate concentration to create flocculation

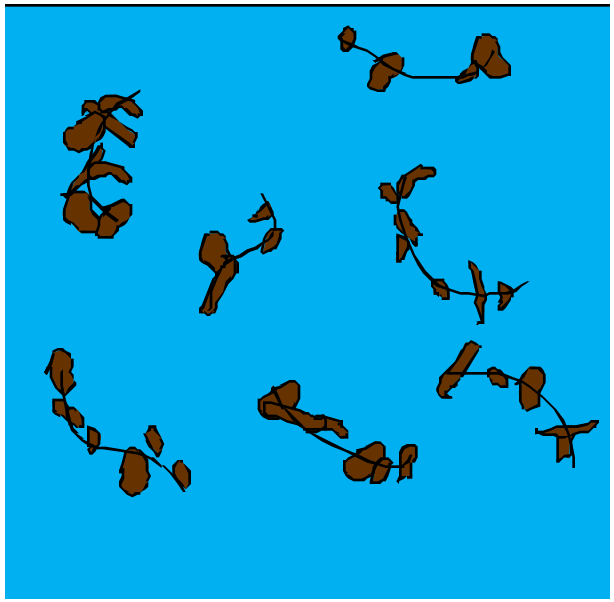
Flocculation by PAM

- PAM binds (or flocculates) suspended sediment by attaching to several soil particles forming a larger aggregate or floc.



Flocculation by PAM

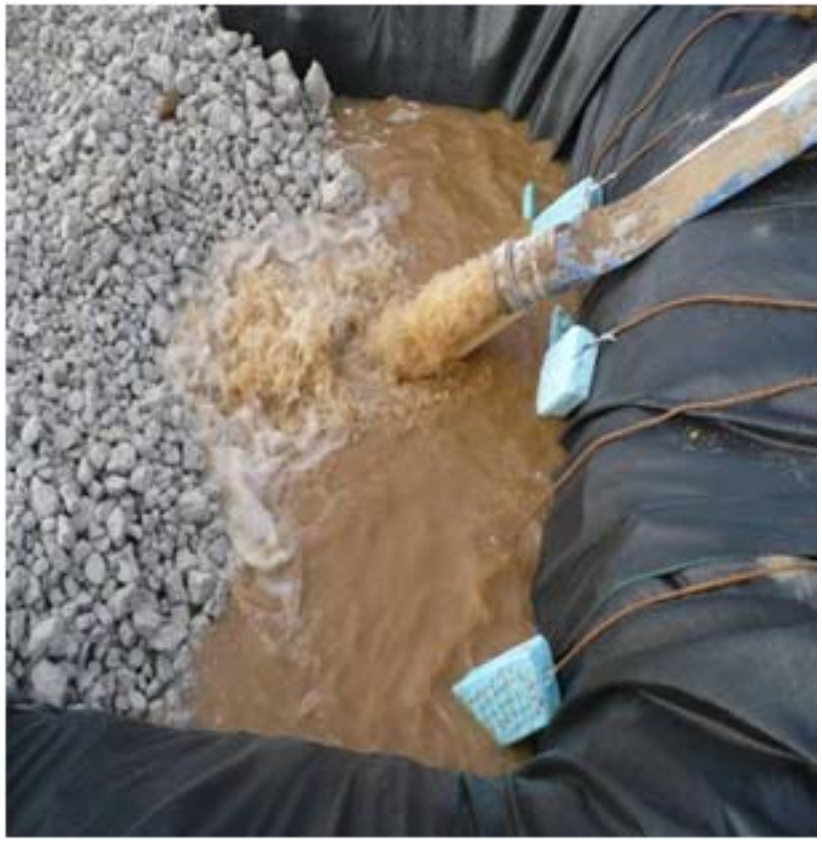
- The larger (and now heavier) flocs then settle out of suspension.



Flocculation

Polymer Dewatering Swale Treatment

Polymer Dewatering Swale Treatment



Polymer Dewatering Swale Treatment

Erosion Control Best Management Practices

Prevent Storm Water Contact With Bare Soil

- Storm water from the sky – Rainfall
- Storm Water from adjacent areas - Run-on

Methods of Erosion Control

- Limited Disturbance
- Vegetative Practices
- Mulching / Erosion Control Blanket
- Run-On / Runoff Control

Limited Grading Where Possible

- Limit the amount and duration that areas are exposed to rainfall impact, run-on, run-off, and wind

Vegetative Stabilization Practices

Permanent Seeding

Sodding Plugging

Temporary Seeding

Long Term Erosion Control

- The most effective and efficient means of controlling soil erosion on construction sites is a healthy and full stand of vegetation.

That's great, but how do we get there?

Vegetative Stabilization

- Typical construction sites provide challenges to stabilizing soils
- Vegetation establishment is difficult at best
  - Low nutrient content
  - Little natural soil structure
  - Clay soils are prone to sealing off
  - High soil compaction
  - Little moisture retention
  - Low temperature moderation

Seeding

- Keys to Success

- Ground Preparation
- Proper Seed Selection
- Soil Amendments
- Proper Installation

No matter what, seeding on poor soils takes additional time to mature.

Methods of Seeding

- Broadcast

Methods of Seeding

- Mechanical

Methods of Seeding

- Hydroseeding

Temporary Seeding

- Seed Mixes
  - Annuals
    - Seed Oats – Hearty, Fast Germinating & Growing, Frost Intolerant, Good in Spring
    - Annual Rye – Fast Germinating & Growing, Will Reseed, Great quick cover all year, slightly more frost tolerant
    - Cereal Rye / Winter Wheat – Great in Fall, Germinates in colder temps, winter survivorship
  - Perennials
    - Perennial Rye – Durable, Fast Germinating, Dense
    - Timothy – Pasture Grass, Very fine Seed, Durable
    - Creeping Red Fescue – Simple durable and fast growing
    - Tall Fescue – Good cover, grows dense and tolerates drought
    - Aliske Clover – Not always desirable (especially in native areas) but fast growing, spreads in, tolerant of both drought & wetness,

Seeding Practices

- Key to Successful Seeding on Construction Sites
  - Each site is different
  - Choose seed mixes that are appropriate for the soil conditions
  - Proper Installation is KEY!!
  - Soil Amendments
  - Mulching

Mulching / Terraseeding / Erosion Control Blanket

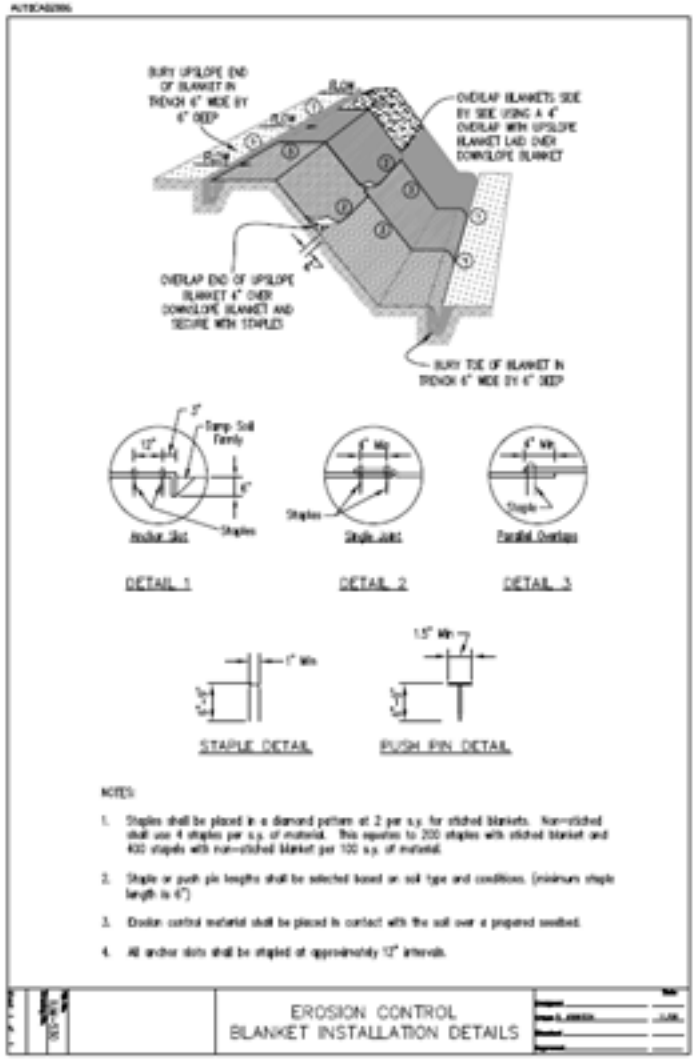
- The job of any mulching is to stabilize soils and provide ideal growing conditions for seeding.
  - Erosion Control
  - Moisture Retention
  - Temperature Moderation
  - Nutrients and Organic Material

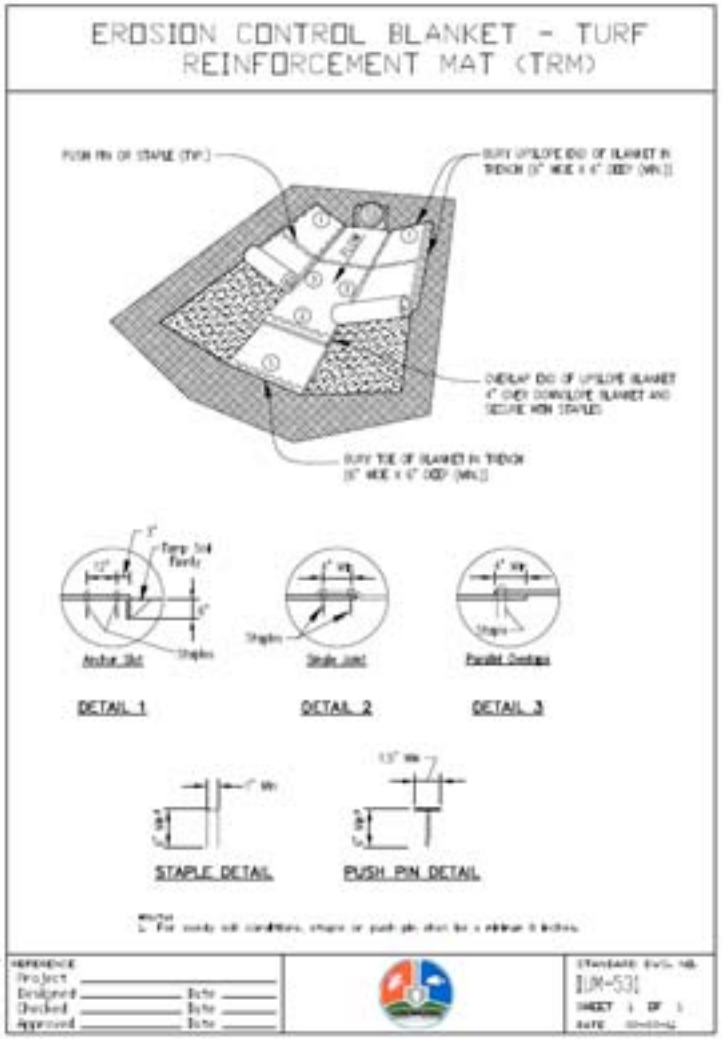
Erosion Control Blanket

Practice & Product Selection Criteria

- Slope Steepness & Length
- Functional Longevity
- Velocities & Sheer Stresses
- Staple Pattern
- Soil Conditions

Erosion Blanket / TRM Installation





Erosion Control Blanket

Installation

- Soil surface stable and free of rocks and obstructions
- Material meets specifications
- Protected from contributing disturbed areas
- Direct contact with soil

Erosion Control Blanket

INSTALLATION

- Anchored on summit of slope
- Unrolled parallel to primary direction of flow
- Overlapped in the direction of flow
- Staple Pattern & Quantity is Correct

Erosion Control Blanket

INSTALLATION

- Staple Pattern & Quantity is Correct

Mulching

Practice & Product Selection Criteria

- Slope
- Soil Conditions
- Duration Needed
- Access
- Cost

Options for Mulching

- Straw Mulching
- Hydromulching
- Compost Mulching (Terraseeding)

Straw Mulching

- Economical
- Application Rate of 2 Tons per Acre minimum
- Crimping necessary

Straw Mulching!!!!

Straw Crimping

Hydromulching

Considerations

- Slope
- Access
- Duration
- Types of Fiber
- Bonding Agent / Tackifier
- Seeding with mulching?
- Mix Ratio
- Rate of Application

Hydromulching

INSTALLATION

- Mix Thoroughly
- Add water first, then lightest to heaviest elements
- Spray from two opposing directions
- Ensure appropriate application rate

Compost Mulching

- What is Compost Mulching?
- A layer of loosely applied compost or composted material that is placed on the soil in disturbed areas to control erosion and retain sediment resulting from sheet-flow runoff.[1]

[1] USEPA – NPDES Stormwater Menu of BMPs

Terra Seeding

- Application of Compost –
  - ½ inch thick with seed - November 5

Terraseeding

- Application of Compost – ½ inch thick with seed

March 18 - Rainfall

May 7 - Rainfall

Runoff Control Measures
Protect Disturbed Soil Areas From Erosion

- BMPs to protect from erosion
  - Top of slope dikes
  - Slope drains
  - Gravel bag berms or fiber rolls

Diversions

- BMPs practicable to protect disturbed areas from run-on are:
  - Earth dikes/drainage swales and lined ditches
  - Sandbag Barriers

Other BMPs

- Spill Prevention and Clean-Up
- Waste Disposal
  - Dumpsters
  - Porta-potties
- Secondary Containment of Pollutants
- Street sweeper
- Dust control
- Material Storage

Strategies for Problem Solving with BMPs

- Identify the cause of the problem, not the symptom
- Select the appropriate BMP for the type of problem you are encountering
- Identify how long you need the solution to last
- Be creative and mix your BMPs
- There is no magic carpet or silver bullet

Problem Solving

Are Different Practices Needed?

Problem Solving

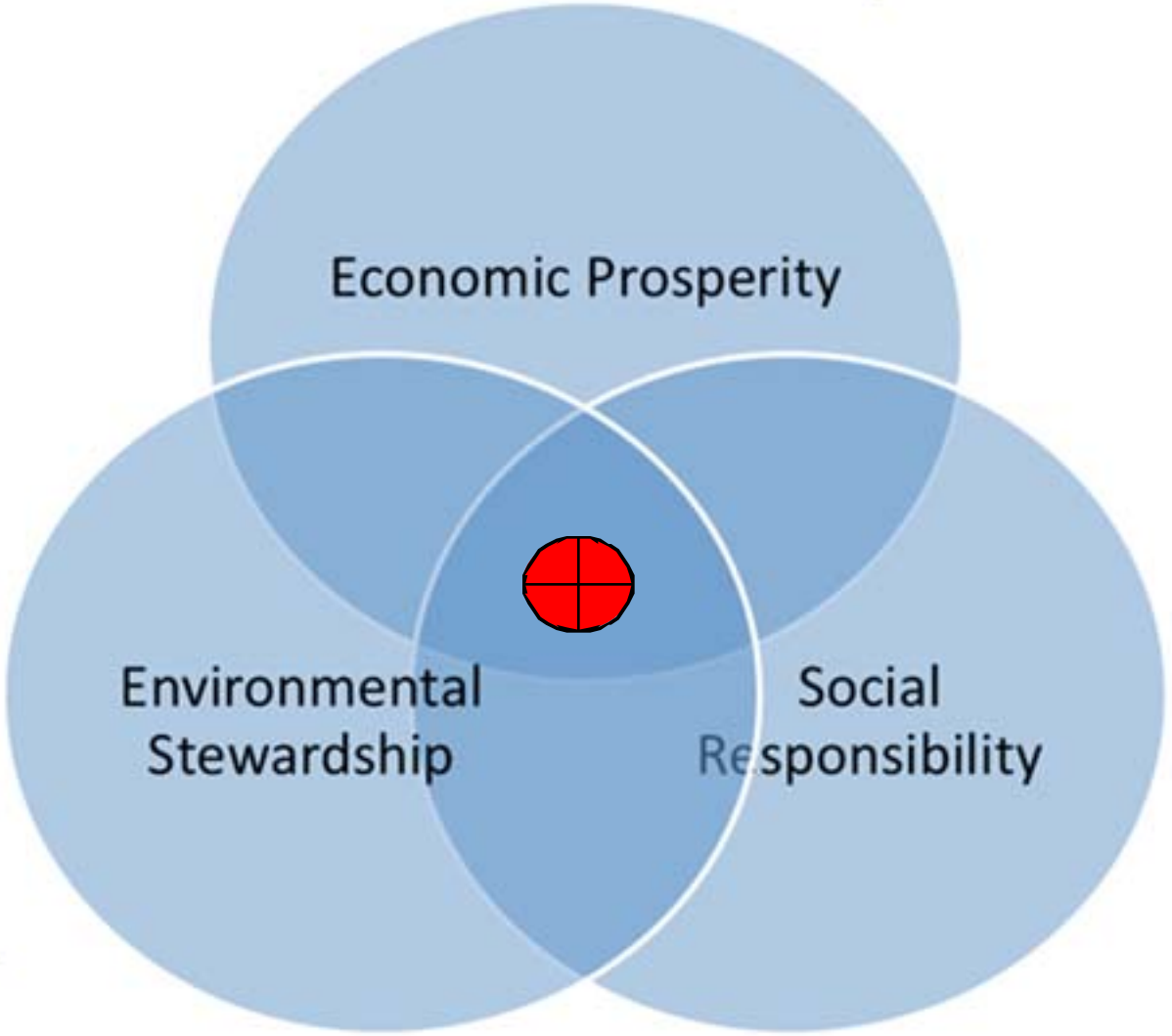
More is not better

Problem Solving

- Develop Treatment Train

Why BMPs Matter

Use Your BMPs Wisely



Questions?

ENCAP, Inc.

Practical Land Improvement Solutions for Over 35 Years

Jonathan Koepke, CPESC, LEED-AP
Vice President, General Manager
ENCAP, Inc.
1709 Afton Road, Sycamore, IL 60178
815-899-1621
www.encapinc.net
jkoepke@encapinc.net