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Make it Drain!

Municipal Inspection and Maintenance for Stormwater Best Management Practices

Prepared For

Presented By

Rick Celender, Mike Singleton, and Bill Trimbath
Civil & Environmental Consultants, Inc.

Civil & Environmental Consultants, Inc.

MS4 Program Overview

Prepared For

Presented By

Bill Trimbath
Civil & Environmental Consultants, Inc.

Presentation Outline

- Definition
- Minimum Control Measures
- Benefits of the MS4 Program
- How to Finance the Program

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Jurisdiction

- In 1990 EPA established the National Pollutant Discharge Elimination System (NPDES) Stormwater Program

- Required operators of medium to large MS4 systems to implement control programs

- Extended coverage to certain “small” MS4s

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EPA's Stormwater Phase II rule

- **Establishes the MS4 stormwater management program**

- **It's intent is to, "*…improve the nation's waterways by reducing the quantity of pollutants that stormwater carries into storm sewers.*"**

- **Focus is on improving water quality**

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Common Pollutants

- Oil and grease from paved areas
- Pesticides from lawns
- Sediment from construction sites
- Discarded trash
- Cigarette butts, wrappers, plastic bottles

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What is required of a MCM Plan?

- Minimum control measures
- Multiple Best Management Practices (BMPs) that must be implemented.

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Conveyance Systems Subject to MS4

- Collecting and/or conveying stormwater
- Owned by a public entity
- Not used as a combined sewer
- Not part of a publicly owned treatment plant

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What is a small, medium or large MS4?

- Small– Any MS4 not covered by the Phase I stormwater program (Smaller than 100,000 population)

- Medium—Population between 100,000 and 249,999

- Large Population larger than 250,000

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Definition of small MS4

- Systems with less than 10,000 population in a rural area
- Systems with less than 1000 pop/ square mile in a rural area
- Systems located outside and urban area

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Stormwater Permit Program

- Federal Regulation Program requires a permit
- PADEP created permitting program to meet federal regulations

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What do permits require?

- Implement a stormwater management program
- Track progress toward goals
- Report on progress

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Six Minimum Measures

1. Public education and outreach
2. Public participation and involvement
3. Illicit discharge detection and elimination
4. Construction Site Runoff Control
5. Post Construction runoff control
6. Pollution Prevention/Good Housekeeping

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MCM No 1 Public Education and Outreach

- Develop and maintain an outreach program
- Identify list of audiences
- Distribute education materials

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MCM No 2 Public Involvement / Participation

- Develop and maintain an outreach program
- Provide opportunity for public notice and feedback
- Solicit involvement form target audience groups
- Start a volunteer program

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MCM No 3 Illicit Discharge Detection and Elimination

- Develop written program(Ordinance)
- Develop and maintain a map of regulated outfalls
- Develop map of conveyance system
- Educate the community

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What is an “illicit” Discharge?

- Sanitary wastewater
- Effluent from septic tanks
- Car wash wastewaters
- Improper oil and grease disposal
- Radiator flushing liquids
- Laundry wastewaters
- Spills form roadway accidents
- Improper disposal of auto and household toxics

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MCM No 4 Construction Site Stormwater Control

- Develop a program containing compliance procedures
- Erosion and sedimentation control BMPs
- Construction site control
- Record tracking system
- Coordination with county conservation district

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MCM No 5 Post Construction Stormwater Management (PCSM)

- Develop written program
- Develop tracking system
- Implement controls
- Enforce ordinances
- Encourage low impact development

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MCM No 6 Pollution Prevention /Good Housekeeping

- List of operations
- Implement O & M Program
- Vehicle maintenance, fueling and washing
- Training community employees

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Requried documentation

- Report must be submitted during the first permit term
- Reports submitted in years 2 and 4 following the first year

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Report Must Contain

- Status of compliance with permit conditions.
- Assessment of the appropriateness of selected BMPs
- Progress toward reachable goals
- Summary of stormwater activities planned for the next reporting cycle
- Change in any best management practice

Benefits of the MS4 Program

- Enhanced water quality
- Enhanced aesthetic values
- Enhanced recreational opportunities for fishing and swimming
- Drinking water benefits

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How to Finance?

- Stormwater authority
- Monthly stormwater charges
- Range from $2 / to $12 / month per household

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Waters of the United States

- MS4 systems not included in the new definition
- Inclusion would have subject MS4 systems to additional permit requirements

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Questions?

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Typical BMP Design & Function Overview

Prepared For

Presented By

Rick Celender
Civil & Environmental Consultants, Inc.

Pennsylvania Stormwater Best Management Practices Manual

December 2006

This manual is based on the following set of principles:

1. Managing stormwater as a resource;
2. Preserving and utilizing existing natural features and systems;
3. Managing stormwater as close to the source as possible;
4. Sustaining the hydrologic balance of surface and ground water;
5. Disconnecting, decentralizing and distributing sources and discharges;
6. Slowing runoff down, and not speeding it up;
7. Preventing potential water quality and quantity problems;
8. Minimizing problems that cannot be avoided;
9. Integrating stormwater management into the initial site design process; and
10. Inspecting and maintaining all BMPs.

Managing Stormwater as a resource; Sustaining the hydrologic balance of surface water and groundwater.

- Stormwater is a critical resource. We depend on stormwater to replenish groundwater for drinking water and for the health of many aquatic systems. Each is dependent on the steady discharge of stormwater and groundwater.
- The replenishment, or recharge, of groundwater depends on the infiltration of stormwater into the ground.
- Stormwater may carry a variety of pollutants into our waters including metals, bacteria, oil and grease, pesticides, nutrients and sediment.

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Preventing potential water quality and **quantity** problems; Minimizing problems that can be avoided.

- Increased frequency and magnitude of downstream flooding due to rapid runoff of stormwater;
- Enlarged stream channels, increased channel scouring and stream bank slumping, and resulting increased sediment loads due to increased frequency and magnitude of high flows;
- Reduction in the quality of aquatic habitat due to pollutant and heat loading, reduced base flows, enlarged channels, and smothering with sediment.

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Inspecting and maintaining all BMP's.

Massive sinkhole in Rochester ordered filled

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pe

years

rant

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deep

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red

by the State Department of Environmental Protection to have the hole filled by the end of the month.

Related

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Dry Extended Detention Basin

BMP Manual

Dry Extended Detention Basin – Maintenance

Maintenance is necessary to ensure proper functionality of the extended detention basin and should take place on a quarterly basis.

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Wet Detention Ponds

- Wet Detention Ponds are stormwater basins that include a permanent pool for wa anent pool fo
- Wet Po prevent downs

Wet pond with vegetated edge
Photo courtesy of Westmoreland Conservation District

Detail From PADEP
BMP Manual

FILTER DIAPHRAGM

PROFILE

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Wet Pond – Maintenance

Wet Ponds should have a maintenance plan and privately owned facilities should have an easement, deed restriction, or other legal measure to prevent neglect or removal.

A Pond maintenance plan should be developed which includes the following measures:

- **During the first growing season or until established, vegetation should be inspected every 2 to 3 weeks. WPs should be inspected at least 4 times per year and after major storms (greater than 2 inches in 24 hours) or rapid ice breakup.**

- **Inspections should access the vegetation, erosion, flow channelization, bank stability, inlet/outlet conditions, embankment, and sediment/debris accumulation. The pond drain should also be inspected and tested 4 times per year. Problems should be corrected as soon as possible.**

- **Undesirable species should be carefully removed and desirable replacements planted if necessary.**

Wet Pond – Maintenance

- V… …rgent ve…
- A… …of W… …at th…
- C… …n se… ha… pa… w…
- S… …0 p…

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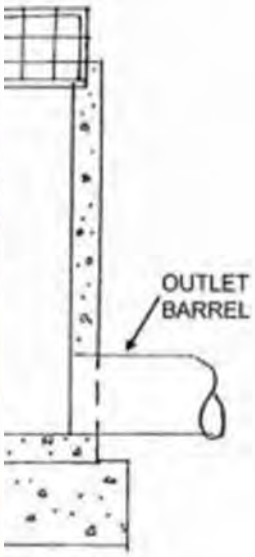
Outlet Structures

Angle iron and rebar
Photo courtesy of Westmo



E VIEW

TRASH RACK FOR TYPE M INLET BASIN RISER

Line drawing provided by Westmoreland Conservation District

Painted rebar trash rack
Photo courtesy of Westmoreland Conservation District

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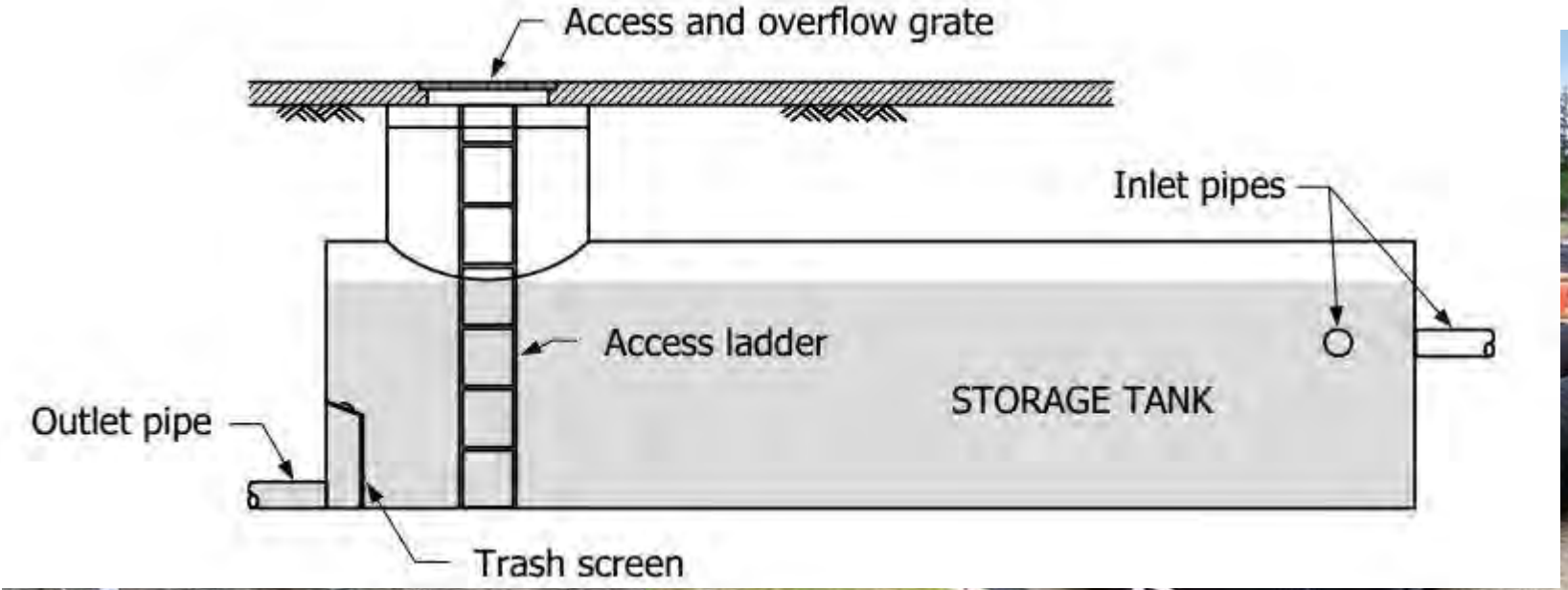
Underground Detention Systems

Underground detention systems are designed to manage excess stormwater runoff and provide limited water quality benefits.



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Underground Detention Systems Maintenance

Inspection Activities	Suggested Schedule
• After several storm events or an extreme storm event, inspect for: signs of clogging of the inlet or outlet struct	As Needed
• Inspect for: tra erosion; sedim embankment; vigor and dens cracking; leak	Semi-annually
• Inspect that th and are opera • Note signs of • Check for sed • Check for prop	Annually
Maintenance Activ	**ggested Schedule**
• Perform struct • Clean and ren	nthly or as needed
• Repair damag repair undercut or eroded areas.	As Needed
• Monitor sediment accumulations, and remove sediment when the pond volume has become reduced significantly.	As Needed

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Rain Gardens

Rain Gardens (Bioretention) is a method of treating stormwater by pooling water on the surface and allowing filtering and settling of suspended solids and sediment at the mulch layer, prior to entering the plant/soil/microbe complex media for infiltration and pollutant removal.

From PADEP BMP Manual

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Rain Garden – Maintenance

Properly designed and installed Rain Garden areas require some regular maintenance. While vegetation is being established, pruning and weeding

Mount Pleasant Borough Parking Lot

From Westmoreland County Conservation District

Two rain gardens in November, at the end of their first growing season.

Two years after installation and numerous rain events, the parking lot rain gardens successfully capture and treat runoff from each storm.

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Inlet Filters

Fabco StormBasin Maintenance:

After installation the StormBasin requires periodic cleaning. There are no hard and fast rules in this regard. Small units and installation sites with higher than expected sediment loads or areas with significant trees and foliage require more maintenance. In general, Fabco Industries recommends cleaning out the unit(s) twice per year by removing the debris, sand and silt and replacement of the cartridges once per year. An Operations and Maintenance Manual is provided as Attachment E.

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Water Quality Units (StormCeptor, etc.)

The system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. Follow manufacturers recommendations.

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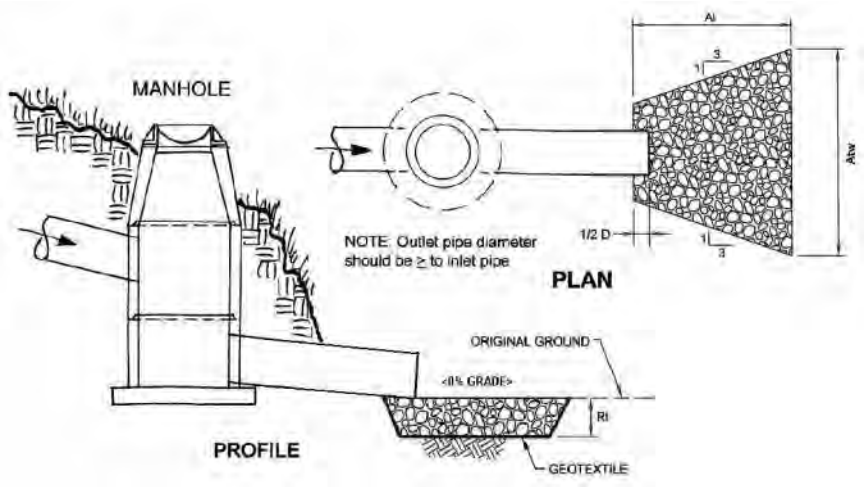
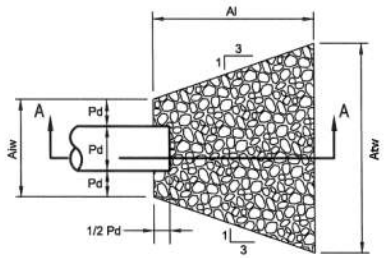
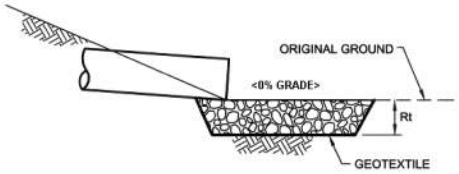
Outlet Protection





PLAN VIEW



SECTION A - A

GOOD

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YIKES!

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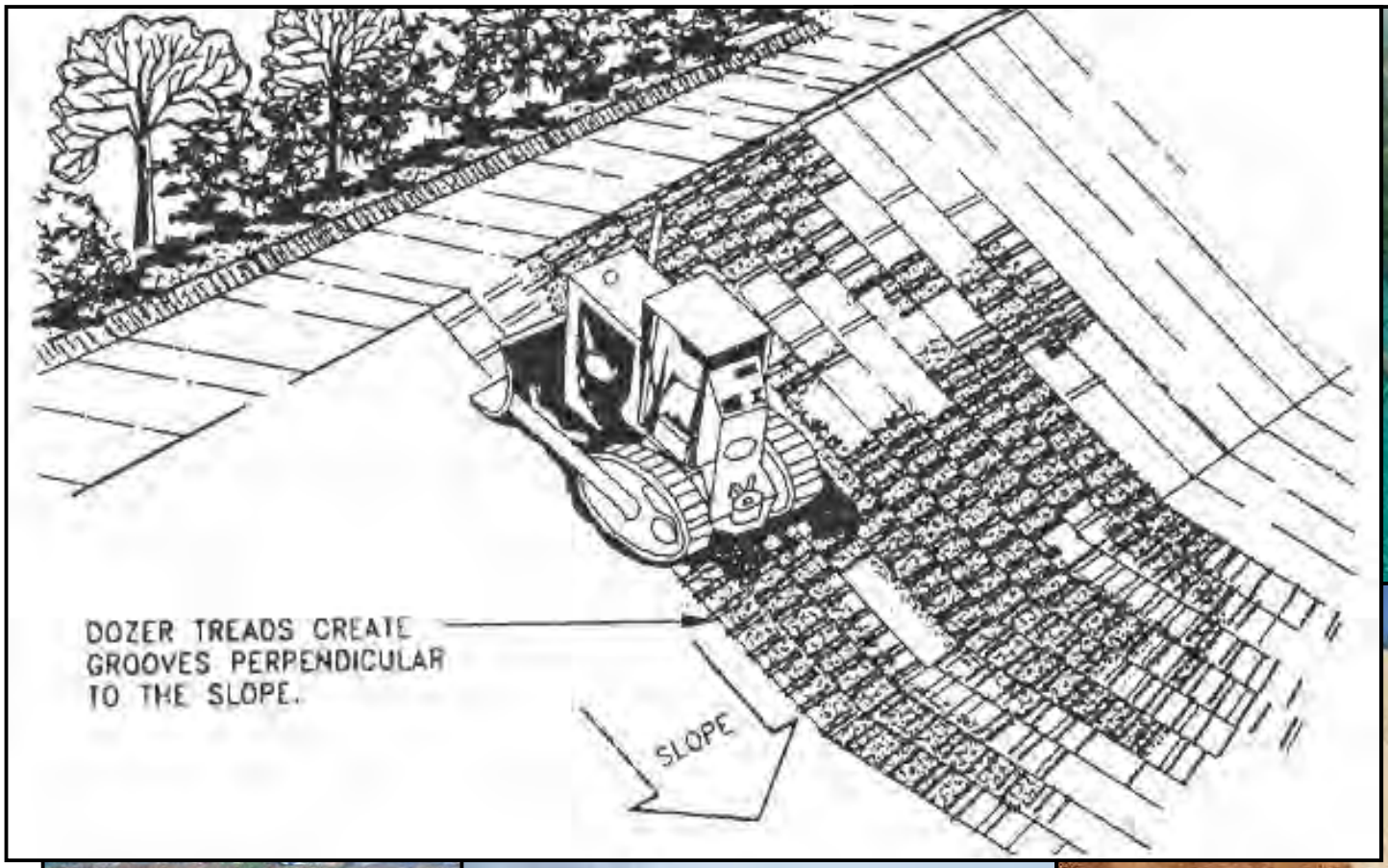
Stabilization



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Stabilization

70% requirement of *total area vegetated* looks like this…

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Housekeeping Issues – Vehicle Maintenance Areas

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Housekeeping Issues

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Housekeeping Issues - Signage

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Questions?

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Inspection, Maintenance and Repair

Prepared For

SOUTHWESTERN PENNSYLVANIA COMMISSION
SPC

Presented By

Mike Singleton
Civil & Environmental Consultants, Inc.

CEC

- **CEC-SIMS**
  - Site Infrastructure Management Services
- **CEC-CM**
  - Construction Management
- **Programs are best friends – different but usually together**
- **This presentation is SIMS**
  - Inspections
  - Evaluations
  - Maintenance / repairs

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Why maintain?

- Proper function
- Regulatory requirements
- Minimize catastrophic results
- Save cost over time
- Minimize public complaints
- Identify what works and what doesn't
- Help with public safety
- Aesthetics

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So you know the rules, you've approved the BMP's.....now what?

- Make a plan - Database
- Set up a program
- Educate
- Update the database
- Put it on a schedule
- Assign cost information
- Prioritize
- Attack

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Make a Plan

- **Catalog all the facilities. GIS.**

- **Ponds, developments, roads, storm sewers, infiltration basins, etc.**
  - Identify major components of systems
  - Separate by pond, road, storm run, etc.

- **Be as detailed or as vague as fits your municipality or as you see fit.**
  - Small municipality – divide into subdivisions
  - Large municipality – divide the subdivisions into streets
  - Very large – divide the streets into drainage areas
  - Commercial property

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Part of the plan is to further detail the items in the areas of concern

- **Ponds**
  - Pipes, structures, spillways, outfalls
- **Storm sewers**
  - Pipe, inlets, manholes, endwalls, aprons, cleanouts
- **Roads**
  - Pavement, underdrains, holes / settlement, cracks, dirt / debris
- **Curbs (they are part of the system)**
- **Slopes**
  - Vegetation, slips / slides, erosion
- **E/S Measures (yes, it matters)**
- **Infiltration Basins**
  - Vegetation, soil cover, draining?

Set-up a Program

- **Inspect**
  - Get out and walk
  - CCTV
  - Observe
- **Clean**
  - Sediment
  - Debris
- **Refresh**
  - Rip-Rap aprons
  - Sealants
  - Vegetation

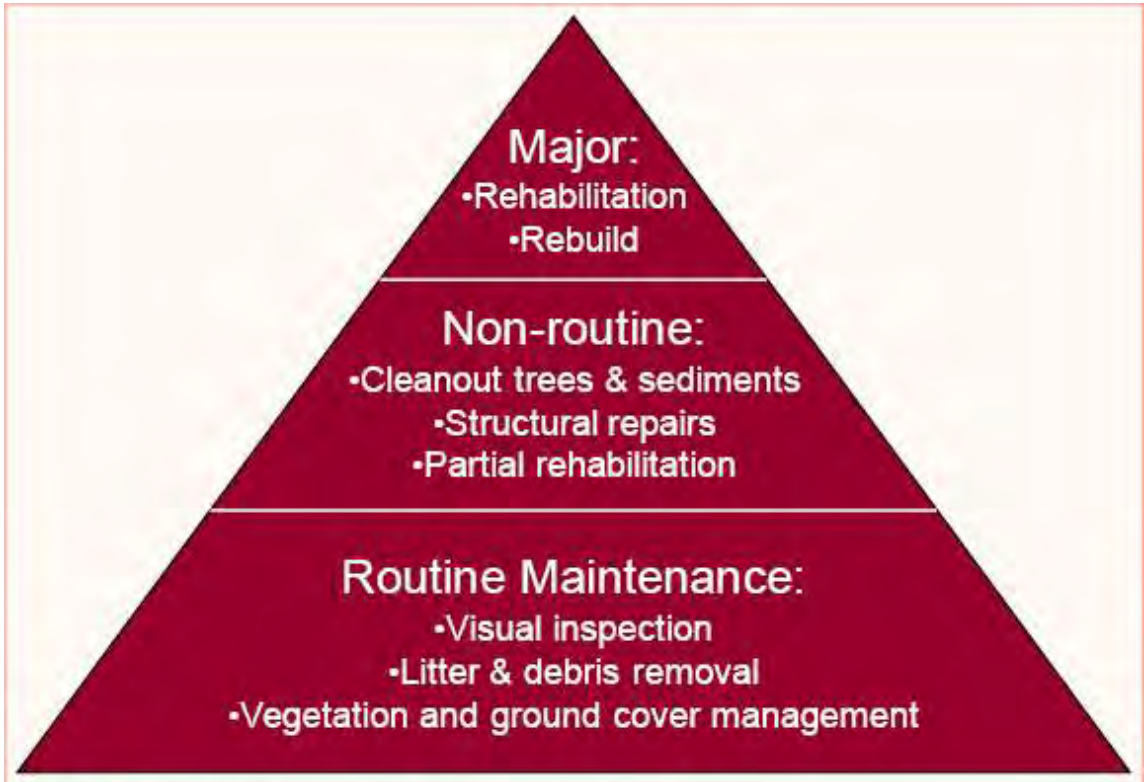

Figure 3.4: Levels of Maintenance for Stormwater Treatment Practices.

Set-up a Program

- **Fix / Repair**
  - Fix
  - Surface
  - Stabilize

- **Maintain**
  - Annually
  - Fix things as you go

- **Document!!!!**

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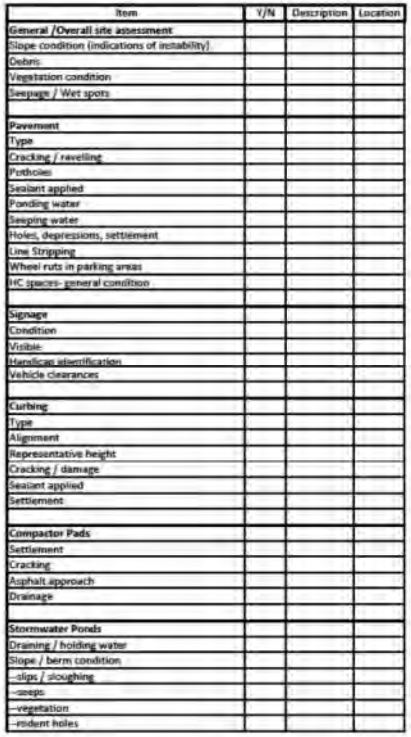
Inspections

- Perform inspections of each facility.
- Complete a form
- Prepare a sketch
- Take photos



Item	Y/N	Description	Location
General /Overall site assessment			
Slope condition (indications of instability)			
Debris			
Vegetation condition			
Seepage / Wet spots			
Pavement			
Type			
Cracking / ravelling			
Potholes			
Sealant applied			
Ponding water			
Seeping water			
Holes, depressions, settlement			
Line Stripping			
Wheel ruts in parking areas			
HC spaces- general condition			
Signage			
Condition			
Visible			
Handicap identification			
Vehicle clearances			
Curbing			
Type			
Alignment			
Representative height			
Cracking / damage			
Sealant applied			
Settlement			
Compactor Pads			
Settlement			
Cracking			
Asphalt approach			
Drainage			
Stormwater Ponds			
Draining / holding water			
Slope / berm condition			
--slips / sloughing			
--seeps			
--vegetation			
--rodent holes			

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333 Baldwin Road
Pittsburgh, PA 15205
412-429-2324

CEC-SIMS
STORMWATER FACILITIES INSPECTION
FIELD REPORT

Date: _____

Project/Site: _____ CEC Project No: _____

Location: _____ Weather: _____

Pre-Maintenance _____ Post-Maintenance _____

CEC Field Representative: _____ CEC Project Manager _____

Client: _____

Client Contact: _____

INSPECTION CHECKLIST

_____ Photos Taken _____

Pond Measurements (Relative Elevation, Dimensions, Slope, etc., if obtainable):

_____ Top of Berm _____
_____ Bottom of Spillway _____
_____ Bottom of Pond _____
_____ Top of Forebay _____
_____ Top of Outlet Structure _____
_____ Inv. of Outlet Structure _____
_____ Outlet Orifices _____

Detailed Observations:

_____ Spillway Material _____
_____ Outlet Structure Type _____
_____ Forebay Construction _____
_____ Outlet Pipe _____
_____ Outlet Apron _____
_____ Inlet Spillways/Swales _____

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Inspections

Item	Y/N	Description	Location
General /Overall site assessment			
Slope condition (indications of instability)			
Debris			
Vegetation condition			
Seepage / Wet spots			
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Cracking / ravelling			
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Holes, depressions, settlement			
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Wheel ruts in parking areas			
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Condition			
Visible			
Handicap identification			
Vehicle clearances			
Curbing			
Type			
Alignment			
Representative height			
Cracking / damage			
Sealant applied			
Settlement			
Compactor Pads			
Settlement			
Cracking			
Asphalt approach			
Drainage			
Stormwater Ponds			
Draining / holding water			
Slope / berm condition			
--slips / sloughing			
--seeps			
--vegetation			
--rodent holes			

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CEC-SIMS
STORMWATER FACILITIES INSPECTION
FIELD REPORT

Date: _____

Project Site: _____ CEC Project No: _____

Location: _____ Weather: _____

Pre-Maintenance: _____ Post-Maintenance: _____

CEC Field Representative: _____ CEC Project Manager: _____

Client: _____

Client Contact: _____

INSPECTION CHECKLIST

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Pond Measurements (Relative Elevation, Dimensions, Slope, etc., if obtainable):

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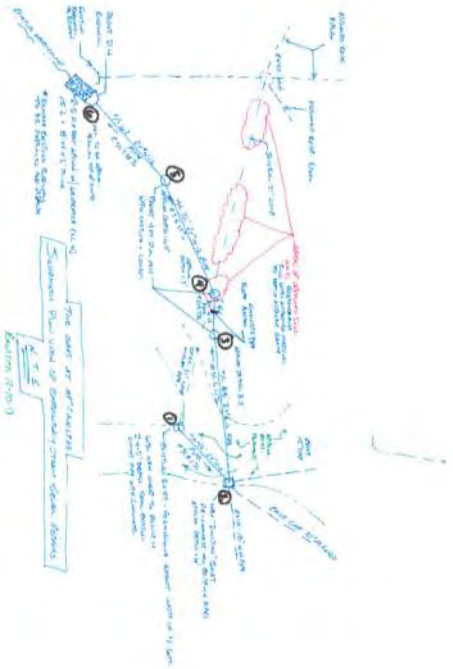

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Inspections

The focus is on problems and issues.

We do this to prevent future problems and issues.

By doing quarterly inspections, problems can be identified and addressed before they become bigger problems.

Can’t be a drive-by.

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Do you know or are you guessing?

Houst

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$$$$$
First time is the worst time
It gets better IF you keep up

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Educate

- **Know what to look for**
- **Know what is OK, what is not**
- **Be able to identify a maintenance issue**
- **Be able to identify a failure**
- **Be able to foresee a failure**
  - Maintenance issues become failures
- **Understand the source of the problem**
- **Understand what is an emergency vs. routine maintenance**

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Failures lead to……Failures!

Update the database

- Things change. Keep your plan current.
- During the site reconnaissance you may identify new items or areas that need attention.
- Items that are repaired may need to be re-visited.
- Fine tune the database to provide finer detail.
- Identify the good as well as the bad. Let's you know what is changing.

Put it on a schedule.

- It needs to be something you do.
- Pick a day in the month. Set it in stone.
- Allows for date driven evaluation. “It was looking good last month.”
- Keeps things in regulatory perspective.
- It makes it important.
- It allows for budgeting.

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Assign cost information

- **Allows for budgeting.**
- **Eludes to degree of repair / maintenance.**
- **Use as a barometer of bid work.**
- **Use as a barometer of progress being made.**
  - Costs should decrease over time for the same scope of work.

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Prioritize

- Prioritize based on severity of problem.
- Prioritize based on cost.
- Allows for a plan and a schedule.
- Allows for proper documentation and future priorities.

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Attack

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What is a storm water system?

- **A storm system is anything that conveys, stores, or discharges storm water, including:**
  - Pipes
  - Manholes
  - Inlets
  - Aprons
  - Endwalls
  - Cleanouts
  - Ponds
  - Channels / Swales
  - Roadways
  - Curbs
  - Dirt
  - Erosion Control Items

- **All of these items need to be monitored and maintained.**

Pipes

- Sliding areas
- No discharge
- Ponding water at entrance
- Sink holes / observed settlement
- Visual inspection
- Really green areas

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Pipes

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Manholes / Inlets

- Sliding areas
- Settlement around perimeter
- Tilting
- Visual inspection---debris
- Ponding water----back-up indicator
- Off-setting / damaged risers

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Manholes / Inlets

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Endwalls and Aprons

- Sliding areas
- Ponding water
- Eroded outlet areas
- Sediment Accumulations
- Broken
- Clogged –debris
- Undermining

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Endwalls / Aprons

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Ponds

- Slides / erosions
- Vegetation
- Outlet Structures
- Spillways
- Sediment accumulations
- Debris

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Ponds

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Channels / Swales

- Debris

- Negative slopes / ponding water
- Vegetation – too much or none at all
- Erosion

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Roads and Curbs

- Cracking
- Settling
- Ponding water
- Missing or damaged curbs

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Roads and Curbs

- Clean sediment and debris.

- Roads have oils, grease, salts, etc.

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Underground Storage Tanks

- **Can't see them from the surface.**
  - **** Confined Space Work
- **Damage, separated joints, failing pipe.**
- **Sediment, debris.**

Interesting project!!!

- Sediment- lots
- Holes- 76,000
- Orifice Plate- no outlet
- Fill slope- YEP!
- Underdrain- No help

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Gravity works

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E/S---Storm water facilities closest cousin

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Summary

- By not maintaining infrastructure not only doesn't work, but it also can cause damage to other infrastructure
- Things stop working as designed
- Can be an invitation to un-welcome guests (wetlands)
- Causes flooding
- Landslides
- Nuisances
- Mosquito homes
- Pavement damage such as heaving, potholes, etc.
- Subsurface water in places you don't want it, but can't see
- Pollution – regulatory consequences
- Sink holes / settlement

- Storm water maintenance and E/S control are closely related

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Questions?

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New Ideas & Technologies

Prepared For

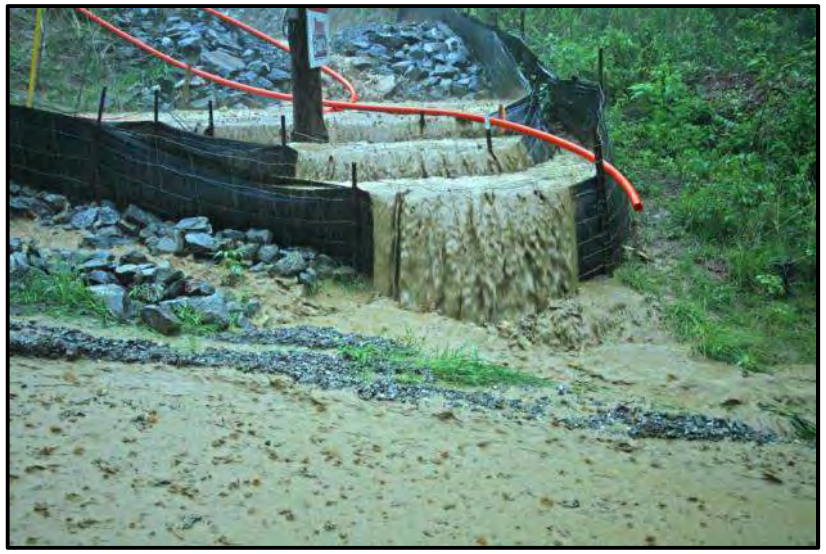
Presented By

Rick Celender
Civil & Environmental Consultants, Inc.

Alternate Drainage Controls

- **Physical Conditions at Site**
  - What is the Issues?
    - Unsuitable soils
    - Stockpiling
    - Sediment Laden Runoff
    - Dewatering
    - Slides
    - Groundwater
- **Explore Alternate Controls**

Regular inspection and maintenance of storm water best management practices is important to ensure that the practices are functioning properly and to remove trash and organic debris EPA Website



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Alternate Sand Bag System - RIBS Bags & RIBSCage™ - Rapid Installation Barrier System

The RIBS Bags and RIBSCage units can be transported with a standard pickup truck, so they require no heavy machinery for setup.

Interesting Fact:

One 50' Section of RIBS Bags = 3,900 sandbags

Pre-p
in 3',

Emer
assembly/use instructions, two (2) RIBSCage units, and 500 LF or 200 LF of RIBS Bags. Each kit is wrapped in a protective sleeve, so it can be stored until time of use.

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Alternate Sand Bag System - RIBS Bags & RIBSCage™ - Rapid Installation Barrier System

Heavy-duty woven polypropylene-coated fabric for a water resistant seal.

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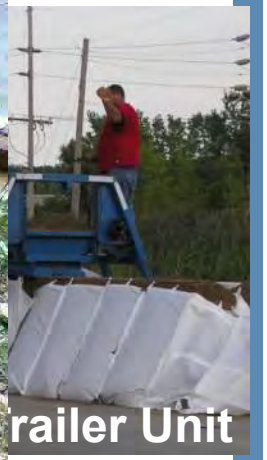
Alternate Sand Bag System - RIBS Bags & RIBSCage™ - Rapid Installation Barrier System

Portabl
berms,

Benefits

- Lightw
- Quick-
- Each F

orage.



railer Unit

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Alternate Groundwater Management

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Alternat… …Ross E…

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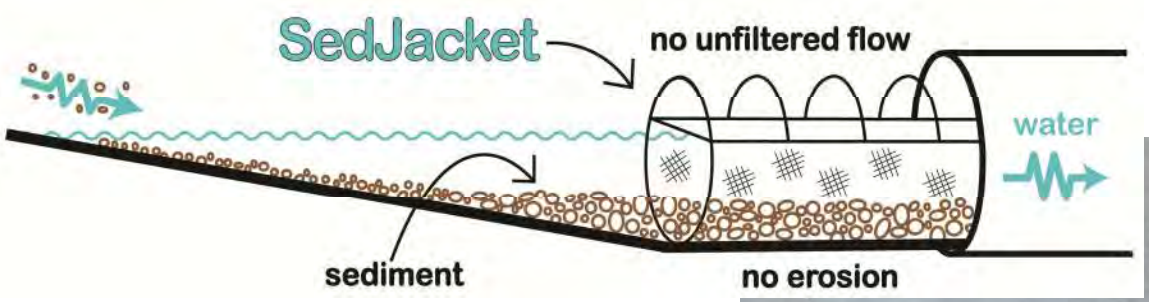
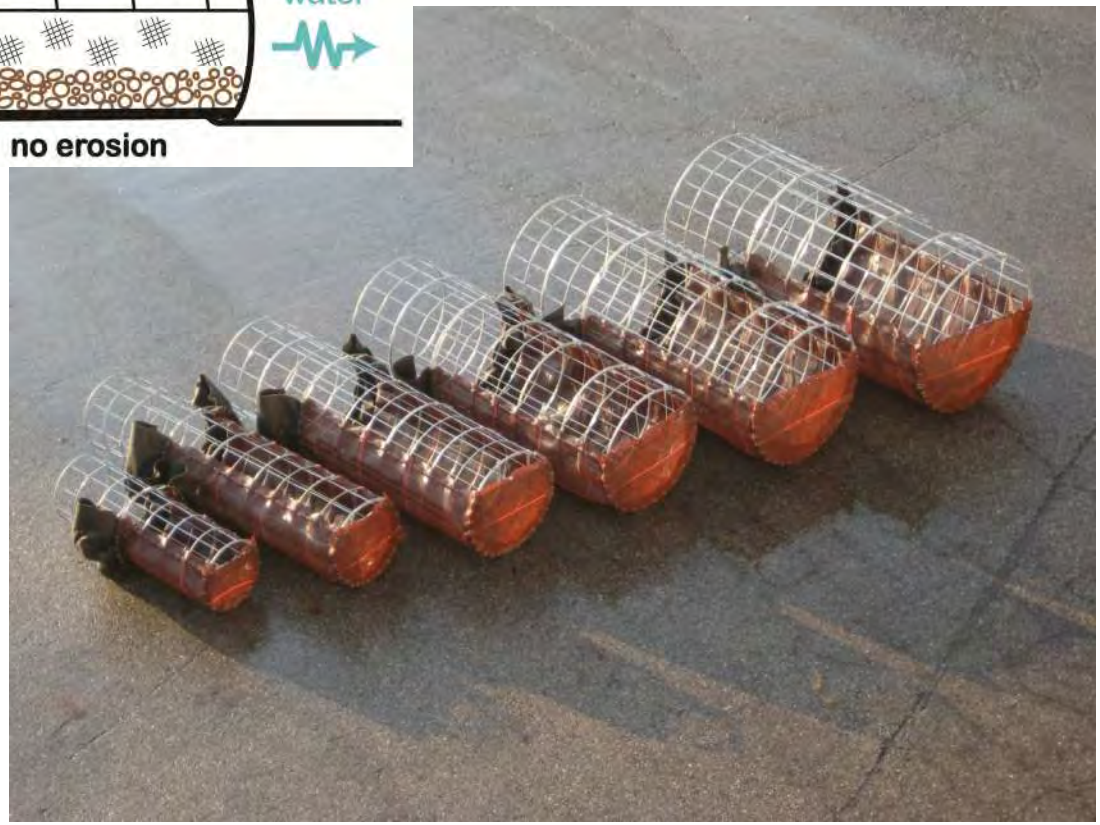
SedJacket Pipe Inlet Protection



A SedJacket is a welded wire cylinder that is partially covered with geotextile. It is slid inside the pipe until it comes to rest against the collar and gasket. It causes sediment to be deposited in the area surrounding the SedJacket.



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SedJacket Pipe Inlet Protection

- Is an inlet protection device for pipes
- Is often the “last chance” to trap sediment.
- Creates another tier for higher combined efficiency.
- Can be installed in minutes without equipment.
- Is reusable, there is nothing to haul away.

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SedCatch – Sediment Cage – Inlet/Manhole Protection

SEDCATCH® SEDIMENT CAGE™ NOTES

1. SEDCATCH® SEDIMENT CAGE™ SHOULD BE INSTALLED AT THE TIME THE STRUCTURE IS SET TO KEEP JOB IN COMPLIANCE AND TO PREVENT THE NEED TO CLEAN OUT THE STORM SEWER SYSTEM AT A LATER DATE.

2. FABRIC MUST BE PINCHED UNDER GRATE TO PREVENT SEDIMENT LADEN WATER FROM ENTERING STORM SEWER SYSTEM.

3. REMOVE SEDIMENT ONCE IT ACCUMULATES TO ½ THE HEIGHT OF THE SEDIMENT CAGE™.

4. TO INCREASE EFFECTIVENESS AND REDUCE MAINTENANCE REQUIREMENTS, THE AREA AROUND THE SEDIMENT CAGE SHOULD BE AS FLAT AS POSSIBLE.

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where is
SCOURSTO

how does
SCOURSTOP WORK?

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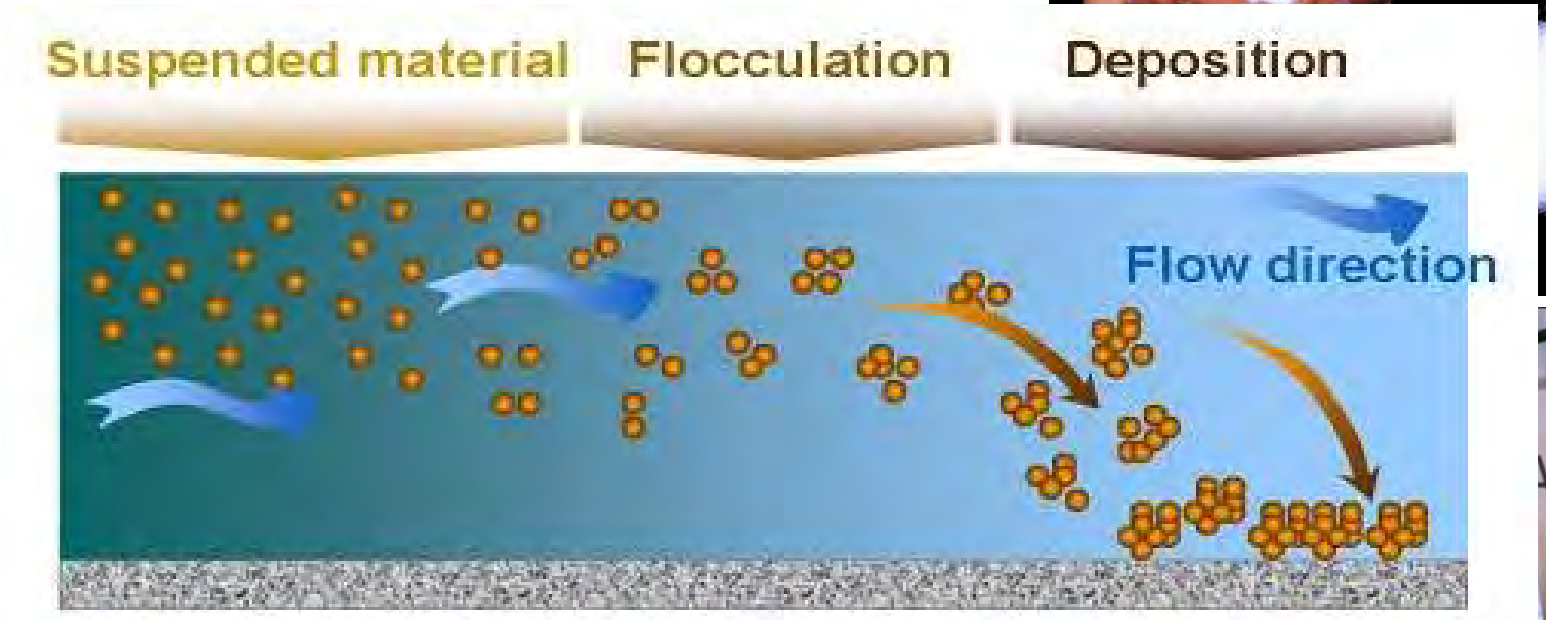
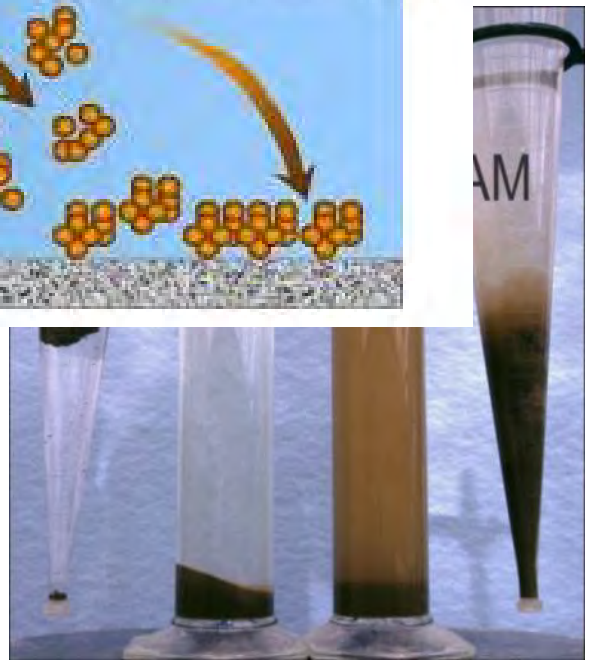
Alternate Soil Binder - Polyacrylamide (PAM)

What Does PAM Do?



- Maintains higher infiltration
- Holds soil in place



USDA

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USDA Research

- **PAM (Anionic) Enviro-Safe**
  - EPA & FDA OK'd for food/water etc. uses
  - An animal feed additive
  - No known toxicities in soil/water (even at more than 10x NRCS rates)
  - No PAM accumulation in crops
  - No negative plant effects at these rates

- ***Anionic PAMs are safe to aquatic life***
- ***Erosion PAMs are ANIONIC***
- ***Do not use CATIONIC PAMS for E&S Controls - They require special handling/use to be safe for aquatic life***

USDA

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USDA Research

CEC
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Flocculation – PAM Demo

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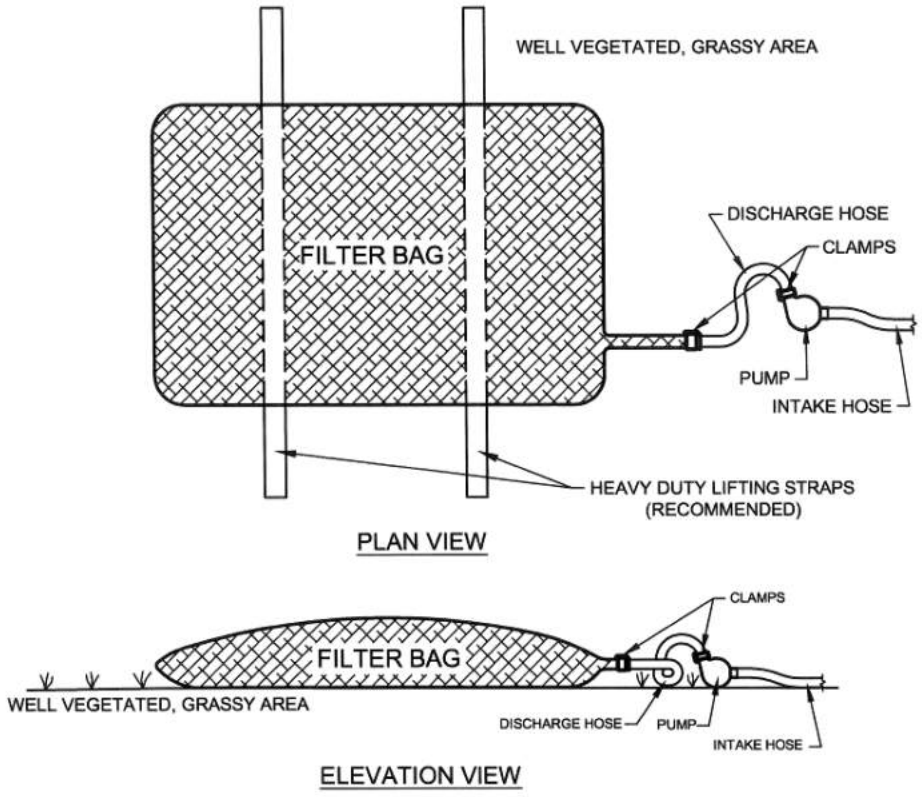
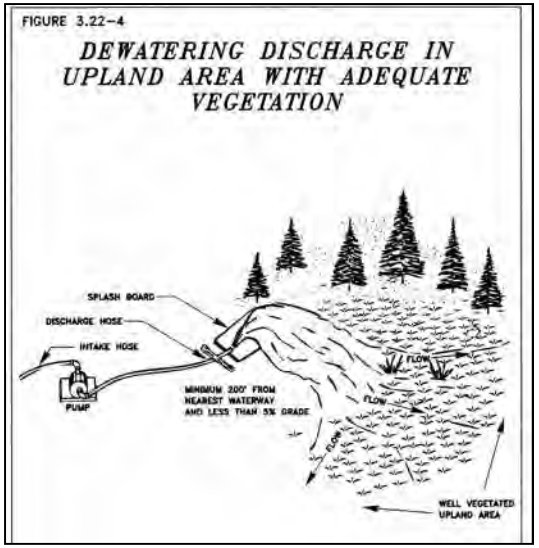
Dewatering

STANDARD CONSTRUCTION DETAIL # 3-16
Pumped Water Filter Bag



PA DEP



- **Filter bags may be used to filter water pumped from disturbed areas prior to discharging to surface waters.**
- **They may also be used to filter water pumped from the sediment storage areas of sediment basins and sediment traps.**

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Dewatering

- **Bags to be located in well-vegetated (grassy) area, and discharged onto stable, erosion resistant areas.**

Northampton County Conservation District

Source: BFA.

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Dewatering

This is not a good location...

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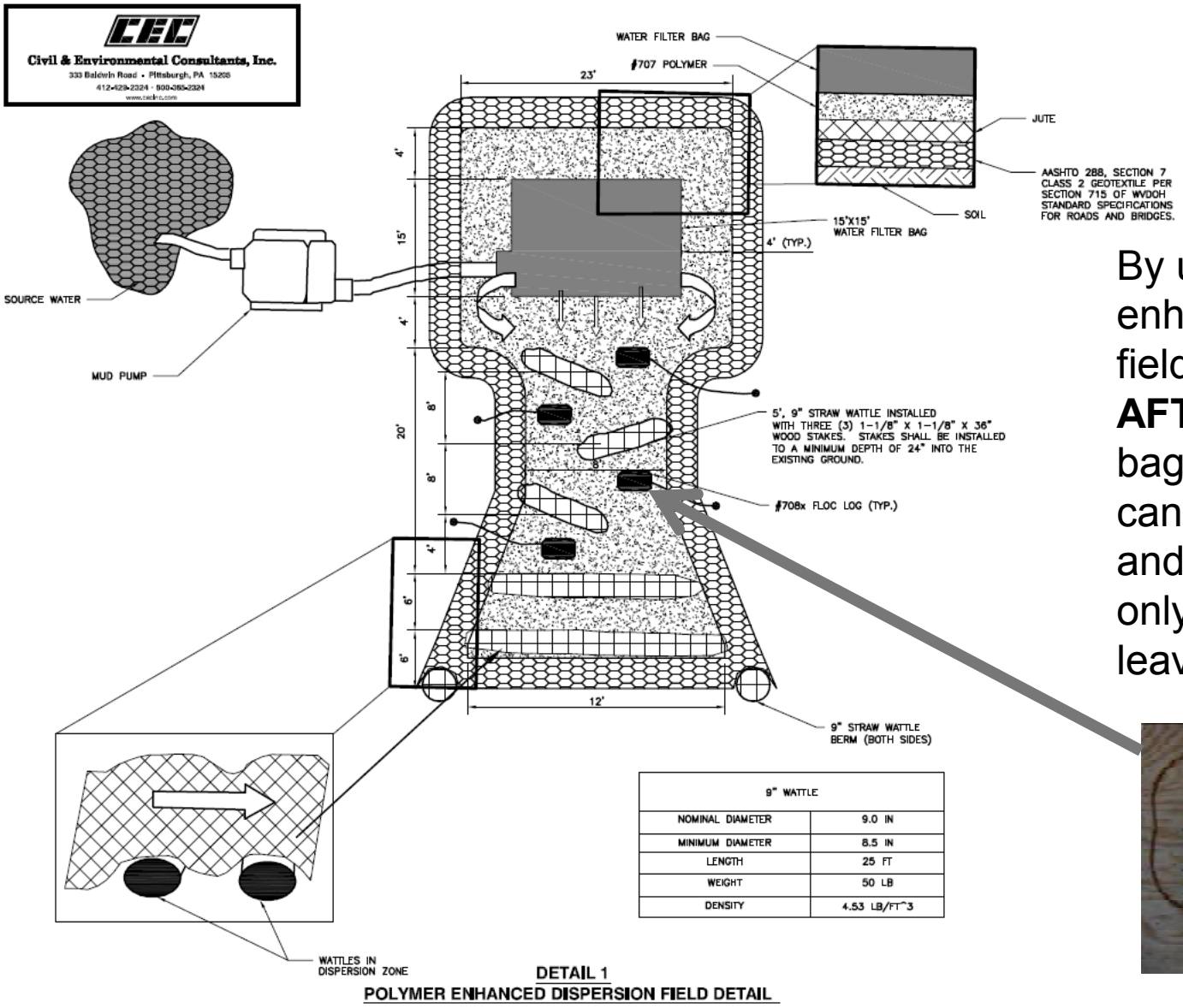

By using a polymer enhanced dispersion field and Floc Logs **AFTER** the sediment bag the fine particulate can be flocculated out and captured allowing only clean water to leave the site.

Polymer Enhanced Dispersion Field

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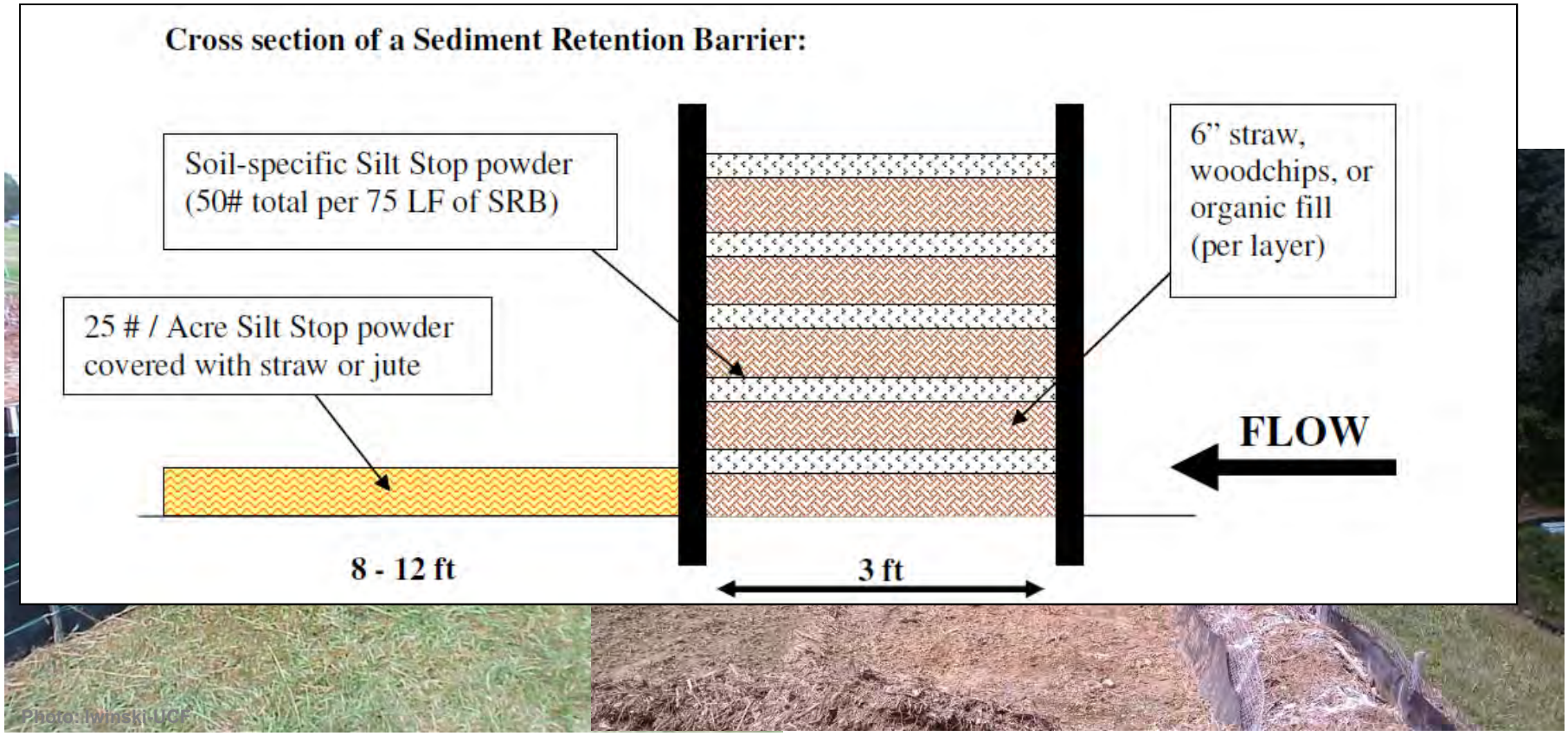
Sediment Retention Barrier

The **Sediment Retention Barrier** (SRB) is a double row of silt fence, standing about 3-6 feet apart, filled with loose mulch, straw, woodchips, or other organic matter mixed or blended with the site-specific polymer.



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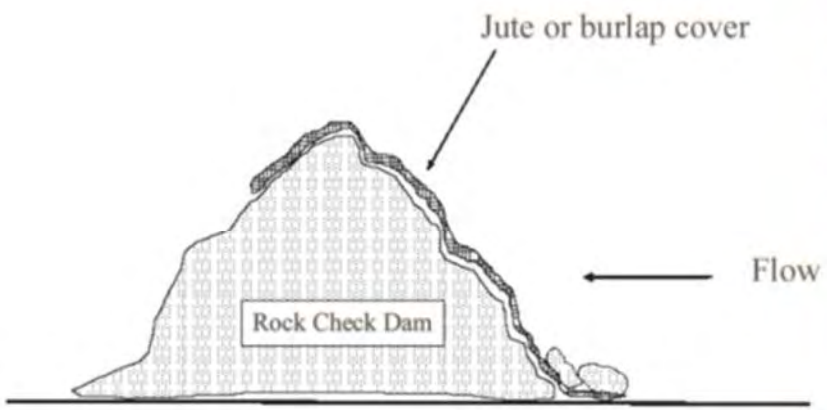
Rock Check Dam with PAM



Apply the correct polymer to the matting.

Apply jute matting to the rock check. The matting provides a surface for attachment of soil-polymer matrix.

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Rock Check Dam with PAM

The fine sediments become attached to the matting reducing the impacts at the discharge points.

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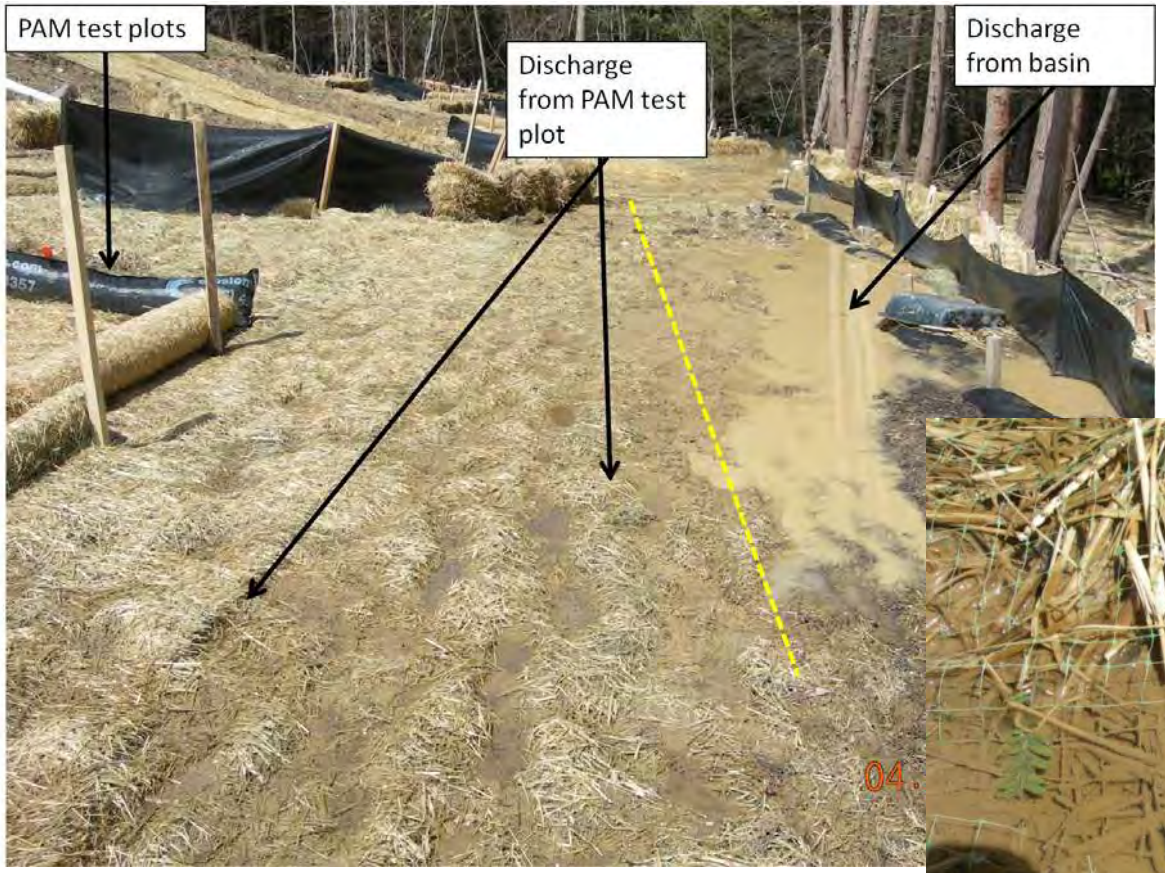
Field Test Plots



Sediment attaches to the straw mat

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Case History

Site with specific discharge limits is exceeding permit requirements…

Floc logs, check dams and PAM powder installed upstream of sediment basins…

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Case History

SEDIMENT DEPOSITS

Basin discharge limits in compliance!

SEDIMENT DEPOSITS

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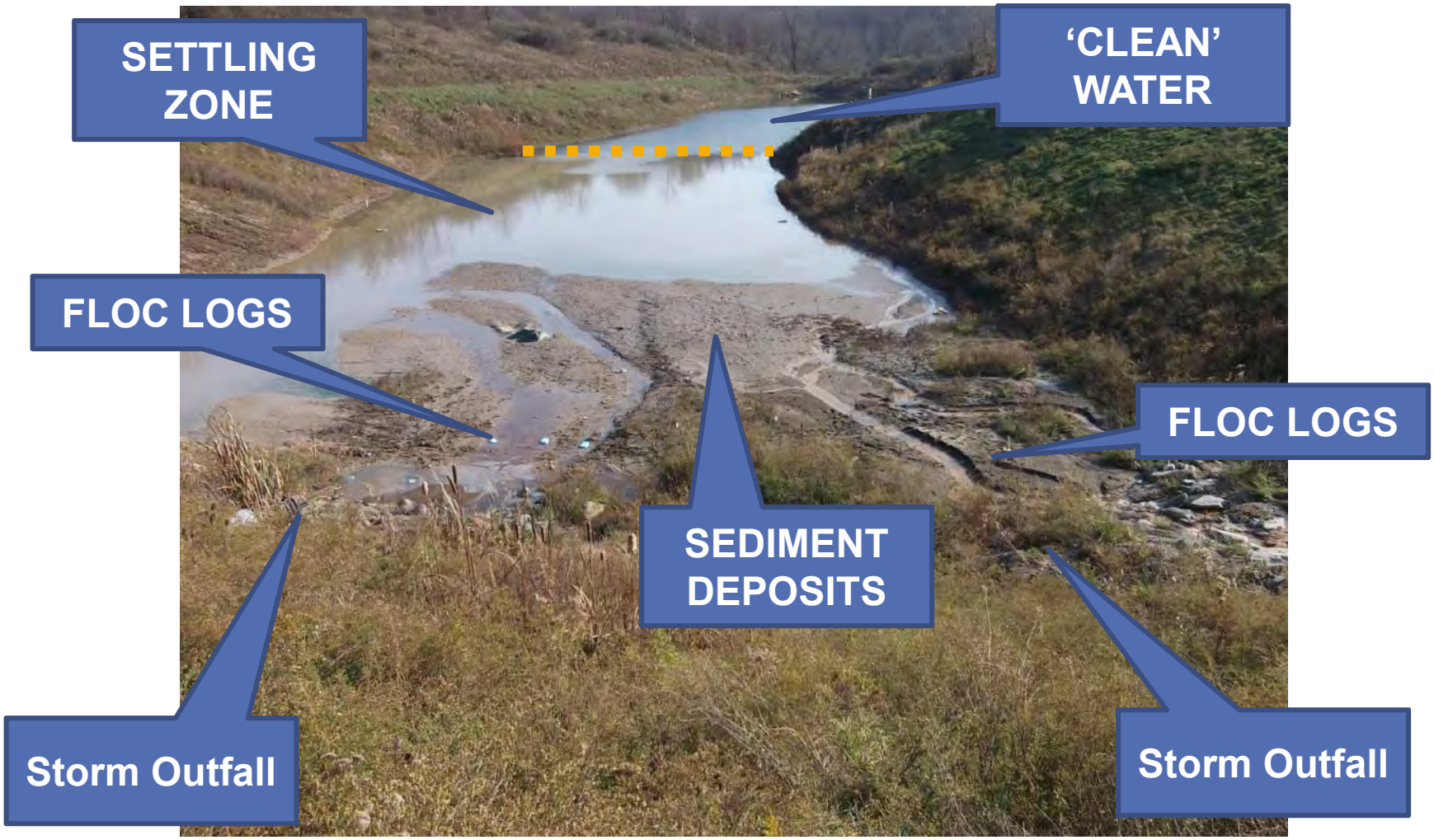
Case History



Basin discharge limits in compliance!

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Alternate Control Estimated Material Costs

HydroPlanks

8’ Plank - $17.40/ea.

10’ Plank - $21.80/ea.

Polyacrylamide (PAM)

Floc Logs (4 logs/Box) - $75 - $125/box

PAM Power (50lb/bag) - $250 - $375/bag

PAM Liquid Emulsion (5 Gal. Bucket) - $225-$300/bucket

Mat & Terra Tubes

Jute Matting (4’ x 225’) - $50 -$62/roll

9” x 13” Terra Tubes - $2.50 - $4.50/lf

8” x 25’ Straw Wattle - $18 - $25/ea.

8" X 25' Straw Wattle (12 per Pallet) - $250-$300/pallet

Prices will vary by region, quantity purchased, etc.

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Questions?