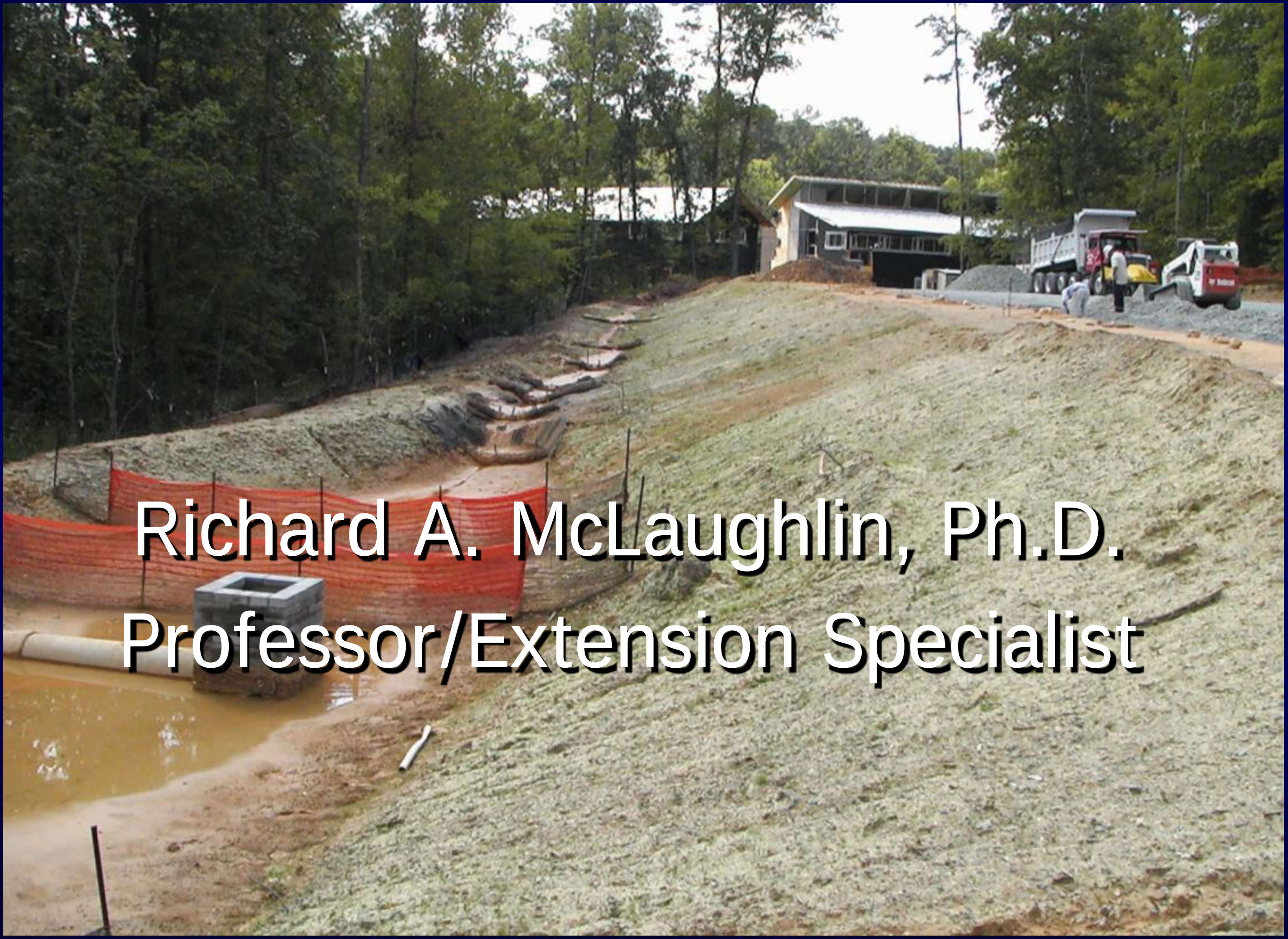
Mixing and Matching for Turbidity Control



Richard A. McLaughlin, Ph.D.
Professor/Extension Specialist

International Conference in Raleigh Next February!

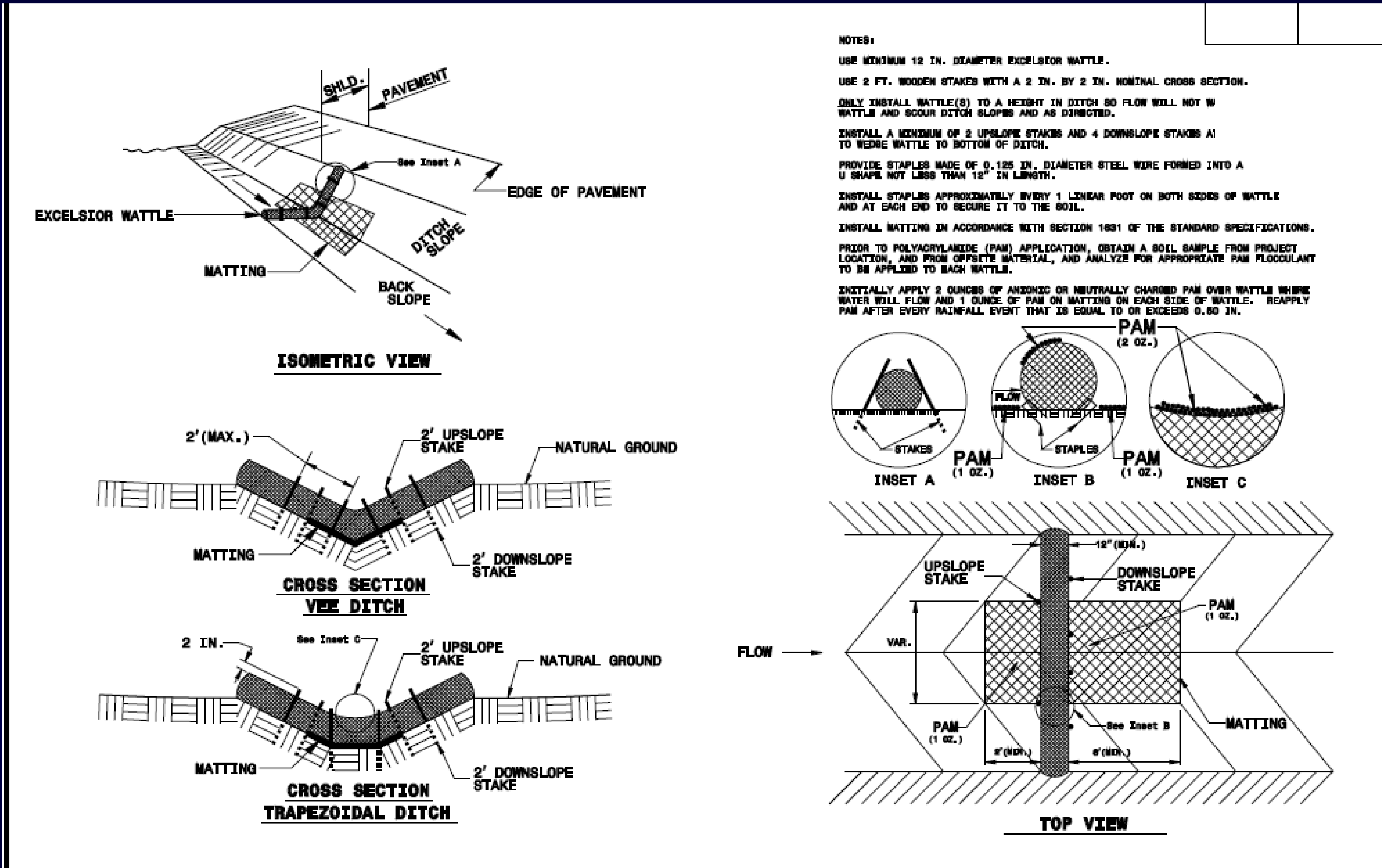
Approach

Passive dosing is any system that relies on gravity flow in a conveyance to achieve flocculation.

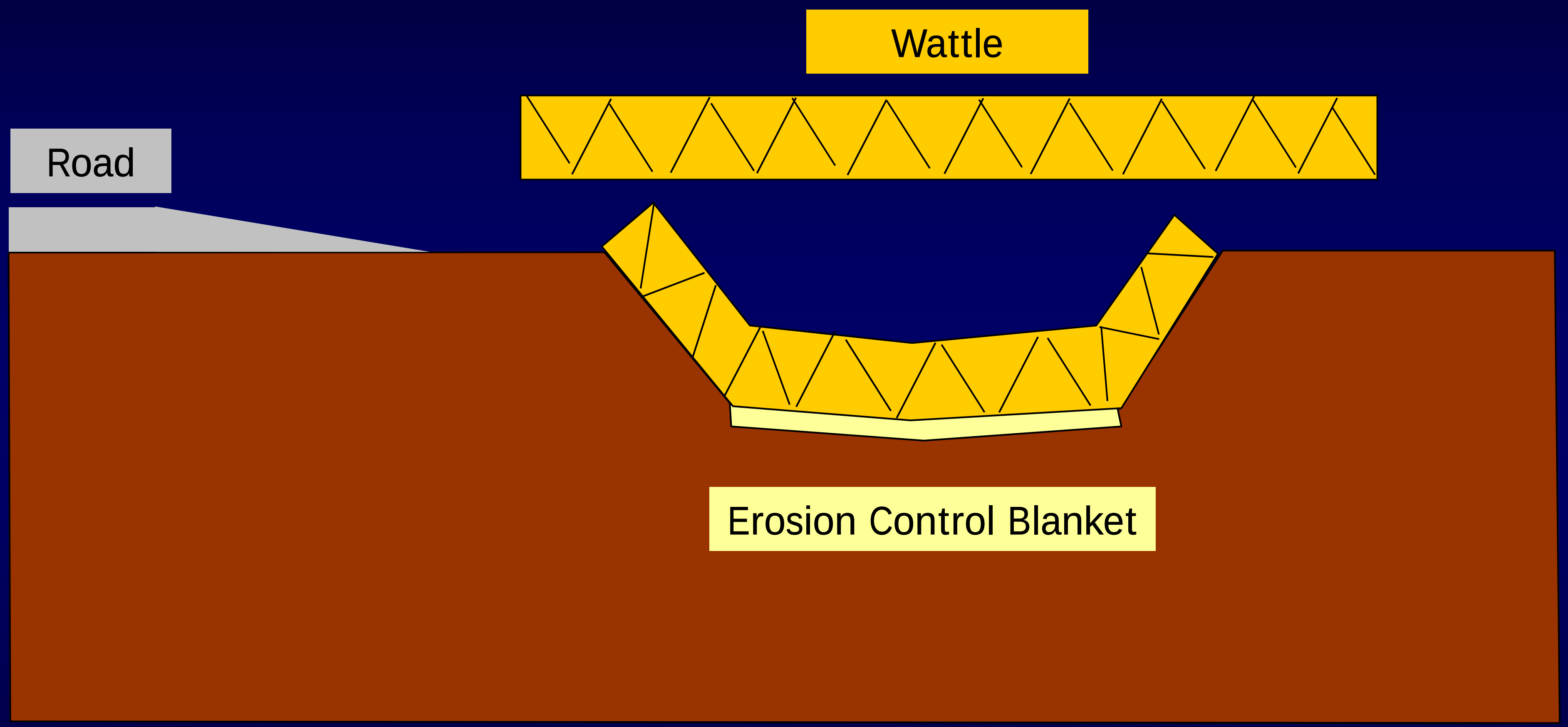
- Check dams with dry granular polymer
- Other granular polymer uses
- Polymer logs or socks (in pipes and other structures)

Remember, polymer-treated water needs to be settled or filtered prior to discharge!

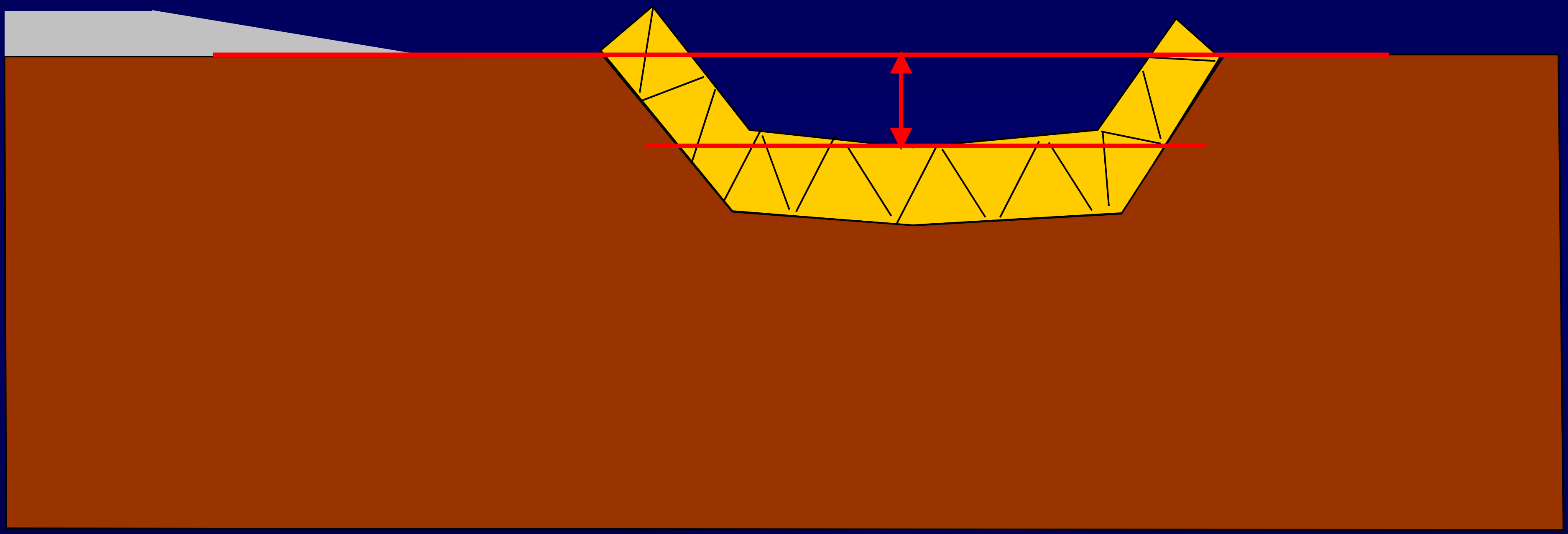
Wattle with Polyacrylamide (PAM)



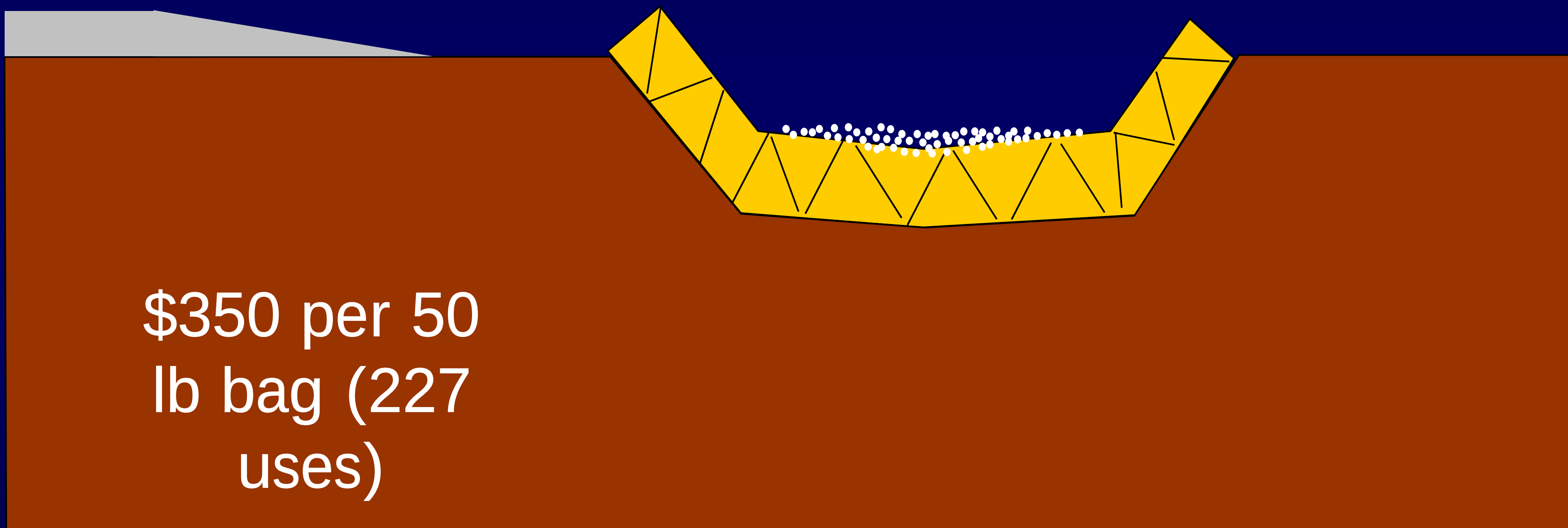
The Basics: Simply fit the wattle across the ditch with some erosion control blanket beneath it.



Important! Make sure the lower spill point of the wattles is below the height of the ditch sides so bypass flow does not occur.



Sprinkle 100 grams of PAM (½ cup) over the lower center portion of the wattle and on the blanket above and below.



Coir Wattle w/ Flaps Helps Eliminate Undercutting

Installation Guide

Is there a gap at the upturned edge of the wattle?

Weave wire staples through mesh at an angle to the wattle-space every 1 ft.

Fill gaps with excess fabric

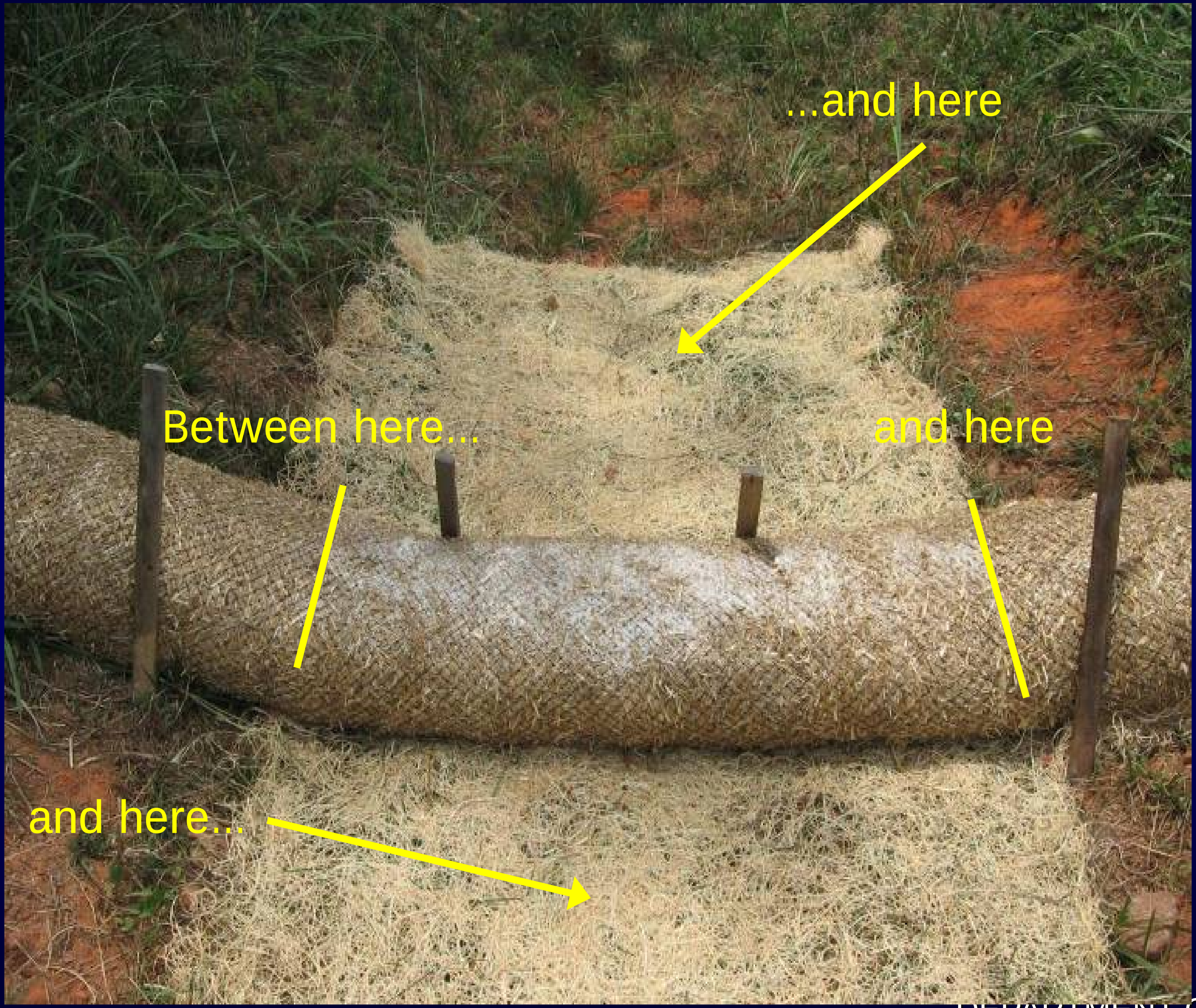
Check Dam Pooling

Simple Check Dams

Can use materials on hand...

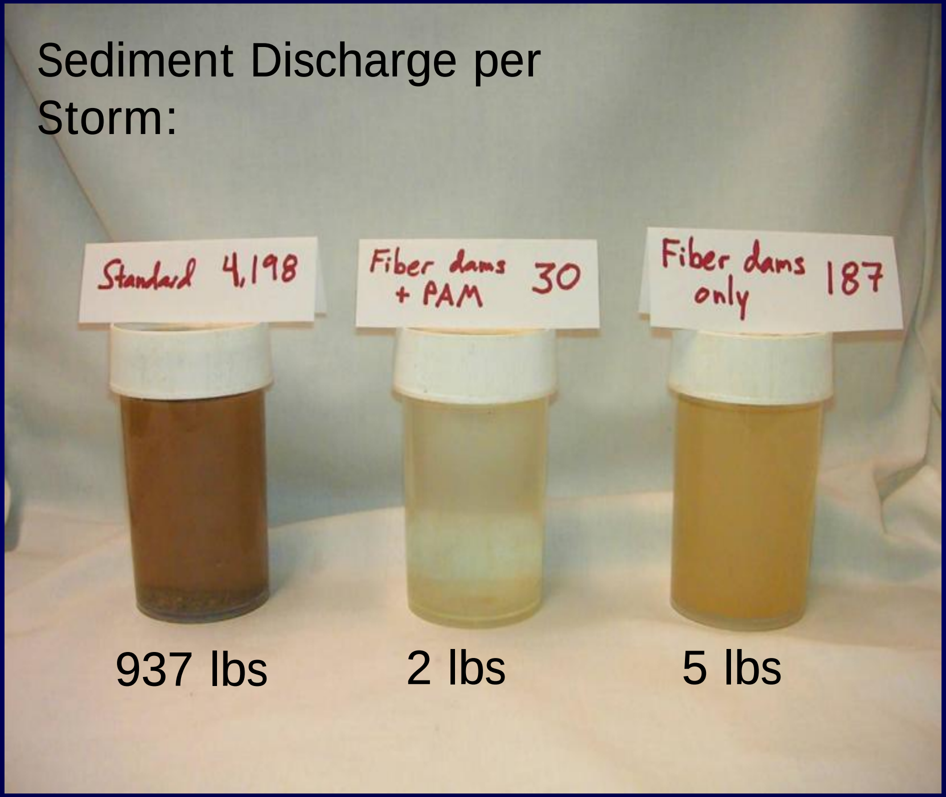
Sprinkle 100 grams (½ cup) of PAM 705 on the lower, center portion of the wattle where water is going to flow over.

Must replace with new PAM every so often as the weather dictates
Maintenance is always important!

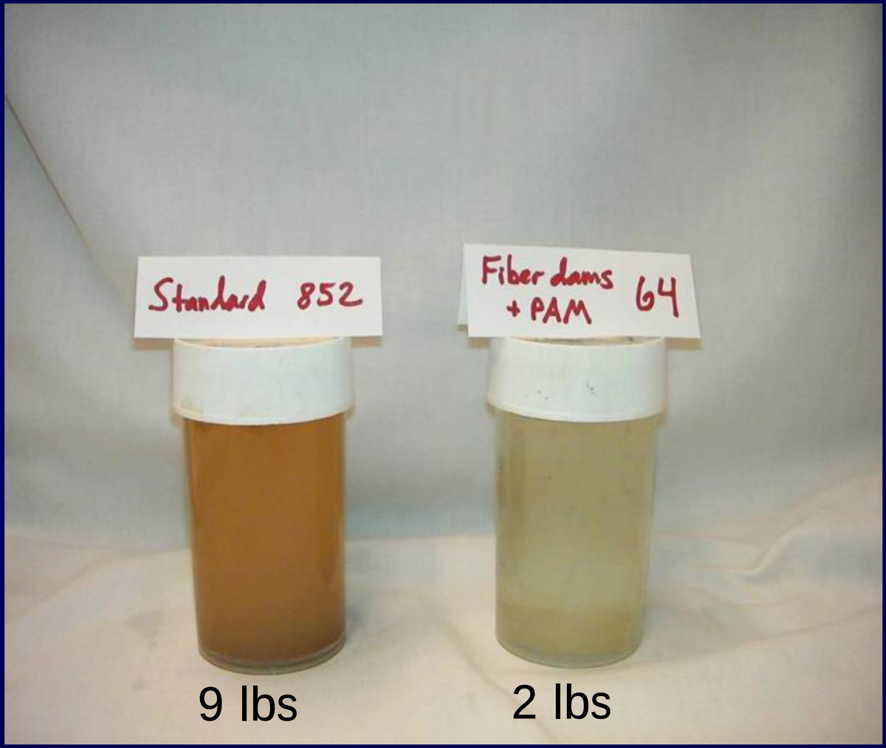


Examples of Poor Installation

Very good results most of the time!



Site 1



Site 2

Cost Estimate Comparison

Site 1:

450’ Standard section	**$1.98 / foot**
668’ Fiber check dams + PAM	**$1.32 / foot**
461’ Fiber check dams only	**$1.70 / foot (spacing closer)**

Site 2:

508’ Standard section	**$1.75 / foot**
489’ Fiber check dams + PAM	**$1.63 / foot**

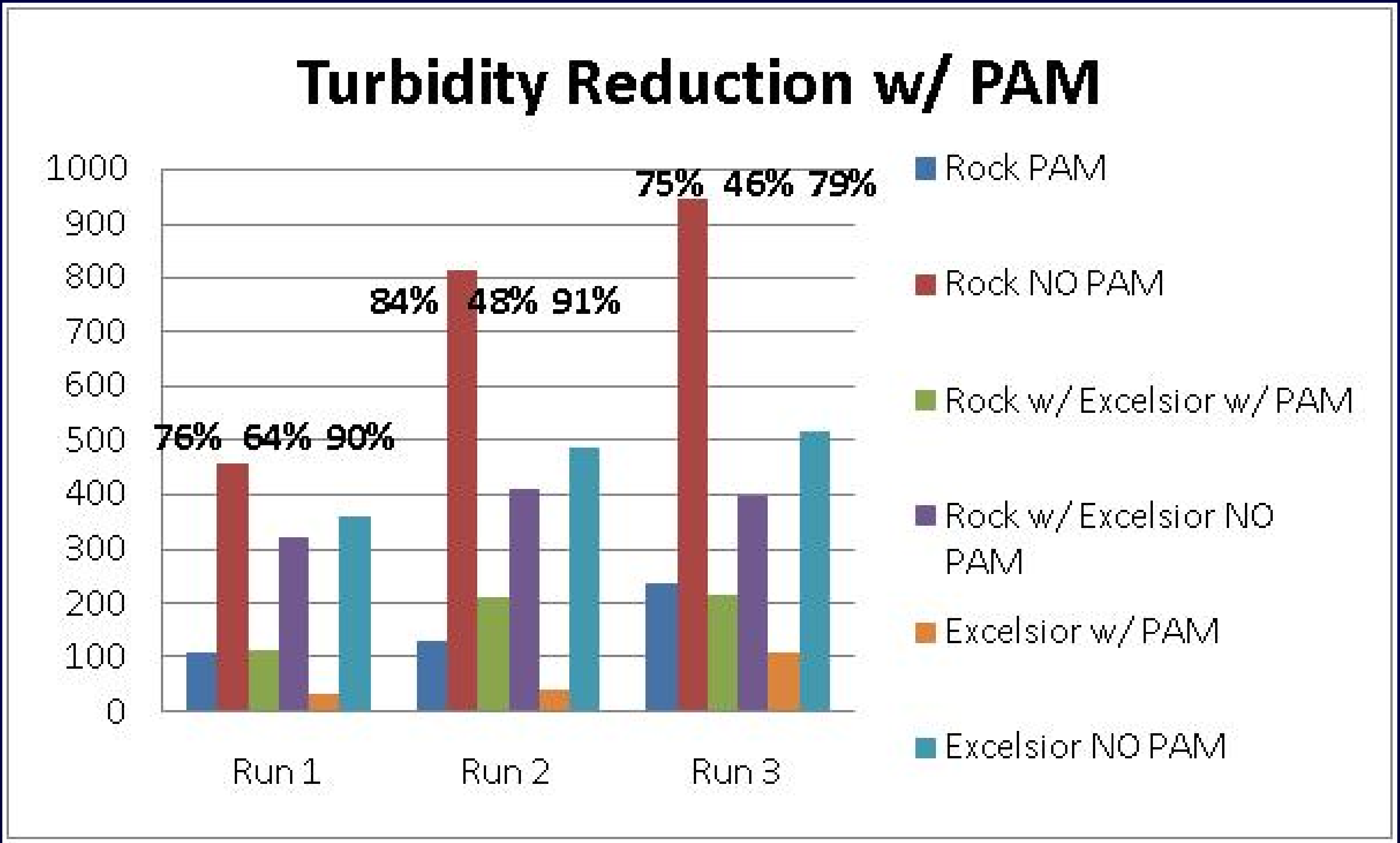
The logs and wattles do not have to be removed either, they can decompose in place.

Flume Testing of Check Dams

Storms simulated and water samples collected:

- 4 minutes at 0.5, 1.0, 2.0, 1.0, and 0.5 cfs
- Soil added at 6,000 mg/L
- 4 samples were collected in each bottle, 5 bottles total
- 3 consecutive “storms” run
- Sediment depth and length was measured and a LIDAR scan was taken

Check Dams w/ PAM: Turbidity



Need a Ditch or Swale for the Wattles!

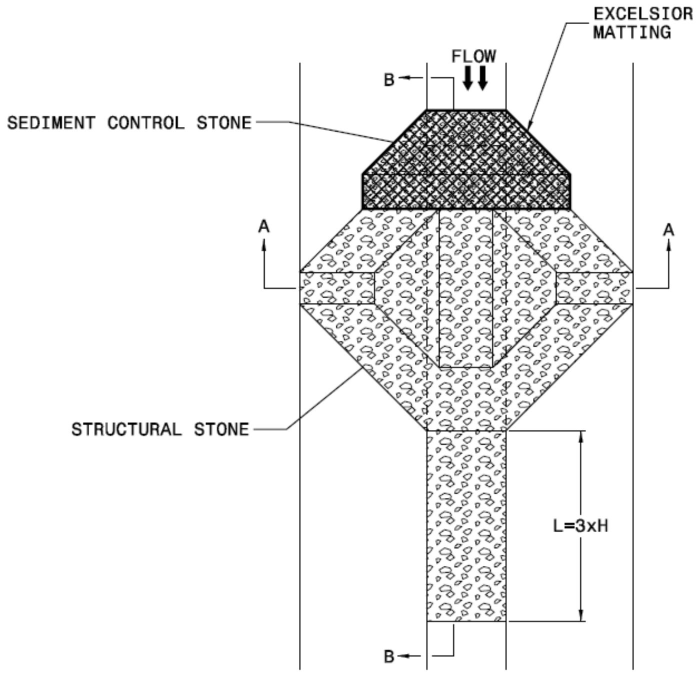
New Alternative: Layfield Spring Berm

Passive Treatment #2: Rock+Fabric

- Modified Type A Silt Check with addition of excelsior (or coir) matting on top of Sediment Control Stone

- Sprinkle lower, center portion of fabric lined weir with 4 oz (½ cup) of PAM-705
- Reapply PAM after 0.5 inch rainfall or greater

TEMPORARY ROCK SILT CHECK TYPE 'A' WITH EXCELSIOR MATTING AND POLYACRYLAMIDE (PAM) DETAIL

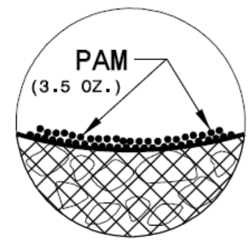


PLAN

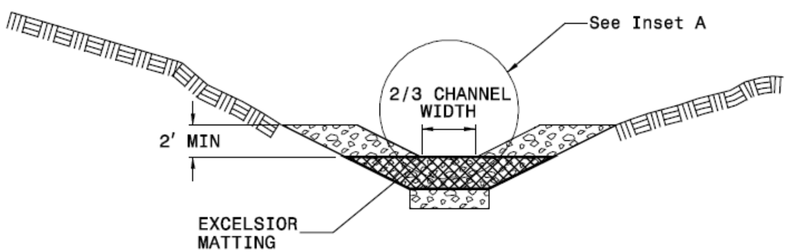
NOTE

USE EXCELSIOR FOR MATTING MATERIAL AND ANCHOR MATTING SECTION AT TOP AND BOTTOM WITH CLASS B STONE.

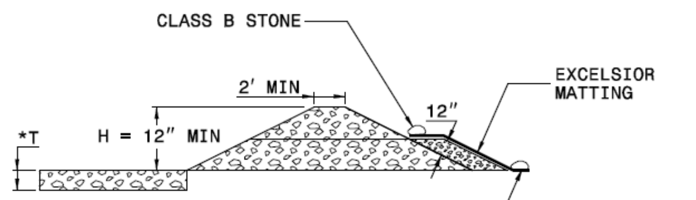
INITIALLY APPLY 3.5 OUNCES OF POLYACRYLAMIDE (PAM) TO TOP OF MATTING SECTION AND AFTER EVERY RAINFALL EVENT THAT EQUALS OR EXCEEDS 0.50 INCHES.



INSET A



SECTION A-A



SECTION B-B

*T = 12" MIN., 18" MAX.

DPS w/ Corrugated Pipe

Typical Demo Results

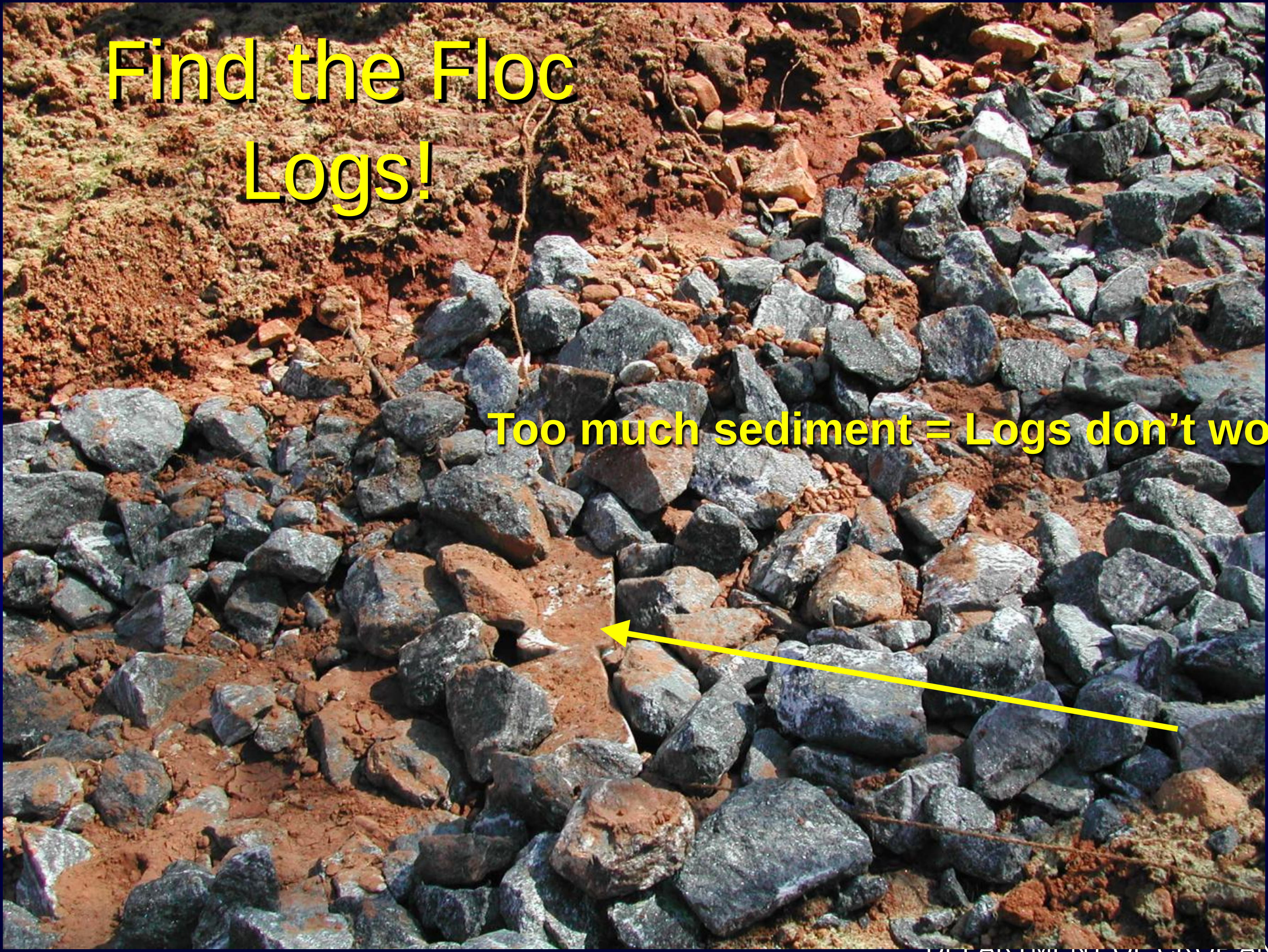
Other Passive Approaches using Granular PAM

PAM sprinkled on coir baffle in basin (maybe)

PAM sprinkled on erosion control matting down a slope

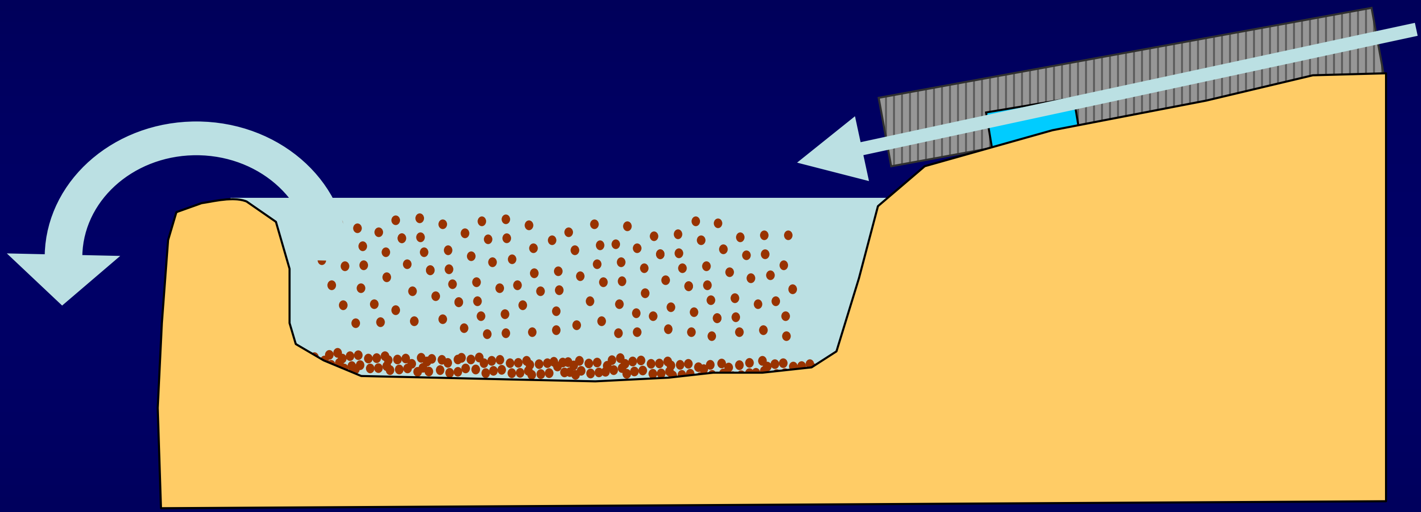
Solid PAM Blocks (Floc Logs™)

Find the Floc Logs!



Too much sediment = Logs don’t work

Place PAM logs inside pipes



Discharge into basin/trap before discharging off site!

Two Chamber Basin Design

100-200 NTU discharge here

4,000 – 5,000 NTU elsewhere

Pipes w/ Logs in Ditches

PAM Bucket?

Drop Inlets – Another Good Option for PAM Logs

Drop Inlets – Another Good Option for PAM Logs

Drop Inlets – Another Good Option for PAM Logs

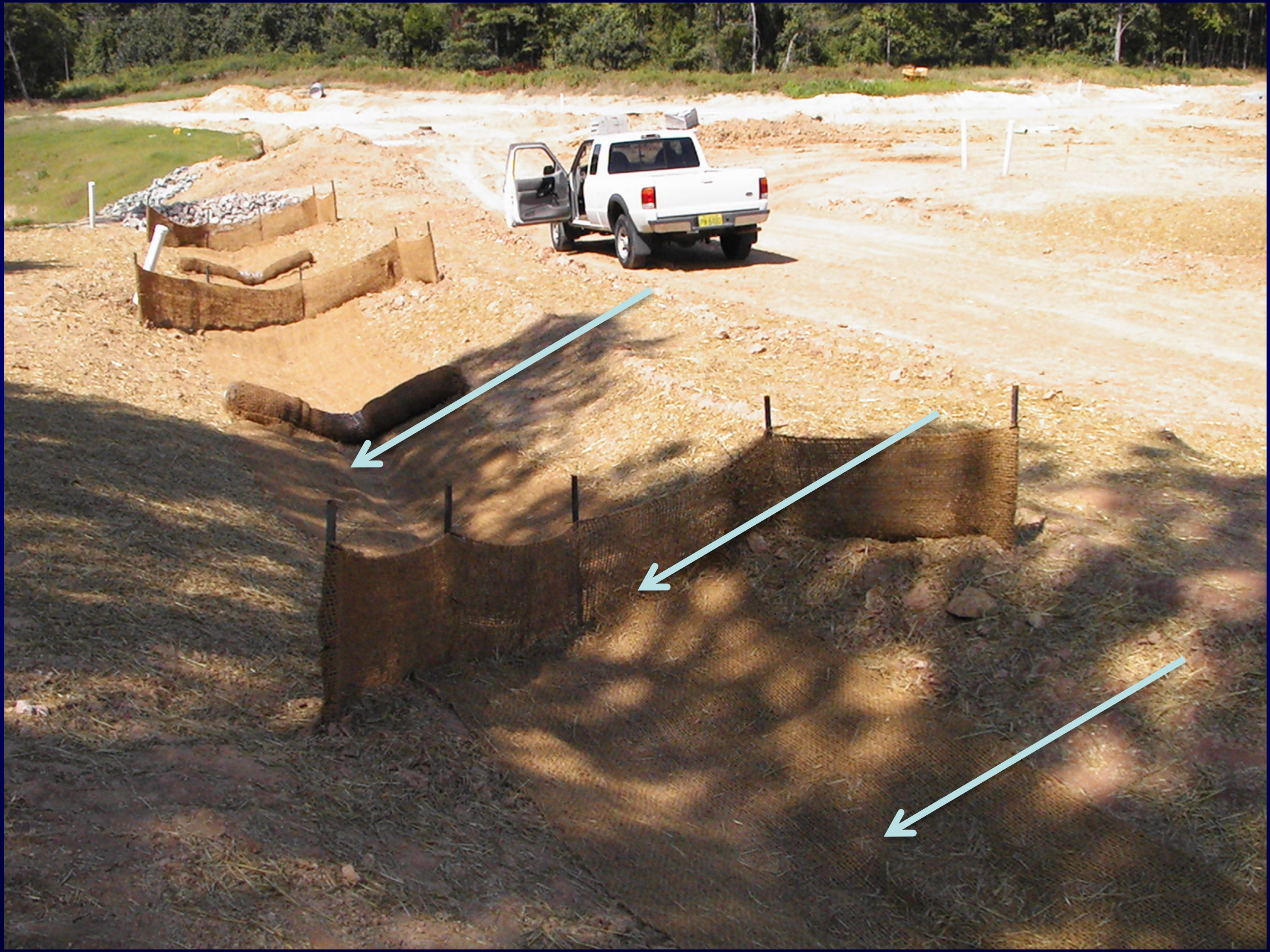
No berm so substantial bypass observed during heavy storms

Keys to Making PTS Work for You

- Match flocculant to your soil or suspended sediment and water chemistry.
- Reduce sediment load prior to flocculant treatment.
- Keep the flocculant moist.
- Create high flow onto flocculant.
- Create high mixing (turbulence) after flocculant.
- Allow for settling post-treatment.

Ideal Passive Treatment Zone!

Innovative Treatment



Active Treatment Systems

Richard A. McLaughlin, Ph.D.

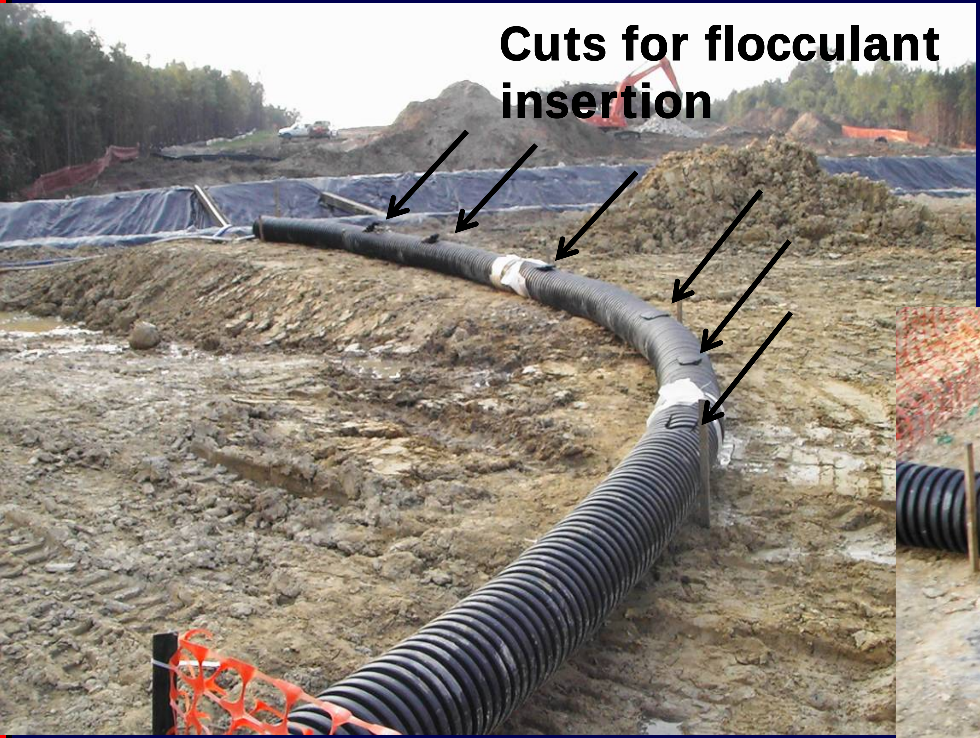
Professor/Extension Specialist


CH&E

Passive Treatment of Pumped Water

- Water is passed over solid flocculants in the pipe

Passive Dosing with Flocculants in Pipes

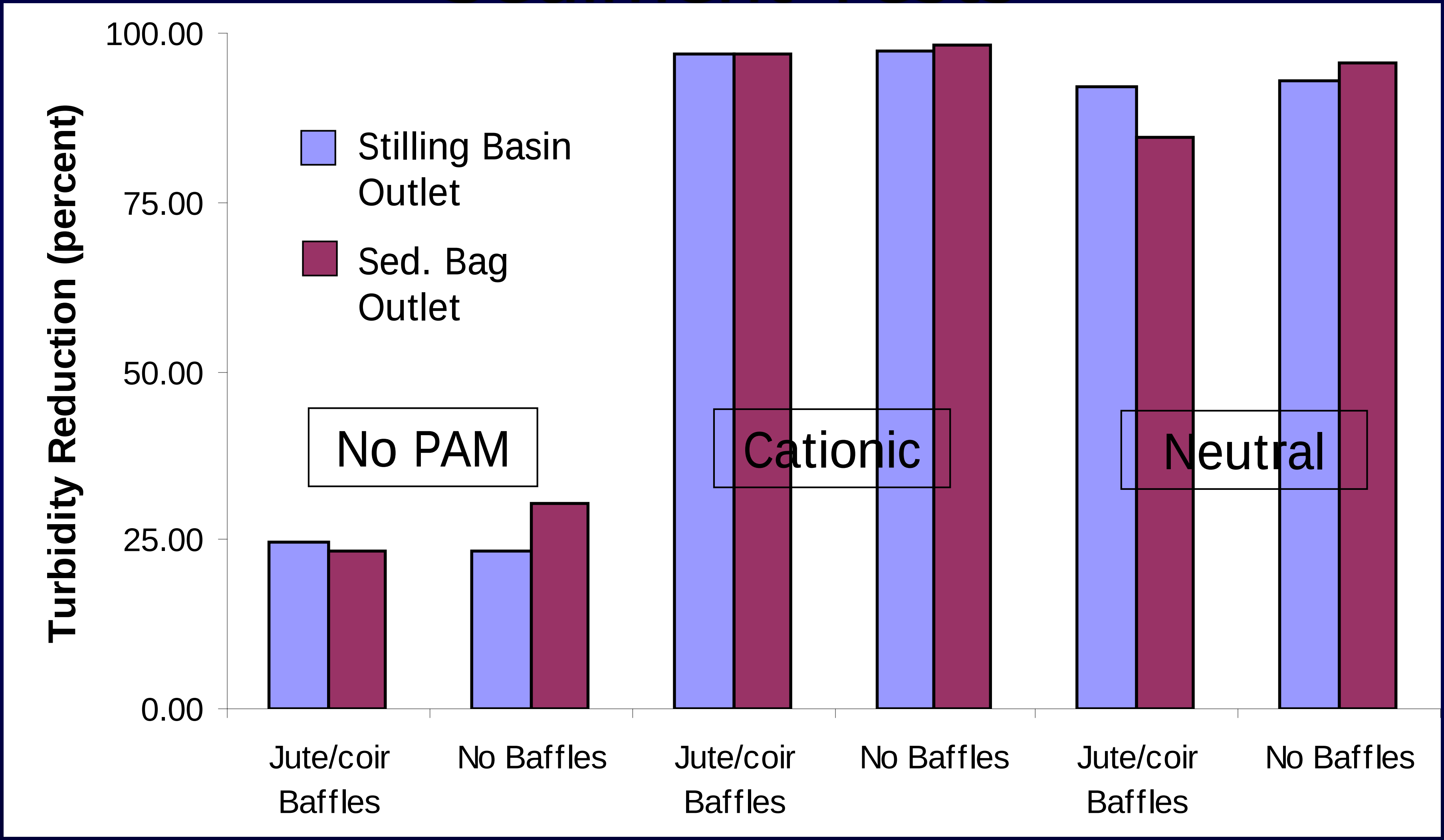


Field Testing: Generate Turbid Water

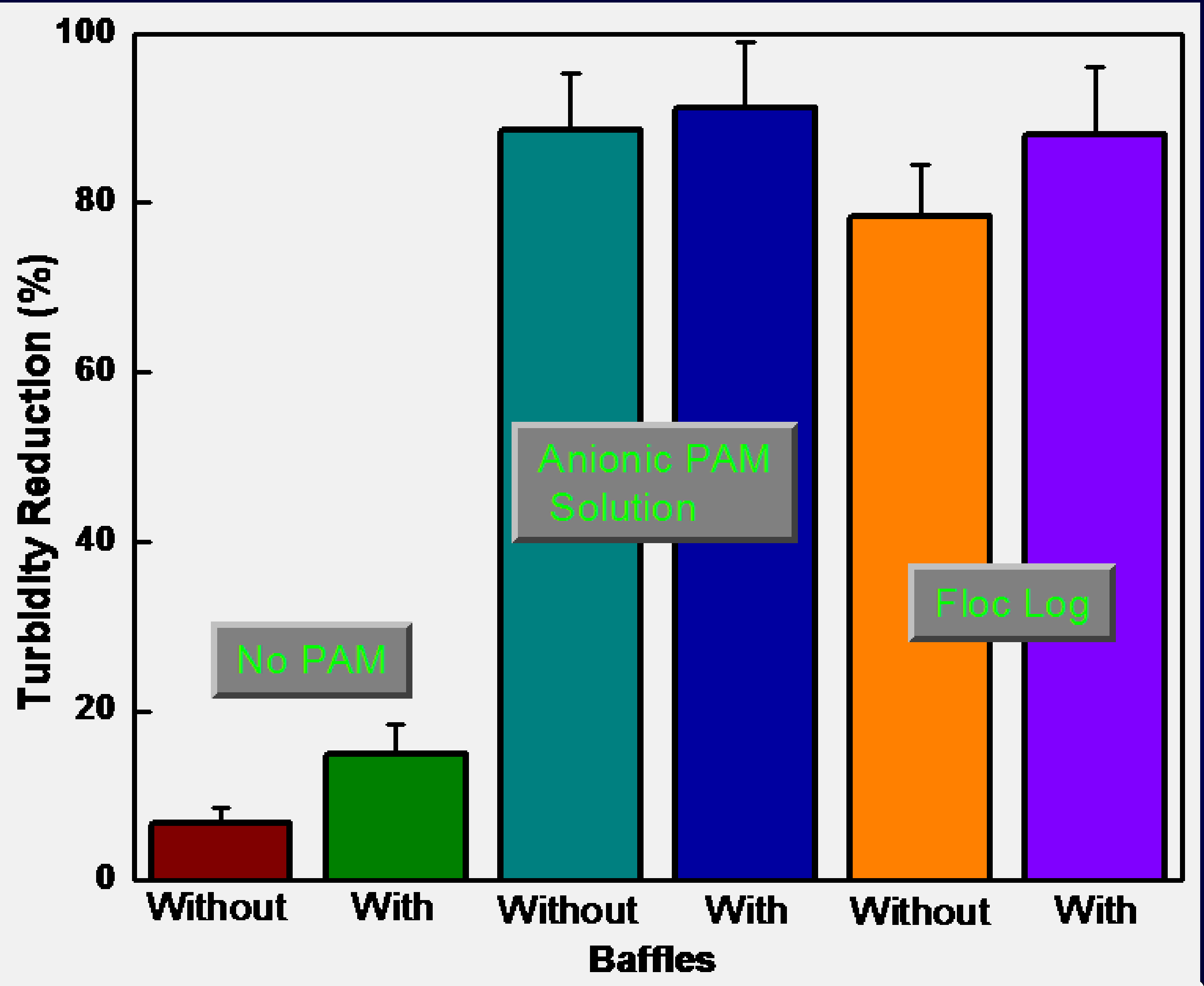
Pump to Stilling Basin

Basin Design Treatments in Stilling Basin

Turbidity Reductions in Plymouth Sediment Tests

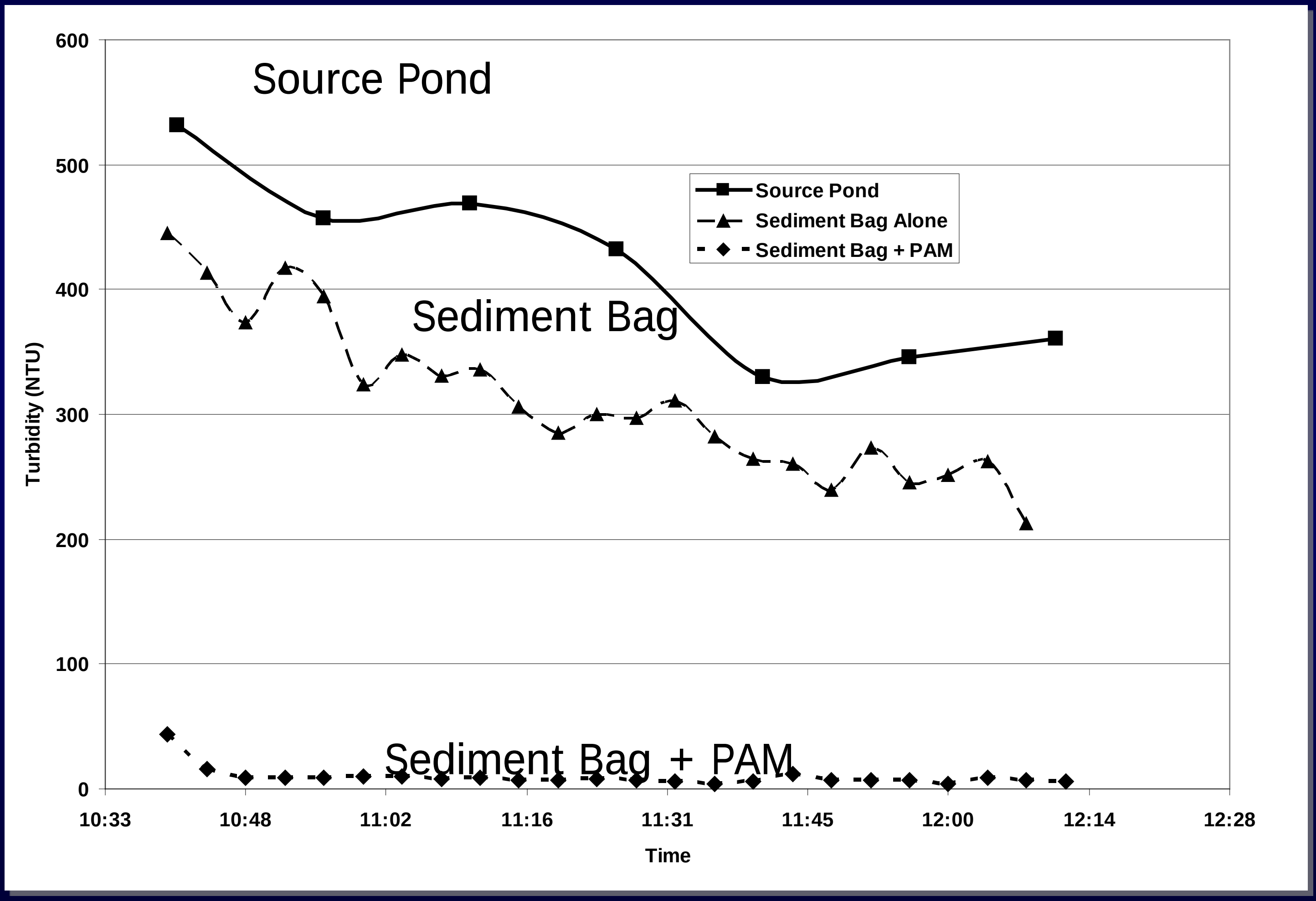


Dosing System: Solution vs. Solid Block



Sediment Bags and PAM?

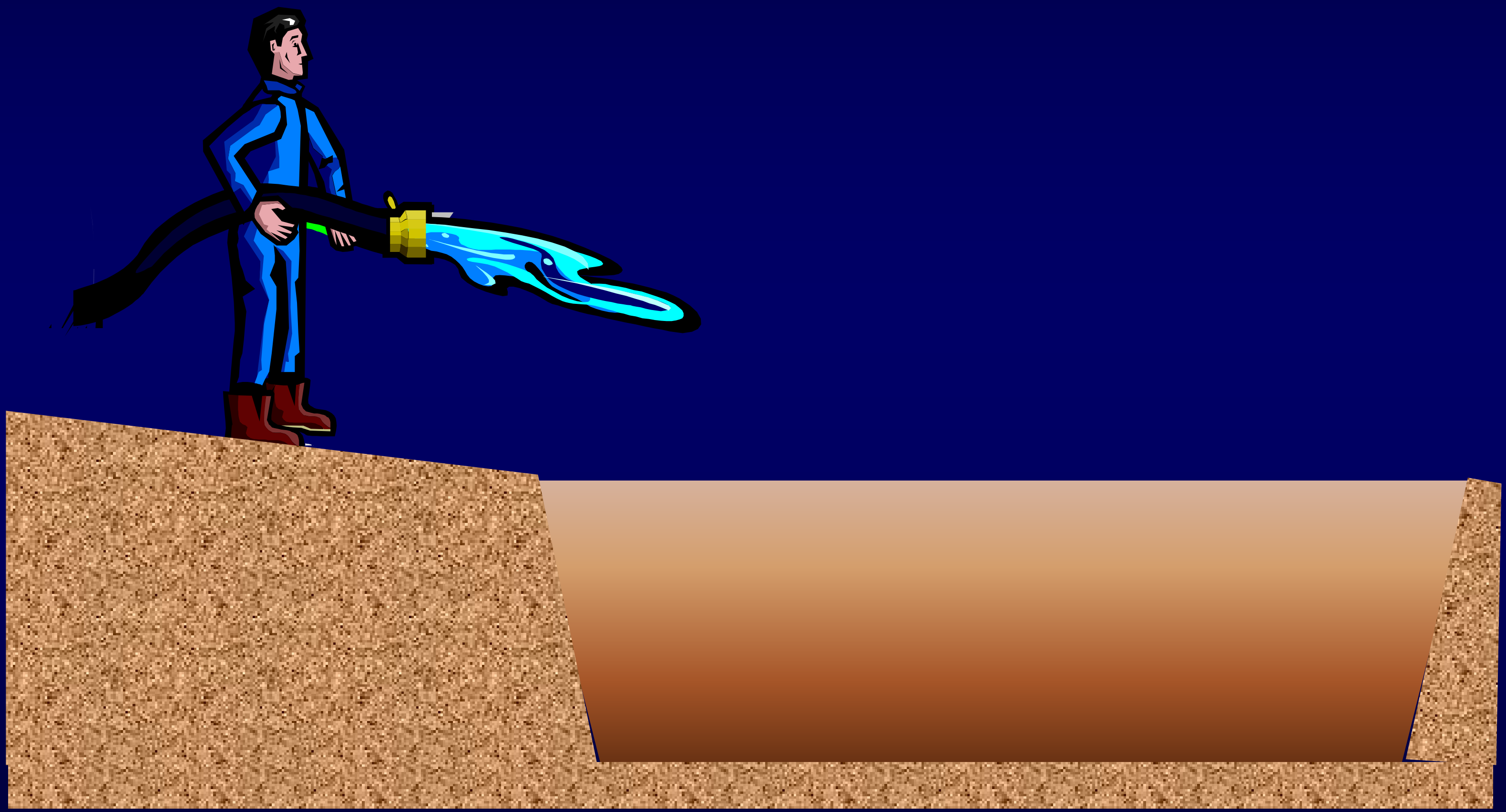
Sediment Bag and PAM Injection



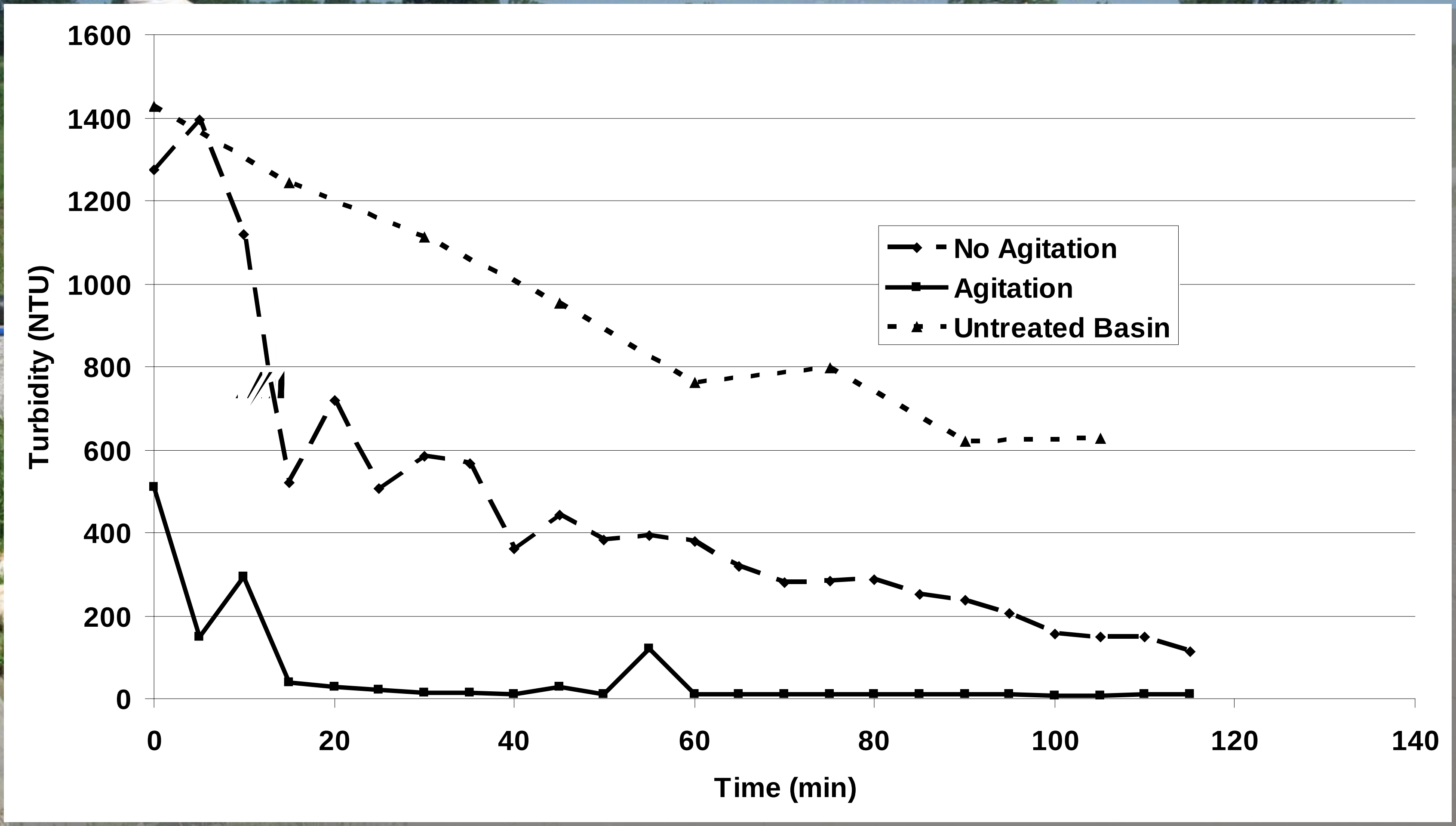
Simple Dosing System

Active pumping, passive dosing

Surface PAM Solution Application?



Surface PAM Solution Application?



Example Batch System Setup

Example Controller System

Influent & Effluent Monitoring

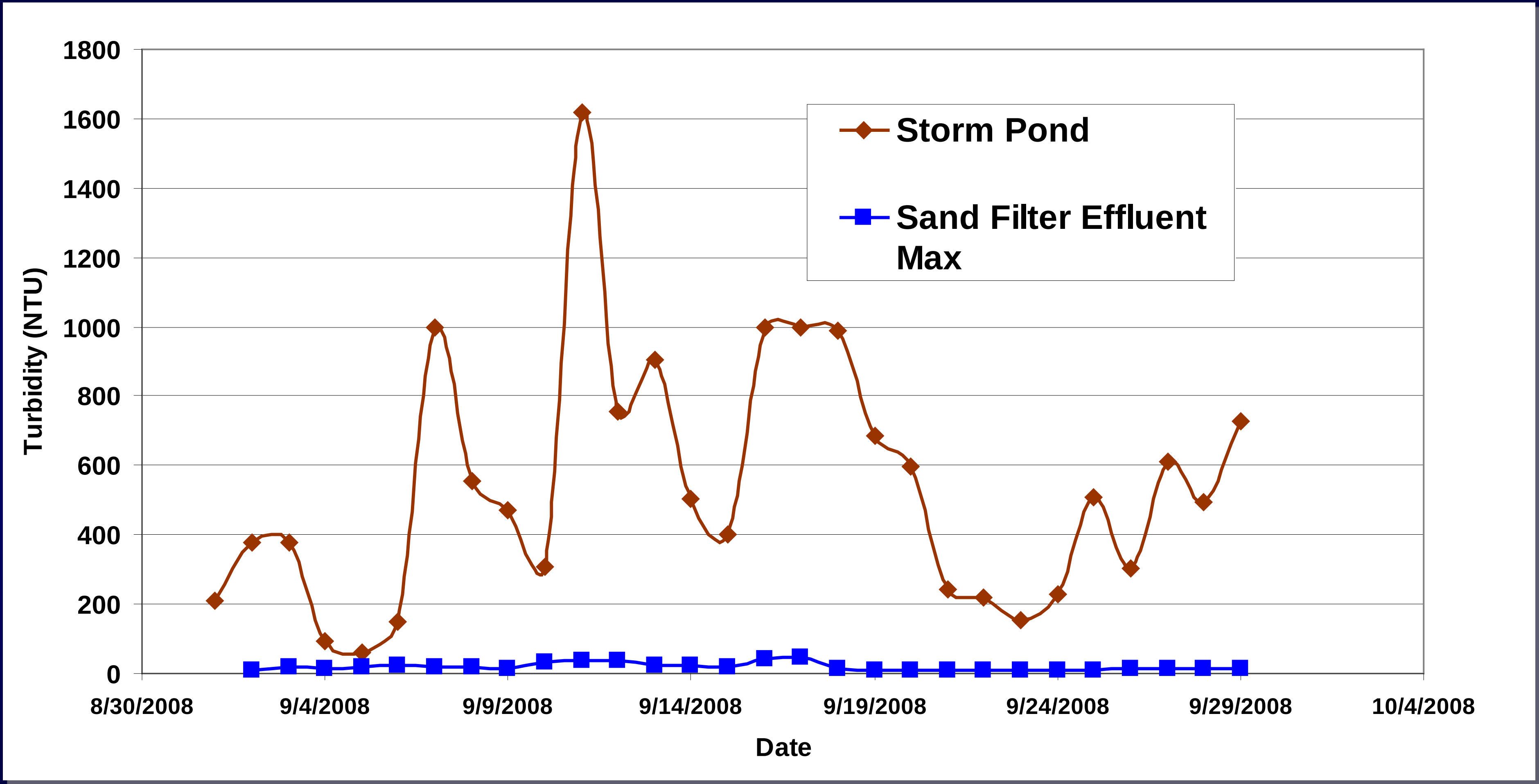
Automatic Recirculation
Of Noncompliant Discharge

Courtesy Alex Zimmerman

Active Treatment Option: In North Carolina!

Sand Filtration – Final Step

Active Treatment: Durham



Receiving Stream Turbidity Was Actually Reduced!

Rain-Driven Liquid Doser

- Created in New Zealand
- Doses runoff with solution of coagulant or flocculant based using rainfall

Rain Displacement Dispenser

Figure 4. *Rainfall Activated Flocculation Housing*

Rain Displacement Dispenser

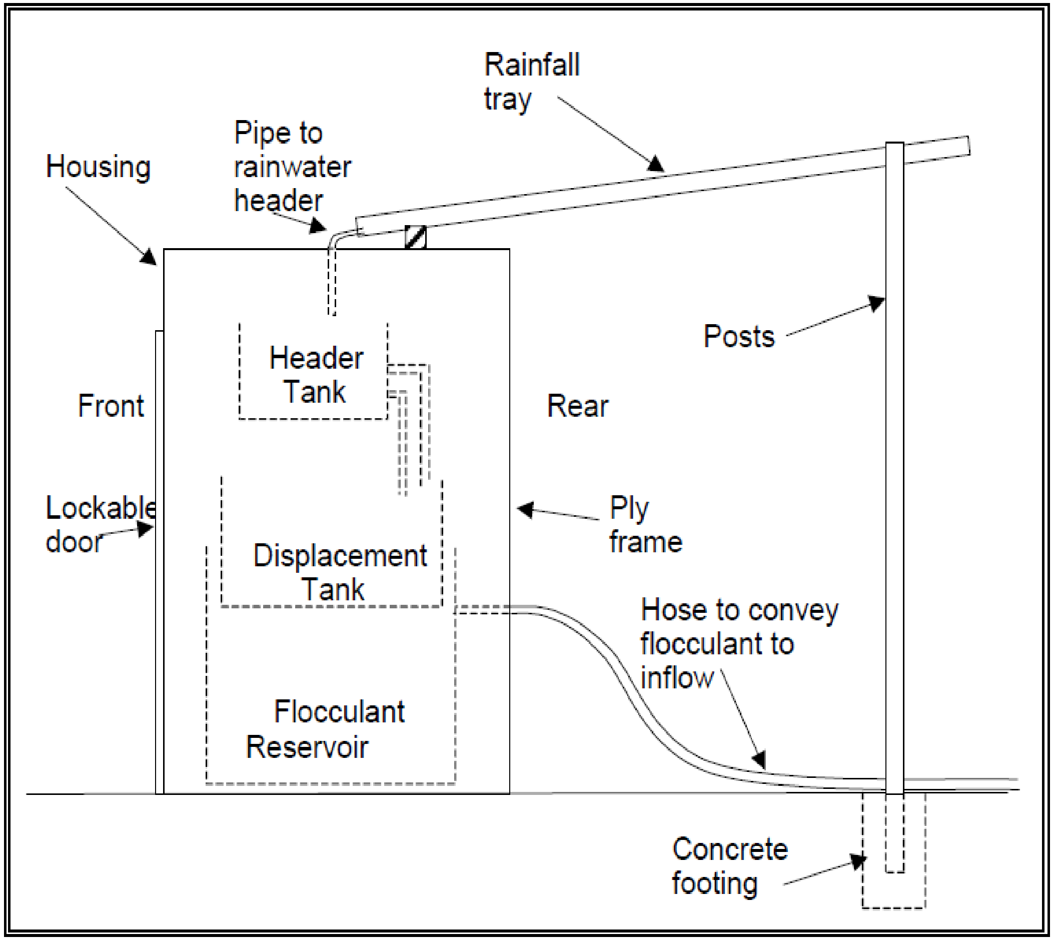


Figure 3. Rainfall Activated Flocculation System Housing Detail – Side View

Rain Displacement Dispenser

Auckland
Regional Council
TE RAUHITANGA TAIAO

The Use of Flocculants and Coagulants to Aid the Settlement of Suspended Sediment in Earthworks Runoff : Trials, Methodology and Design [draft]

June 2004 Technical Publication 227

NCSU Doser

The Scale Problem

- PAM solutions of 1,000 mg/L can only treat 1,000 times their volume (assume 1 mg/L treatment).
- 30 gal can treat 30,000 gal
- 1”/acre is 27,000 gal
- So 30 gal treats 1 acre of 1” of runoff

Remote Sampling

The Construction Site Dream

- Virtually no exposed soil during rain events
- Lined ditches, plenty of check dams with polyacrylamide
- Sediment basins with inlet protection, baffles, stable sides, surface outlet
- Inspectors, contractors, owners working together!

...and all our streams run clear!


Questions?