



Module 5

ESC Handbook and ESC Plan Elements

Module 5a



ESC Handbook Overview



- The Virginia Erosion and Sediment Control Handbook is a technical guide used for design, plan review and inspection of ESC measure or practices on construction sites
- This participant guide only contains excerpts of the specifications



5b. Overview of Structural Controls

Functions of Structural Controls



- *Vegetative Controls = erosion prevention*
- *Less \$ than structural practices*
- *Structural Controls = sediment trapping & erosion control*
- *More expensive*



Functions of Structural Controls

- **“Second line”** of defense against sediment loss.
- **Must be used in conjunction with vegetative controls.**
- **Must not exceed design limitations**

Functions of Structural Controls

- High life cycle costs for a project.
- Temporary controls must be removed after final stabilization.



ESCH Practices

1 Safety Fence

2-3 Road Stabilization

- Construction Entrance
- Construction Road Stabilization

4-8 Sediment Barriers

- Straw Bale Barrier
- Silt fence
- Brush Barrier
- Storm Drain Inlet Protection
- Culvert Inlet Protection

9-12 Dikes and Diversions

- Temporary Diversion Dikes
- Temporary Fill Diversions
- Temporary Right-of-Way Diversions
- Diversions

13-14 Sediment Traps and Basins

- Temporary Sediment Trap
- Temporary Sediment Basin



ESCH Practices

15-16 Flumes

- Temporary Slope Drains
- Paved Flumes

17-21 Waterway & Outlet Protection

- Stormwater Conveyance Channel
- Outlet Protection
- Riprap
- Rock Check Dams
- Level Spreader

22-27 Stream Protection

- Vegetative & Structural Streambank Stabilization
- Temporary Vehicular Crossing
- Utility Stream Crossing
- Dewatering Structures
- Turbidity Curtain

28 Subsurface Drain

39 Dust Control

ESCH Organization

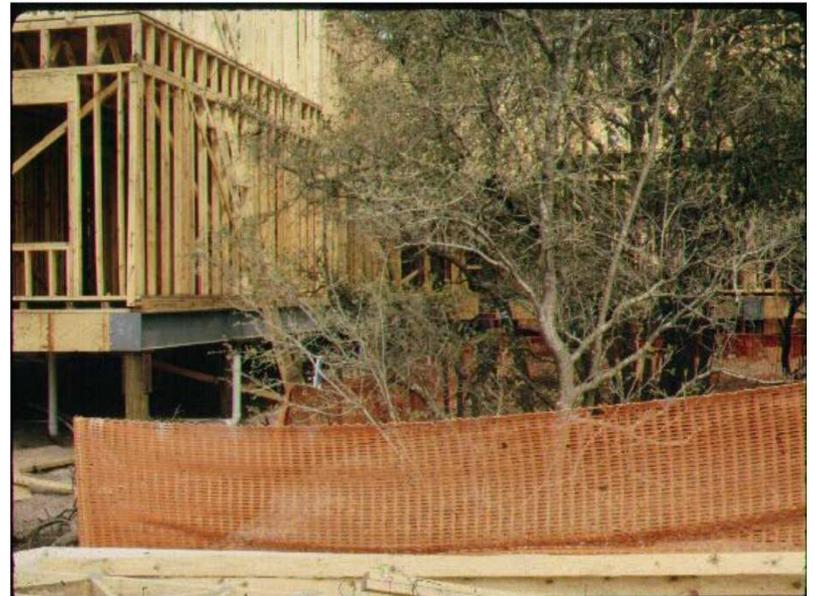
- **Definition**
- **Purpose**
- **Condition where practice applies**
- **Planning considerations**
- **Design criteria**
- **Construction specifications**
- **Maintenance**



Overview of Structural Controls

Safety Fence (3.01)

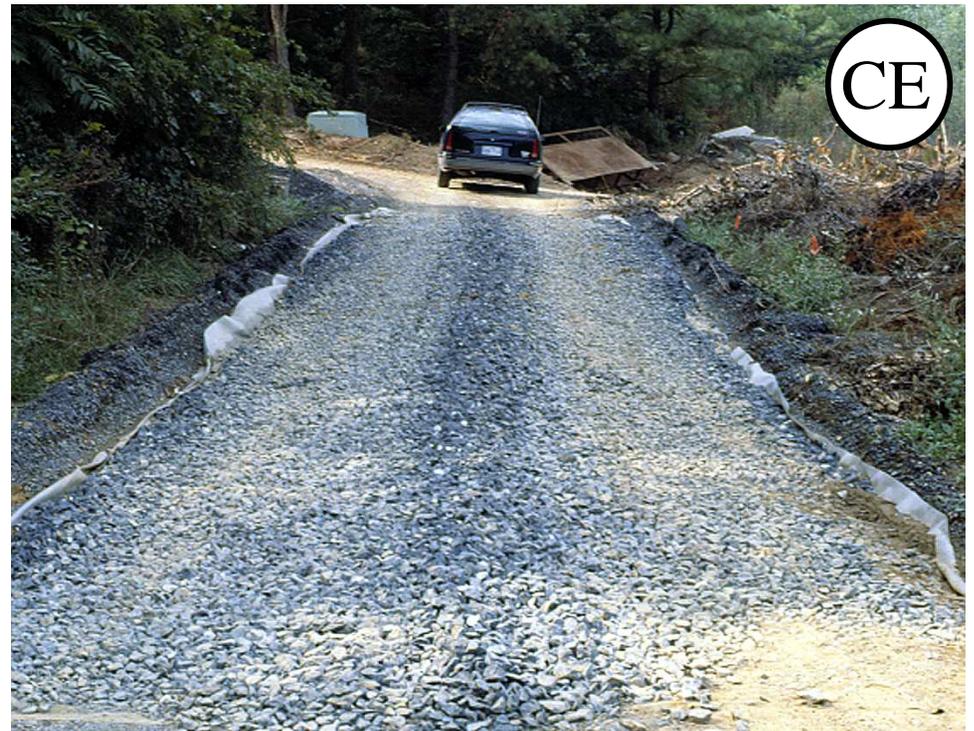
- A protective barrier installed to prohibit the undesirable access to a construction site
- Can be installed completely around the perimeter of the site or protect areas to be left undisturbed
- Usually constructed of plastic or galvanized wire





Construction Entrance (3.02)

- A stabilized stone pad with a filter fabric under-liner
- Located at points of vehicular ingress and egress. Should be @ least 70 feet long
- Used to reduce the amt. of mud transported onto paved public roads by motor vehicles or runoff.
- MS-17; MS-18



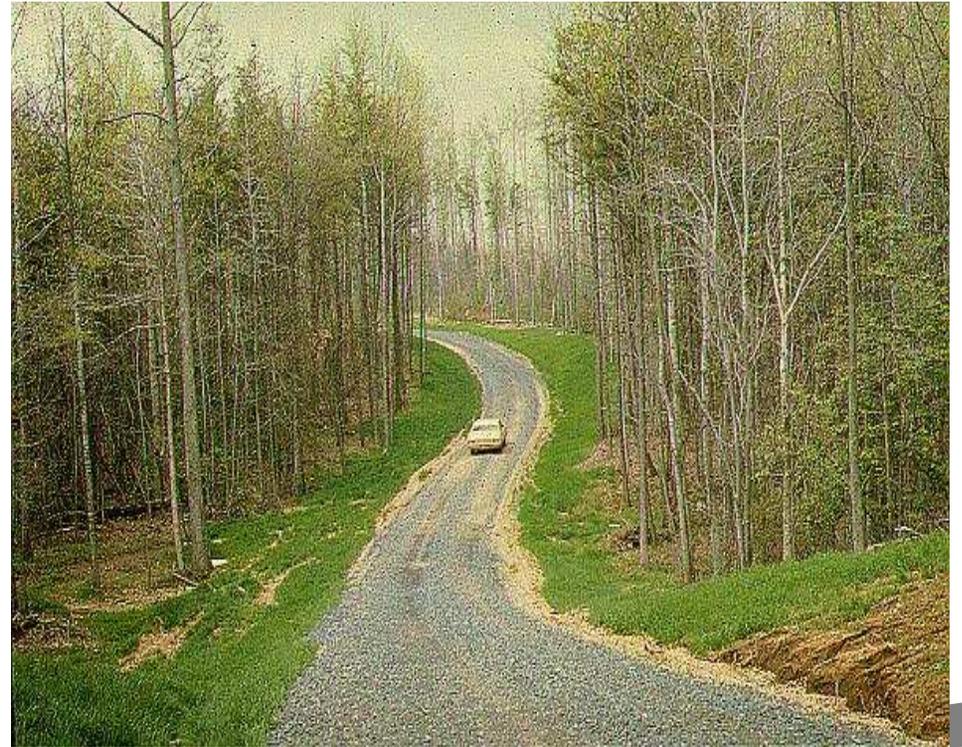




Construction Road Stabilization

(3.03)

- **Temporary stone stabilization of access roads, subdivision streets, parking areas and other traffic areas immediately after grading**
- **Prevents erosion and re-grading**
- **MS-17**





Straw Bale Barrier (3.04)

- A temporary sediment barrier composed of entrenched and anchored straw bales placed across or at the toe of a slope
- To intercept and detain small amounts of sediment from sheet flow
- Limited to 1/4 acre of drainage area per 100 ft.
- Maximum effective life - 3 months
- MS-4; MS-18. MS-3 (post removal)







Silt Fence (3.05)

- A temporary sediment barrier with fabric stretched across and attached to posts and entrenched
- Used to intercept and detain small amounts of sediment from sheet flow
- Decrease the velocity of sheet flows and rill erosion or small concentrated flows (1 cfs max.)
- Limited to 1/4 acre of drainage per 100 ft.
- Maximum effective life - 6 months
- Requires constant maintenance and clean-out
- MS-4; MS-18

Silt Fence



Silt Fence (3.05)

- Typically placed on contour
- Installed as a “first step” perimeter controls in land-disturbance



Clean out when sediment
is 1/2 the height of the
silt fence.





27/11/2006

Storm Drain Inlet Protection (3.07)

- A sediment filter or an excavated impounding area around a drop inlet or curb inlet
- Used to prevent sediment from entering storm drainage systems
- Prior to permanent stabilization
- Limited to drainage areas < 1 acre
- MS-10; MS-18





Curb Inlet



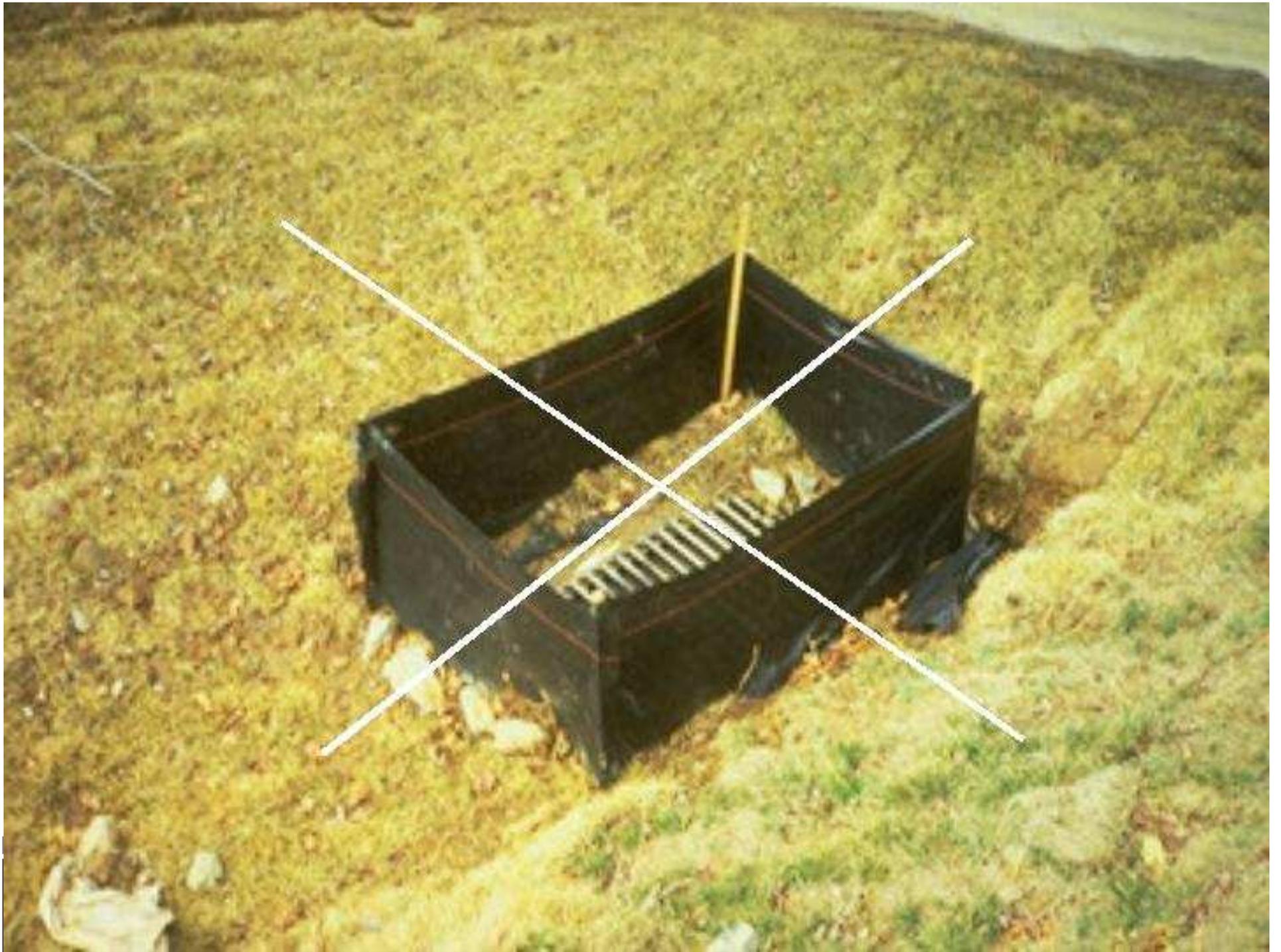
Anchor

Weir Opening

Spacer







IP



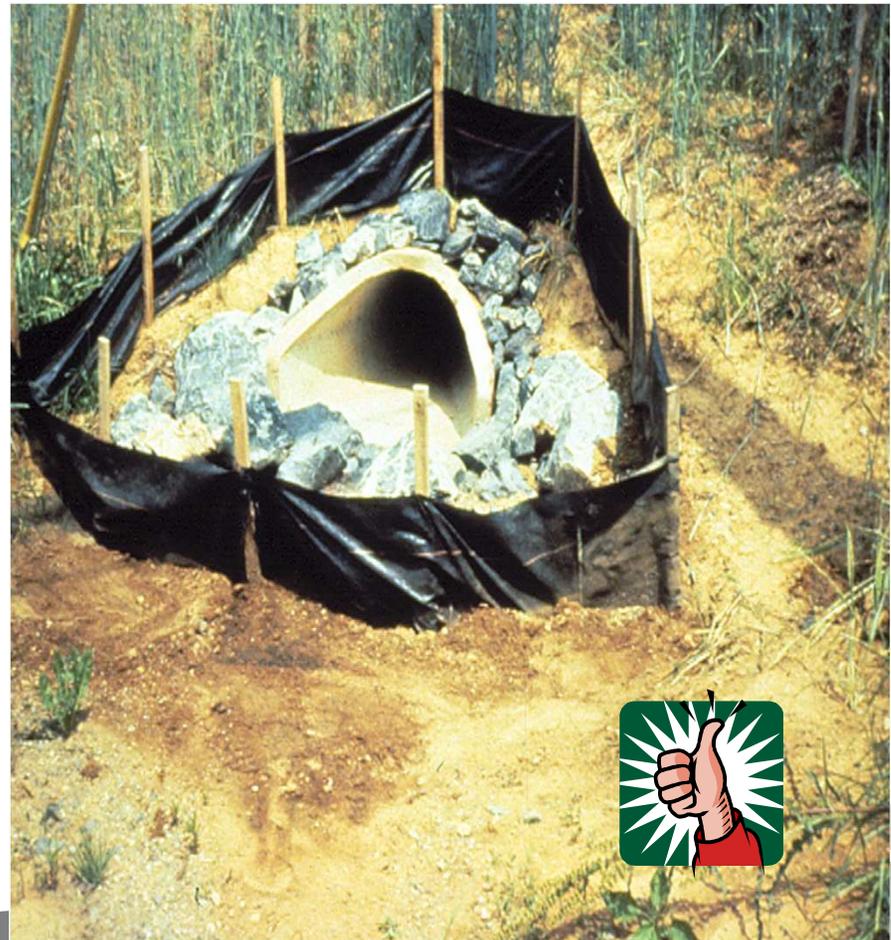






Culvert Inlet Protection (3.08)

- To prevent sediment from entering, accumulating in and being transferred by the culvert.
- To provide erosion control at the storm sewer culvert inlets during elevation and drainage patterns change
- MS-10; MS-18





Temporary Diversion Dike (3.09)

- **A temporary ridge of compacted soil to divert storm runoff from upslope drainage areas away from unprotected disturbed areas and slopes**
- **Stabilized immediately after construction**
- **Must drain to a stabilized outlet or divert to sediment-trapping structure**
- **Maximum life - 18 months**
- **Maximum drainage area - 5 acres**
- **MS-4; MS-5; MS-11; (MS-6; MS-7; MS-8)**

Earth Dike

Purpose: to divert runoff or shorten overland flow

Maximums: 5 acre drainage area



Temporary Fill Diversion (3.10)

- A channel with a supporting ridge of soil on the lower side
- Constructed along the top of an active earth fill at the end of each day
- To divert storm runoff away from the unprotected slope of the fill
- Drains to a stabilized outlet or sediment-trapping facility
- Maximum effective life is one week
- MS-7; MS-8; MS-11



Right-of-Way Diversion (3.11)

- A ridge of compacted soil or loose rock or gravel constructed across disturbed rights-of-way and similar sloping areas
- To shorten the flow length within a sloping right-of-way
- Reducing the erosion potential by diverting storm runoff to a stabilized outlet.
- Gravel structures where vehicles travel
- MS-11



Diversion (3.12)

- A permanent channel constructed across a slope with a supporting earthen ridge on the lower side
- To reduce slope length and to intercept stormwater
- To divert stormwater runoff to stabilized outlets at non-erosive velocities
- Designed to convey the runoff from a 10 year storm
- MS-11; MS-19; MS-4; MS-5



Temporary Sediment Trap (3.13)

- A ponded area formed by constructing an earthen embankment with a stone outlet across a drainage swale
- Stabilize immediately after construction
- Used to detain sediment-laden runoff from small disturbed areas long enough to allow most of the suspended solids to settle out
- Maximum drainage area - less than 3 acres
- Max effective life – 18 months
- MS-6; MS-4; MS-18





Temporary Sediment Basin (3.14)

- **A temporary barrier or dam with a stormwater release controlled structure**
- **Constructed of an embankment of compacted soil across a drainage way**
- **Used to detain sediment-laden runoff from disturbed areas long enough for most of the sediment to settle**
- **Required for drainage areas 3 acres and greater**
- **MS-6; MS-4; MS-18**



Sediment Basin

Earth Dike

Inflow Protection

Principal Spillway

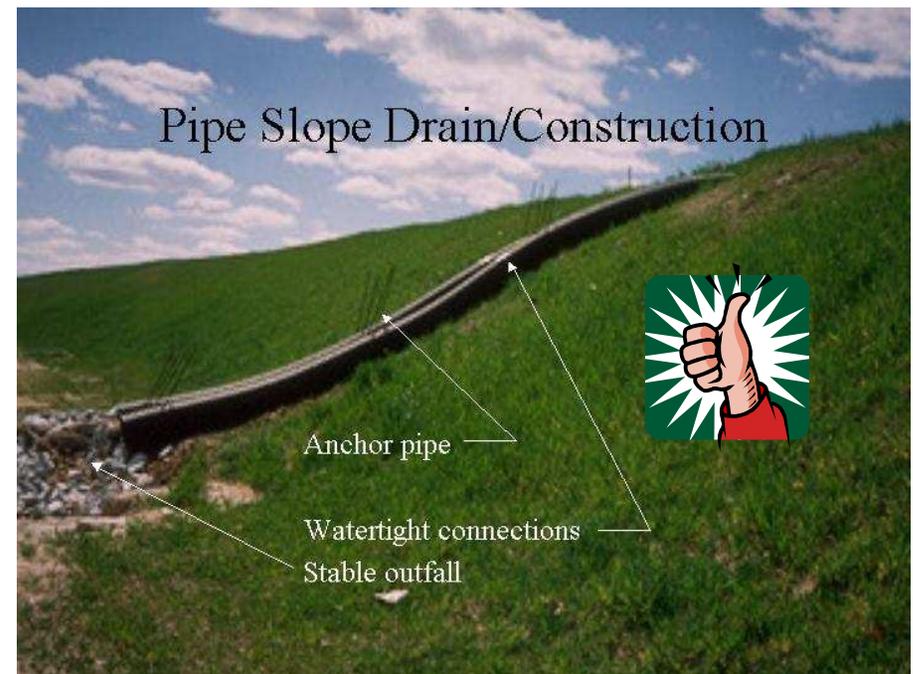
Riser/barrel assembly





Temporary Slope Drain (3.15)

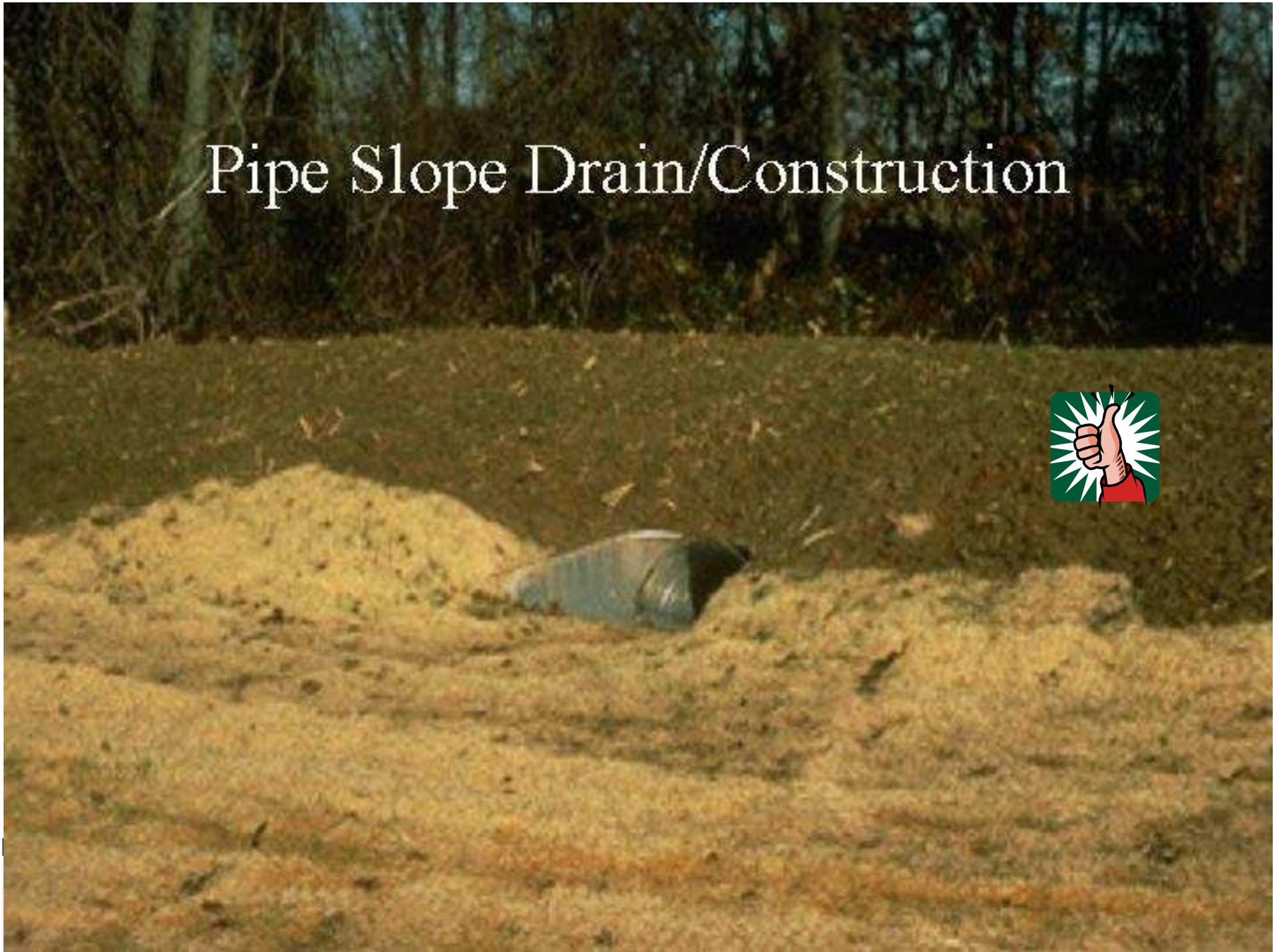
- A flexible tubing or conduit
- Extending from the top to the bottom of a cut or fill slope
- To temporarily conduct concentrated stormwater runoff safely down the face of a cut or fill slope
- Without causing erosion on or below the slope
- MS-8; MS10; MS-11





Purpose: to safely convey runoff down the face of a steep slope

Pipe Slope Drain/Construction

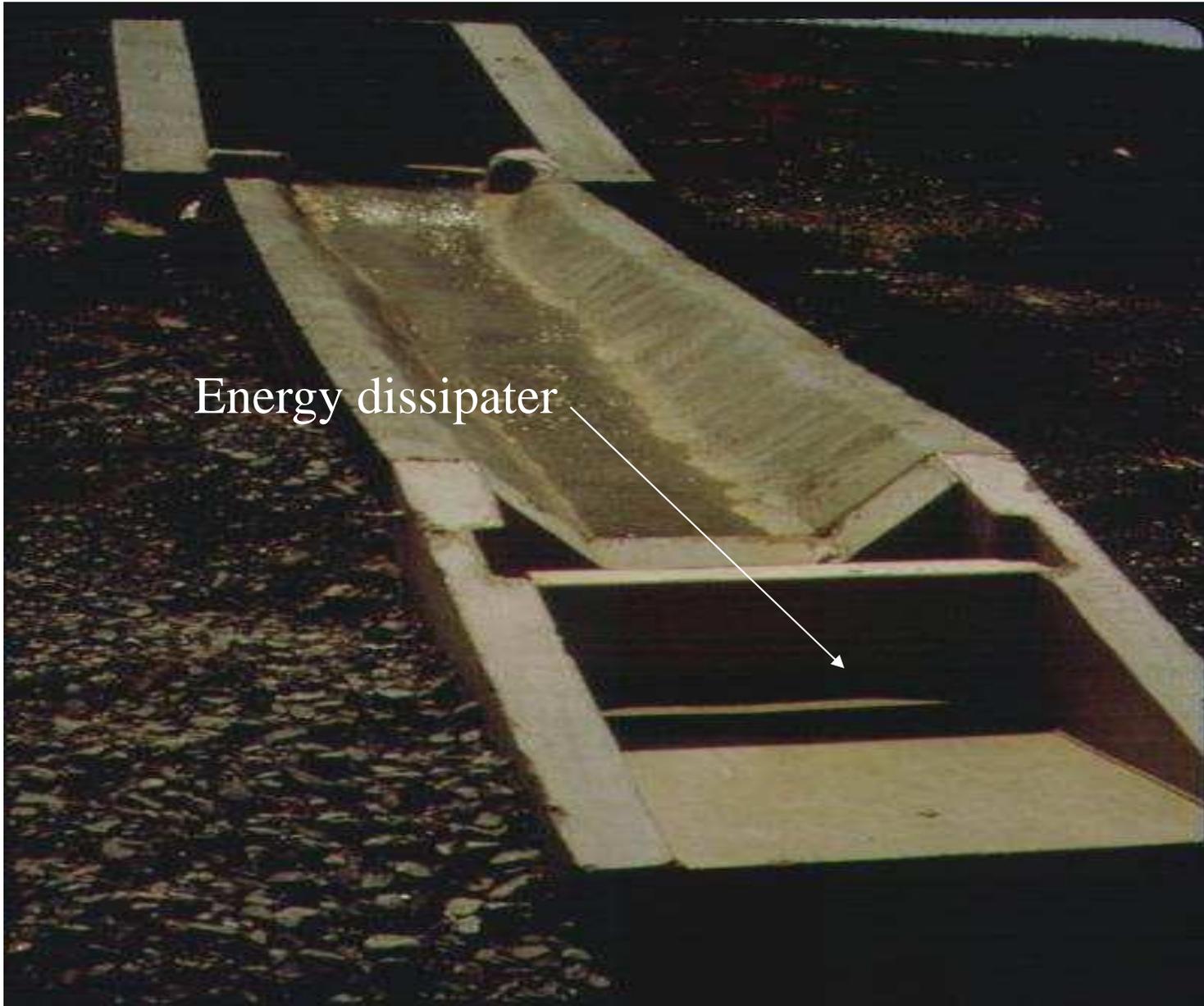


Paved Flume (3.16)

- A permanent paved channel constructed on a slope
- To conduct stormwater runoff safely down the face of a slope
- Without causing erosion problems on or below the slope.
- Must convey runoff from 10 year storm
- MS-8; MS-19

PF





Energy dissipater

Stormwater Conveyance Channel **(3.17)**

- A permanent, designed waterway, shaped, sized, and lined with appropriate vegetation or structural lining
- Used to safely convey stormwater runoff from a 10 year storm to a receiving channel without damage from erosion.
- Needs outlet protection if it empties into a natural stream to prevent erosion
- MS-11 & 19; MS-5 & 14





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SCC



Gabion Channel





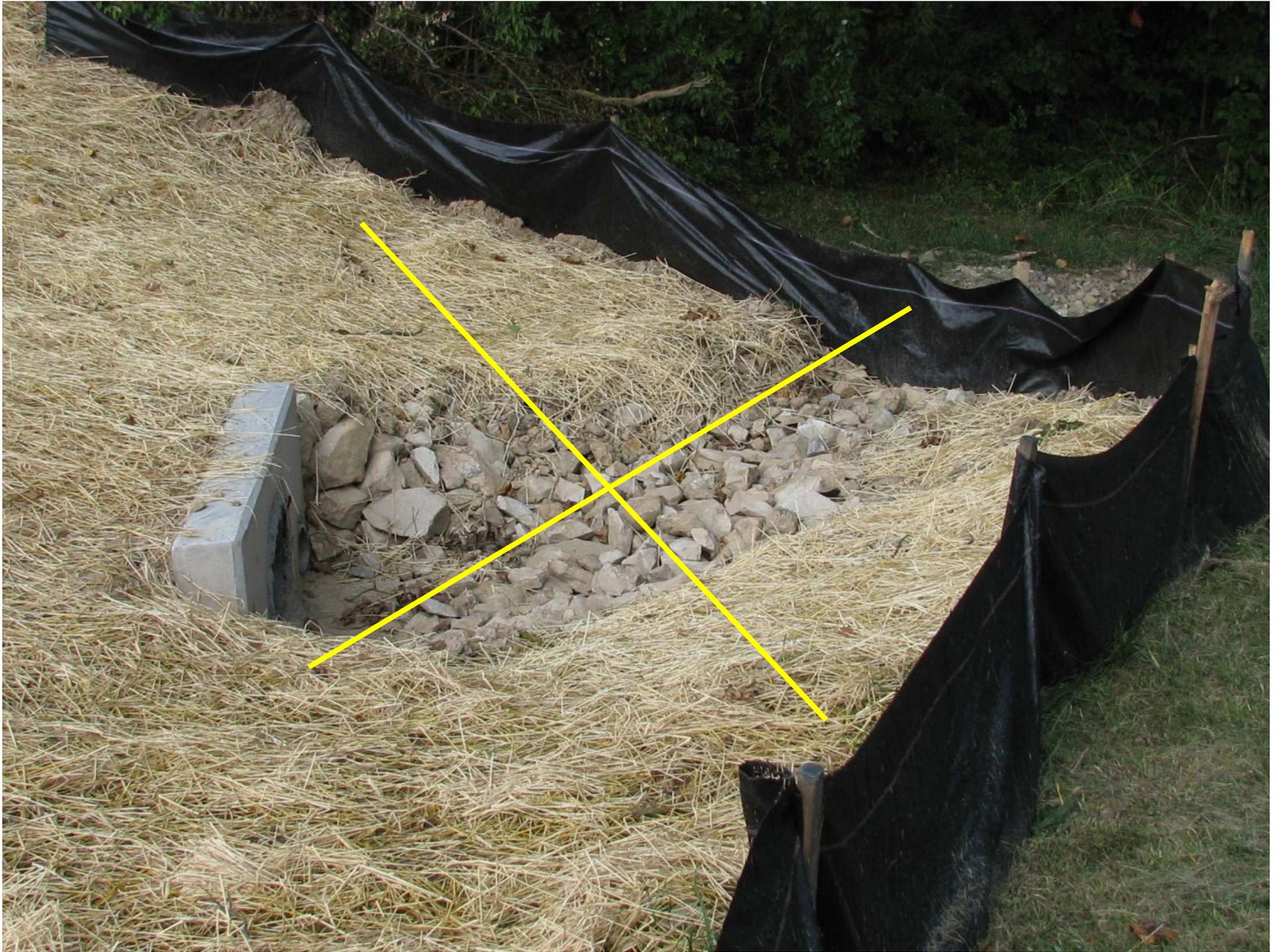
Outlet Protection (3.18)



- Structurally lined aprons
- Placed at the outlet of pipe or paved channel to reduce erosion and under-cutting from scouring at stormwater outlets
- Apron must be constructed with no slope along its length (0% grade)
- MS-11









Riprap(3.19)

- A permanent large, loose, angular stone with filter fabric or granular underlining
- Used to protect the soil from the erosive forces of concentrated runoff
- Slow the velocity of concentrated runoff while enhancing the potential for infiltration
- Utilized to stabilize slopes with seepage problems and/or non-cohesive soils
- MS-11 & MS-19; MS-7 & MS-9

RR

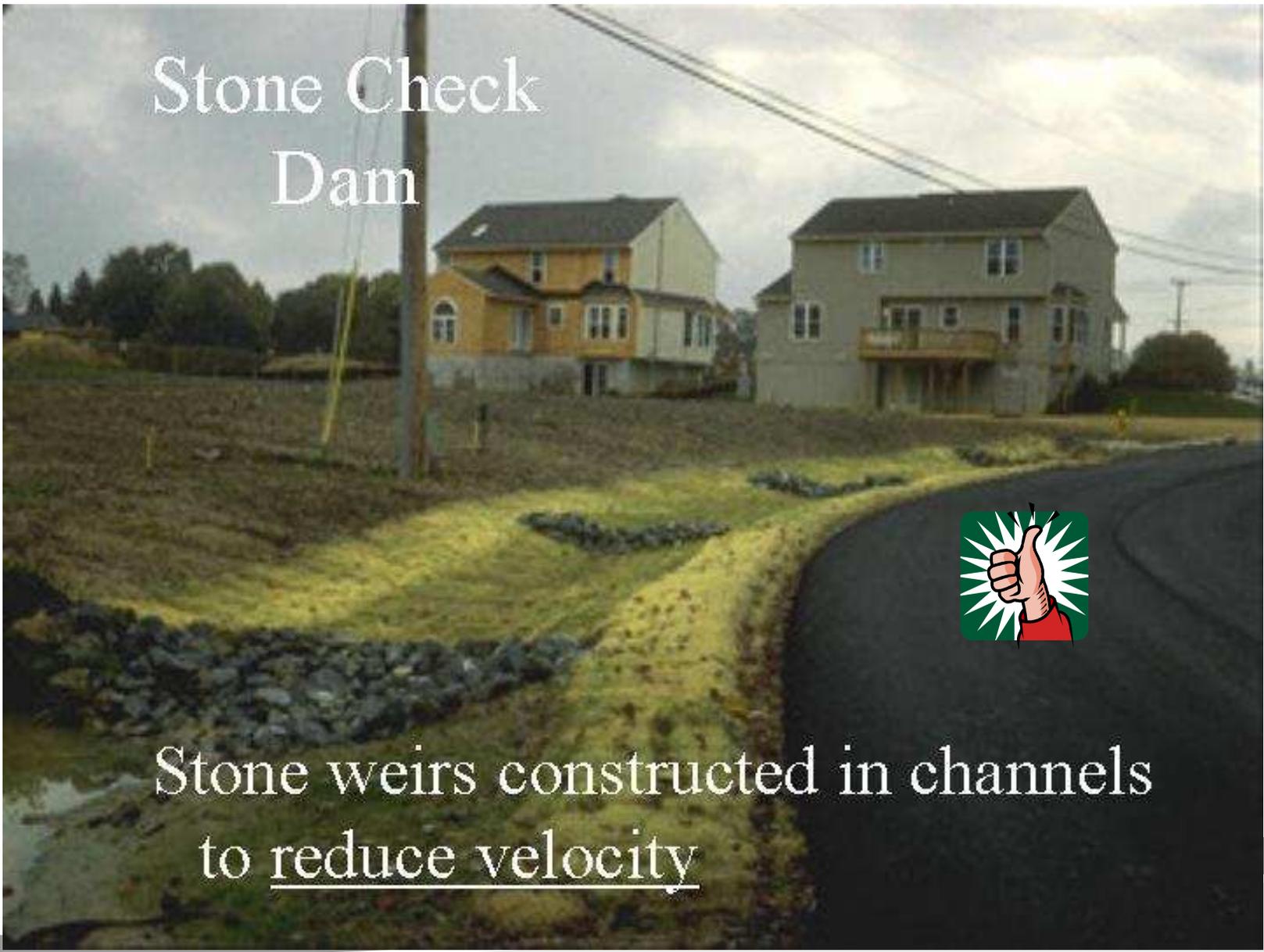


Rock Check Dam (3.20)

- **Small temporary stone dams constructed across a swale or drainage ditch**
- **To reduce the velocity of concentrated stormwater flows and erosion of the swale or ditch**
- **This practice may also traps sediment by ponding of the stormwater runoff**
- **Not to be used in a live stream**
- **MS-4; MS5; MS-18**



Stone Check Dam



Stone weirs constructed in channels
to reduce velocity

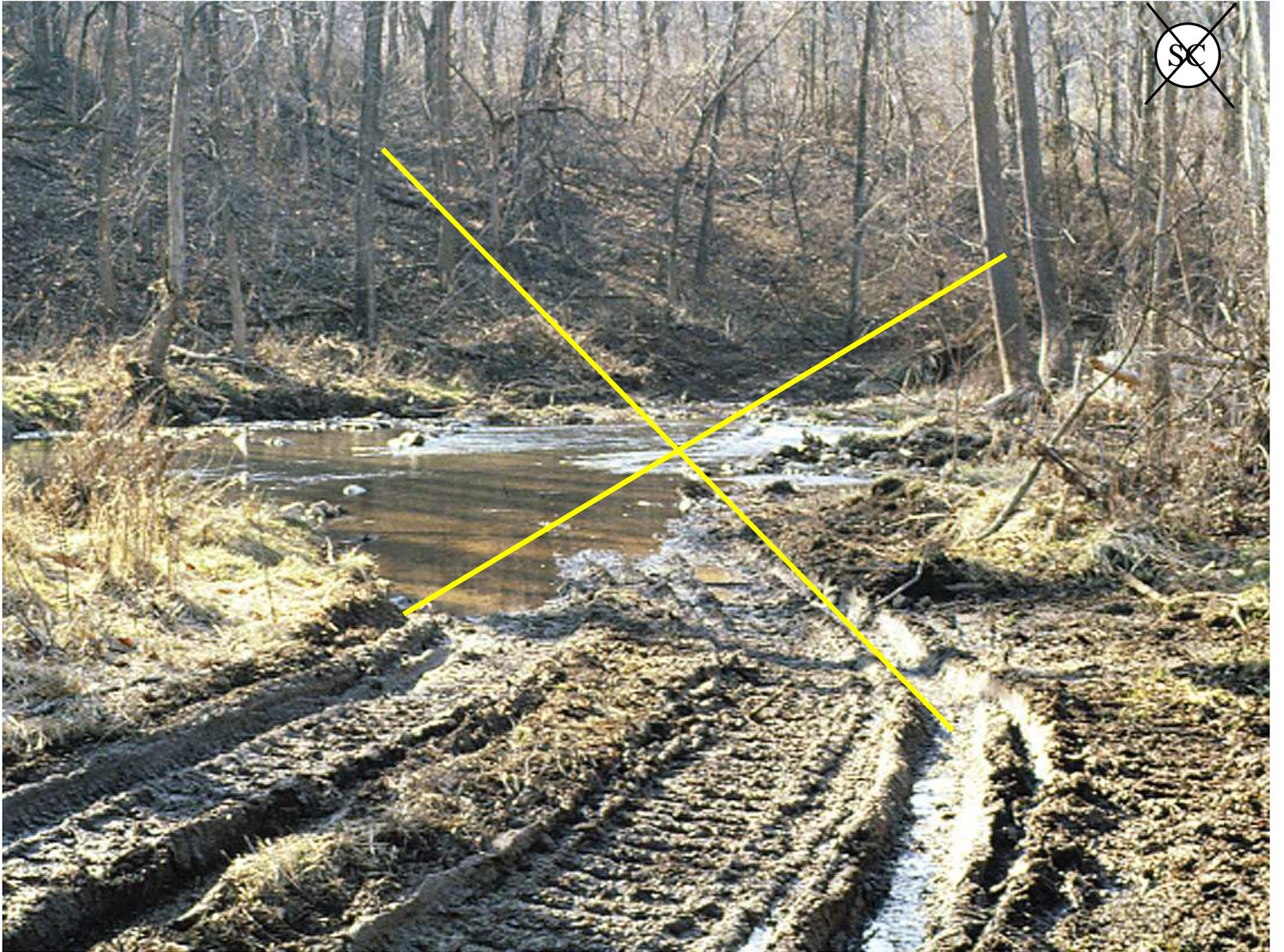
Stone Check Dam





Temporary Vehicular Stream Crossing (3.24)

- **A temporary structural span installed across a flowing watercourse to be used by construction vehicle without damaging the channel or banks**
- **To keep sediment generated by construction vehicles out of the stream.**
- **To flowing streams with drainage areas less than 1 square mile**
- **MS-13**



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Utility Stream Crossing (3.25)

- For crossing small waterways when in-stream utility construction is involved
- To help protect sediment from entering the stream
- To minimize the amount of disturbance within the stream itself
- Applicable to flowing streams with drainage areas less than 1 square mile
- MS-12; MS-13









Dewatering Structure (3.26)

- **A temporary settling and filter device for water being pumped from trenches, basins, traps or other areas which contains sediment laden water**
- **May be constructed of straw bales and filter fabric, portable boxes or tanks**
- **Must be sized according to pump capacity in cfs**
- **MS-11; MS-16c; MS-19**





DS





Turbidity Curtain (3.27)

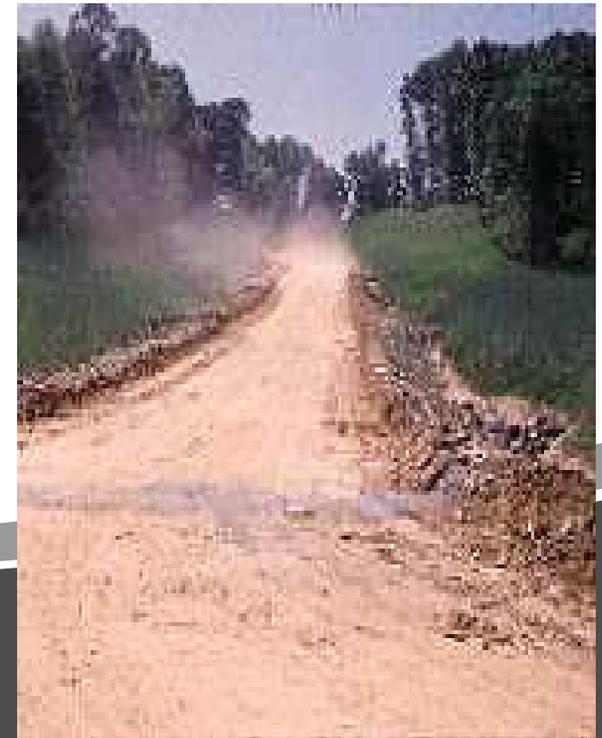
- **A floating geo-textile material which minimizes sediment transport from a disturbed area adjacent to or within a body of water**
- **Used in non-tidal and tidal watercourses**
- **Keeps sediment limited to a confined area until it settles out**
- **Should not be installed across channel flows**
- **MS-12; MS-14**





Dust Control (3.39)

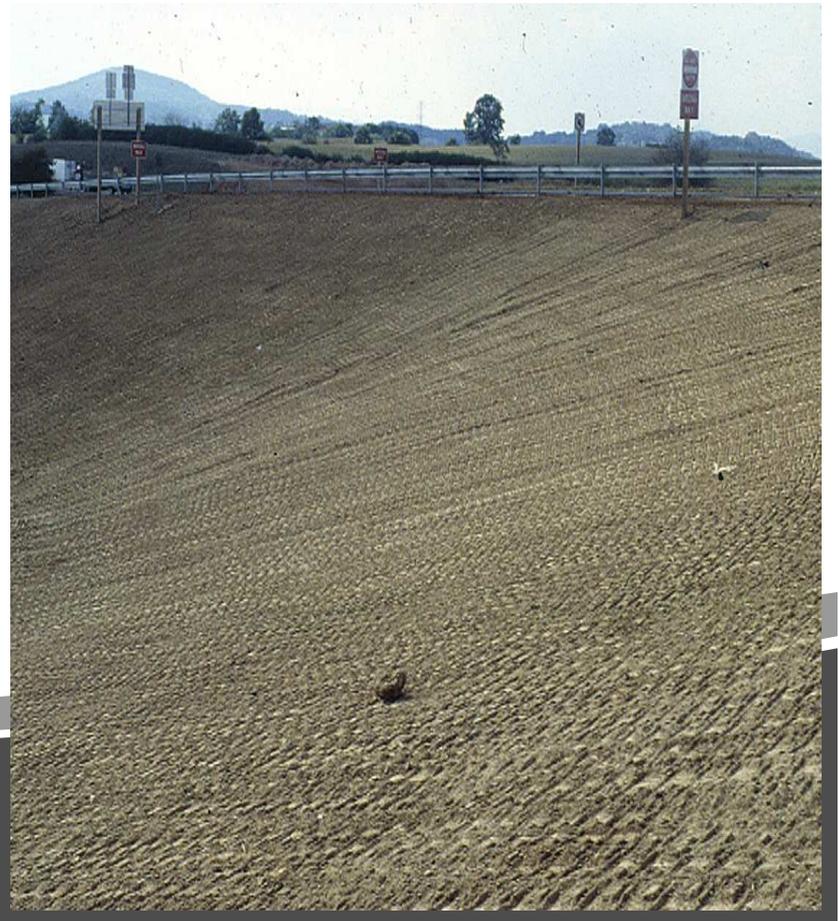
- ***Most common method to control is spray water.***
- ***Phased clearing/grading can significantly reduce dust.***
- ***Additional options include other temporary stabilization.***



Surface Roughening (3.29)

Purpose: To slow down water and increase infiltration down; thus, reducing erosion

- **Make sure groves, cleat tracks or other roughening are oriented horizontally (not vertically)**





Slope roughening examples



Area should be seeded & mulched per MS?





5c. Vegetative Controls

Benefits of Vegetation

- **When planning for ESC establishment of vegetation is one of the first steps that needs to be considered**
- **Several Minimum Standards apply directly to vegetation establishment (MS-1, 2, 3, 5, 7)**

Benefits of Vegetation

- **Good vegetative cover is about 90-99% effective**
- **Protects against raindrop impact**
- **Slows runoff velocity & filters sediment**
- **Roots bind the soil surface & enhance filtration**
- **Increased organic matter improves soil structure**
- **3 X less expensive than structural controls**



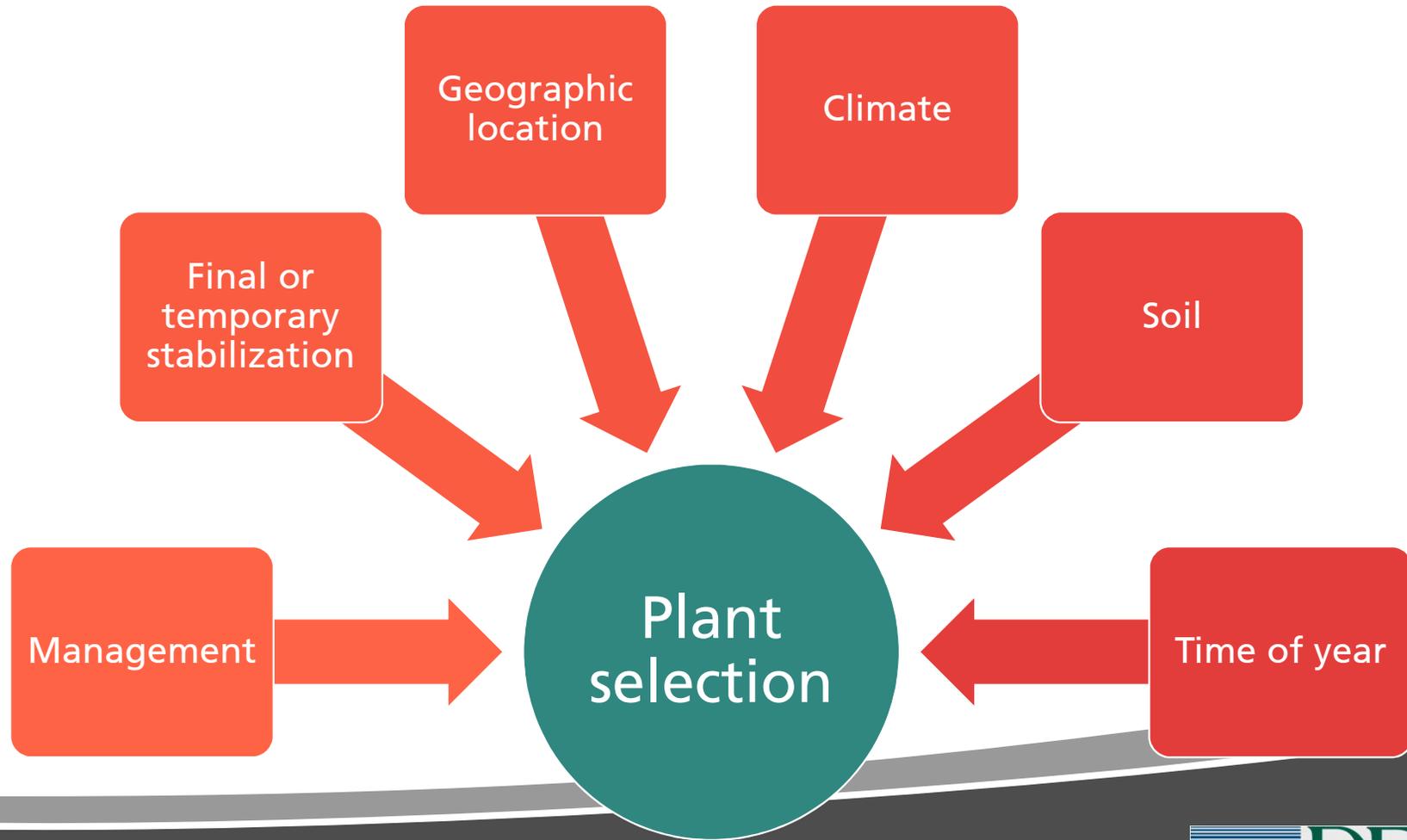
Preservation of Existing Vegetation

- **Minimize cost of development**
- **Native vegetation**
- **Buffers**
- **Does not disturb soil → infiltration**





Plant Selection





ESCH Vegetative Control Practices

29-30 Seedbed Preparation

- Surface roughening
- Top soiling

31-34 Vegetation Establishment

- Temporary seeding
- Permanent seeding
- Sodding
- Bermuda and zoysiagrass establishment

35-36 Mulches

- Mulching
- Soil stabilization, blankets and matting

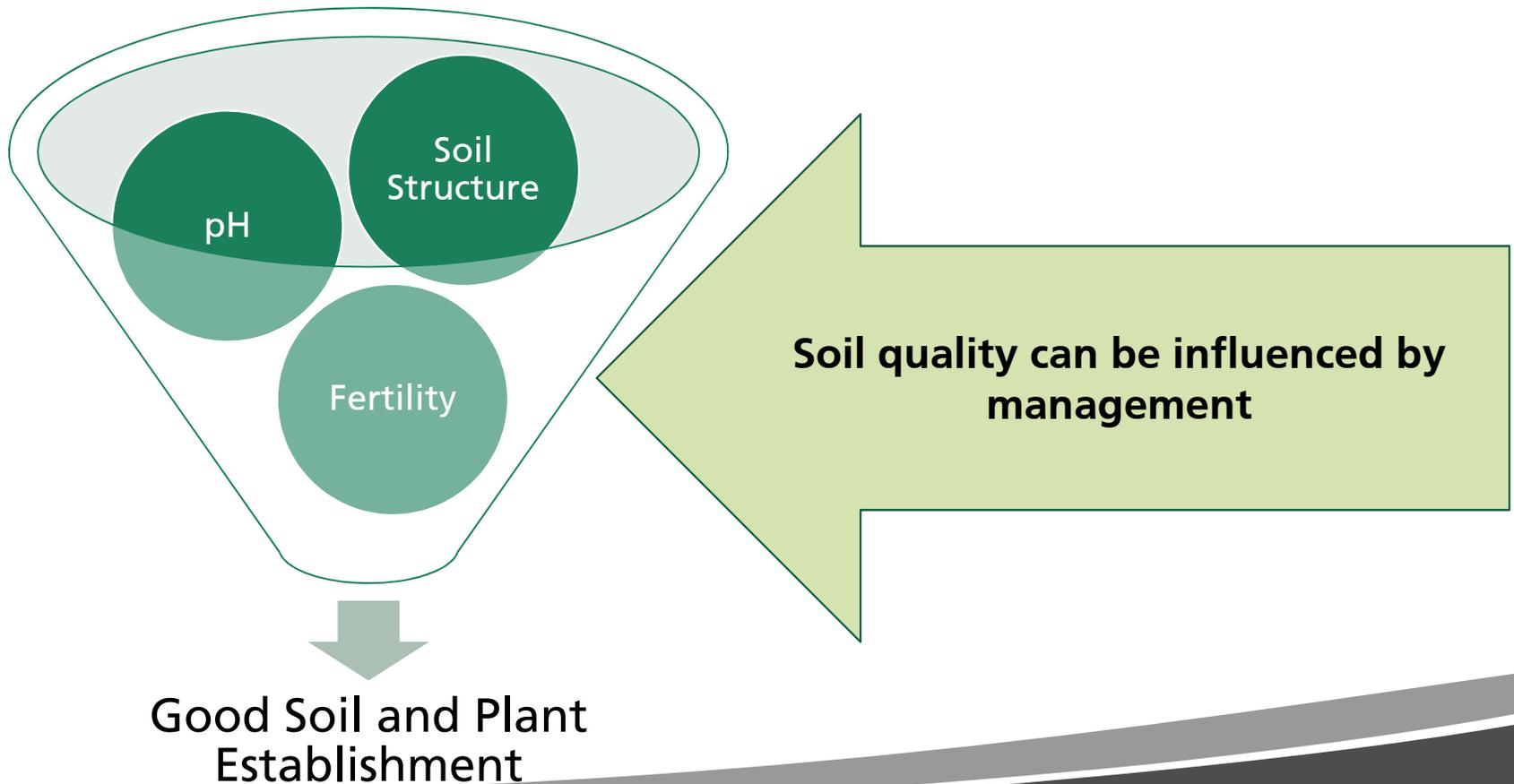
37-38 Other Vegetative Controls

- Trees, shrubs, vines and ground covers
- Tree preservation and protection

39 Dust control



Plant Establishment





Soil Testing

- Determine soil texture, pH and nutrient content
- Samples are collected & sent for testing
- Helps to properly establish vegetation

Virginia Cooperative Extension Virginia Tech
Virginia Tech • Virginia State University
Soil Testing Laboratory
Publication 452-125
Revised 2013

Soil Sample Information Sheet for Home Lawns, Gardens, Fruits, and Ornamentals

Please Print (Form expires January 2015)
INSTRUCTIONS: See other side for sampling instructions. For a recommendation, be sure to fill in the plant code number. Place check marks (✓) where appropriate. Use another form for commercial crop production. Send samples, form, and payment to Virginia Tech Soil Testing Lab, 145 Smyth Hall (MC 0465), 185 Ag Quad Ln, Blacksburg VA 24061, in a sturdy shipping carton weighing less than 37 pounds. Processing will be delayed if soil is not received in an official sample box. See www.soiltest.vt.edu for more information.

Your Name: _____	Date sampled: _____
E-mail: _____ Phone: _____	MM/DD/YY
Mailing Address: _____	Office Use only
City: _____ ZIP Code (required): _____	Extension Unit Code:
Country Where Soil is Located (required): _____	<input type="text"/>
Copy Report To (Consultant, etc.): _____	
Their E-mail: _____	

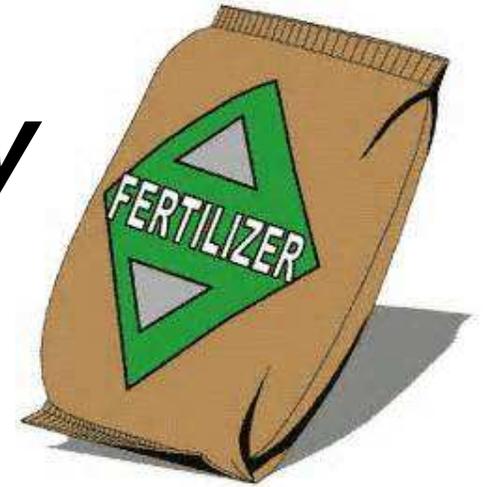
SAMPLE IDENTIFICATION	PLANT TO BE GROWN	PLANT CODE LIST
Your Sample Box Number or Name (Up to 5 digits) <input type="text"/>	Insert Plant Code # from list at right <input type="text"/>	Lawn: Kentucky Bluegrass, Fescue, or Ryegrass 201 Establishing New Lawn 202 Maintaining Lawn, Repair of Bare Spots Lawn: Bermudagrass, Zoysiagrass, or St. Augustine 203 Establishing New Lawn 204 Maintaining Lawn, Repair of Bare Spots Garden 210 Vegetable Garden 211 Flower Garden 212 Roses Acid-Loving Shrubs 240 Azaleas 241 Andromedas 242 Camellias 243 Laurel 244 Rhododendrons

SOIL INFORMATION	
Last Lime Application	
Months Previous	Pounds per 1,000 sq. ft.
<input type="radio"/> -	<input type="radio"/> 0
<input type="radio"/> 0 - 6	<input type="radio"/> 10 - 50
<input type="radio"/> 7 - 12	<input type="radio"/> 51 - 100
<input type="radio"/> 13 - 18	<input type="radio"/> 101 - 150
<input type="radio"/> 19+	<input type="radio"/> 151+

SOIL TESTS DESIRED AND FEES		
<input type="checkbox"/> Routine (soil pH, P, K, Ca, Mg, Zn, Mn, Cu, Fe, B, and estimated CEC)	\$10.00	\$16.00
<input type="checkbox"/> Organic Matter - Determines percentage in soil - no recommendation given	\$4.00	\$6.00
<input type="checkbox"/> Soluble Salts - Determines if fertilizer salts are too high	\$2.00	\$3.00

Send in payment along with soil sample and form, make check or money order payable to "Treasurer, Virginia Tech."

Statewide Soil Fertility

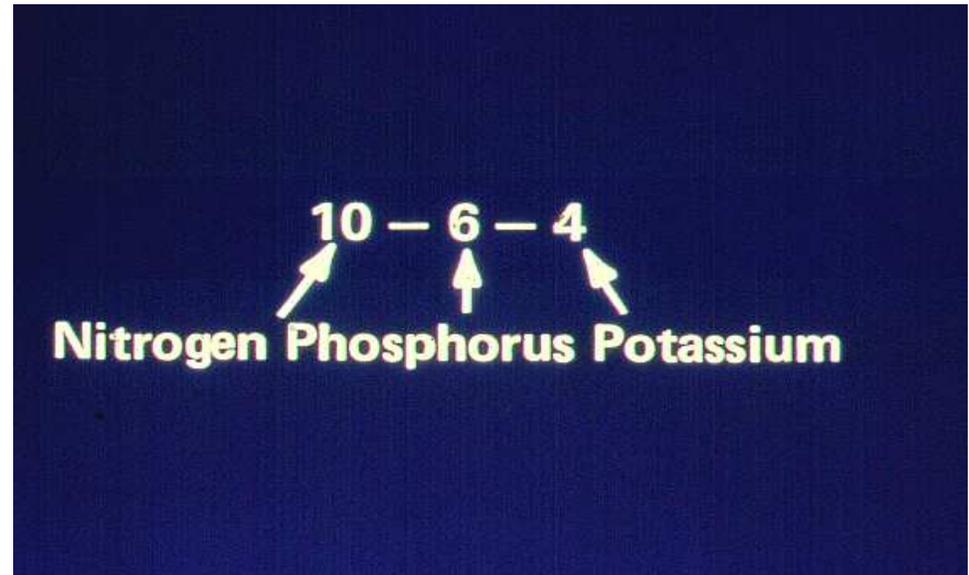
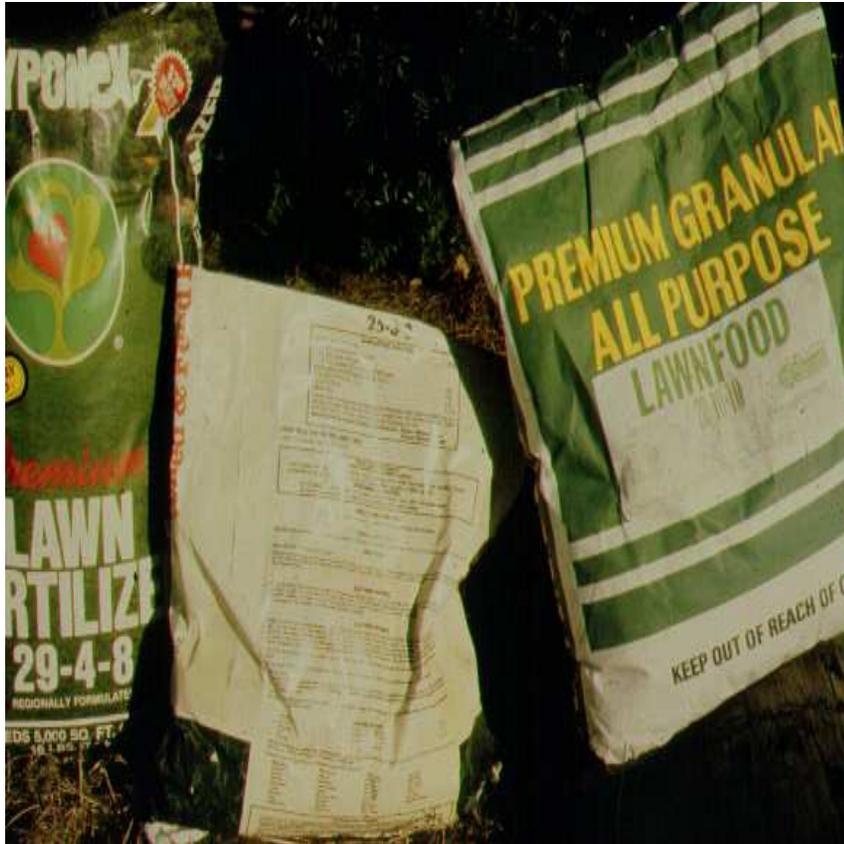


- N needed; P typically needed
- Lime almost always needed
- Soils in Coastal Plain and sandstone areas need K





Application of Fertilizer



Plant selection and planting



methods

- **After we establish what type of vegetation works best, we want to use the best methods to establish it.**
- **We can classify the types to establish as either high or low maintenance**

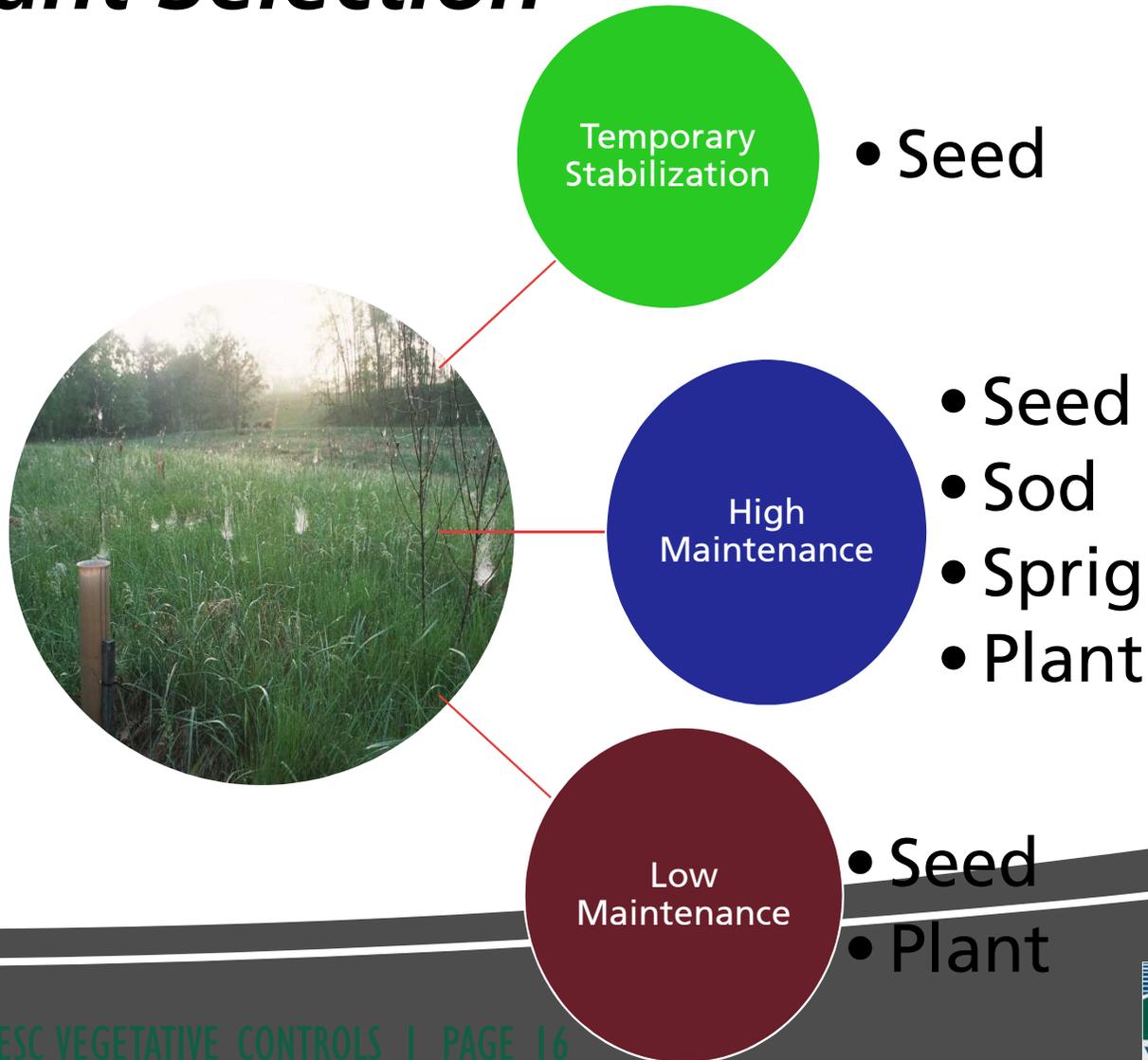
High or low maintenance

- **Low maintenance would not require frequent mowing or fertilizer application**
- **High maintenance is just the opposite**
- **However the plants used are very different**





Plant Selection



Permanent vs. Temporary Seeding

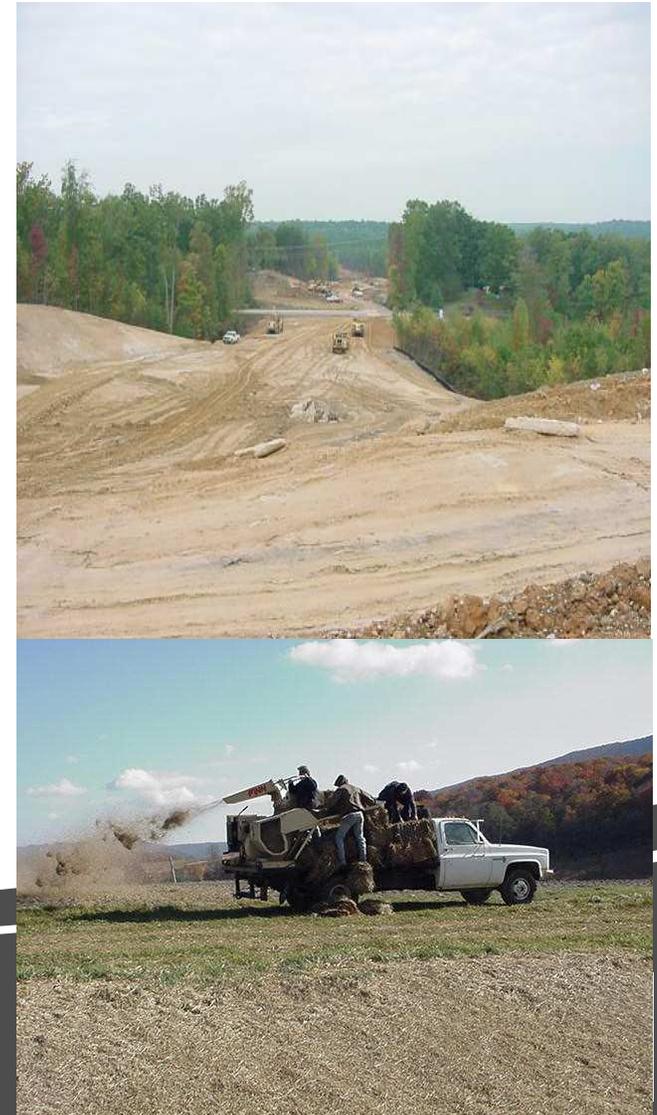
Seeding is typically the last activity

- Often considered a cosmetic operation
- Should be the principle tool to control erosion

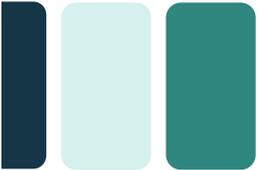


Temporary Seeding

- Inexpensive and effective tool for controlling erosion
- May reduce landscaping & maintenance costs
- Disturbed areas should be brought to final grade early and seeded, or stabilized when not disturbed for more than **14** days



Species	Summer Planting	Fall/Winter Planting	Spring Planting	Remark
Oats	No	No	Yes	
Rye	No	Yes	No	
German Millet	Yes	No	No	
Annual Ryegrass	No	Yes	Yes	
Weeping Lovegrass	Yes	No	No	Short lived perennial
Korean Lespedeza	Yes	No	Yes	


★Remember: a bag of seed is generally less expensive than the cleaning out of sediment traps and basins, or the repair and cleaning of a breach in a silt fence or a diversion

Permanently Seeding

Permanent seeding is usually done per recommendation from the landscape architect or planner of the project; it is usually very land use specific. Section 3.32 in the ESCHB provides a list of potential species that can be used in planning a landscape

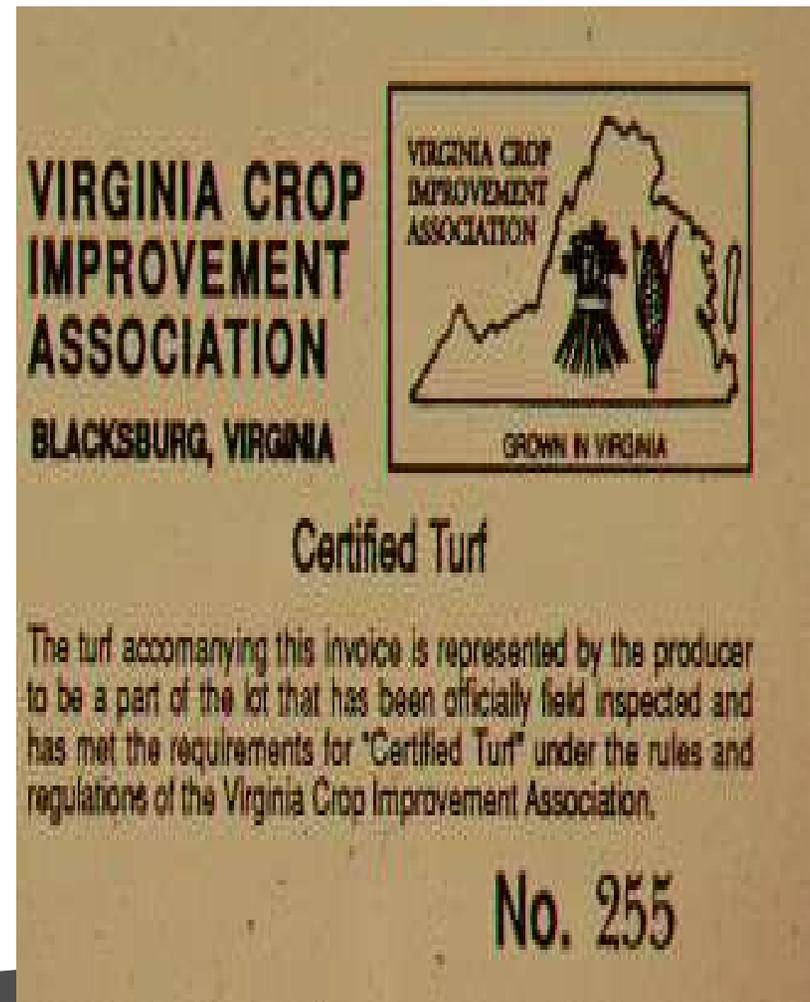
Permanently Seeding

Some of the more common species are: tall fescue, Kentucky bluegrass, perennial ryegrass, red fescue

Seed companies have developed a “contractor’s mix”, which is a blend of the different species listed above. These “contractor’s mixes” are designed to get a quick and diverse cover and take the guess work out of trying to blend a number of species; however, they are not site-specific.

Sodding

- High quality/VCIA
- Cut and lay within 36 hours
- Lime and fertilize same as seeding
- All year round - as long as the ground is not frozen



Bermuda grass/Zoysia grass

- Both Bermuda and Zoysia are warm season grasses. They are usually planted using sprigs, stolons or plugs. Once planted, they form a dense mat in 8 to 12 weeks



Mulching & Netting

Protect the soil from raindrop impact

Prevents soils crusting

Increases the infiltration rate of the soil

Reduces soil moisture loss

Modifies soil temperatures

Provides a suitable microclimate for seed germination and plant establishment

Provides organic matter to the soil



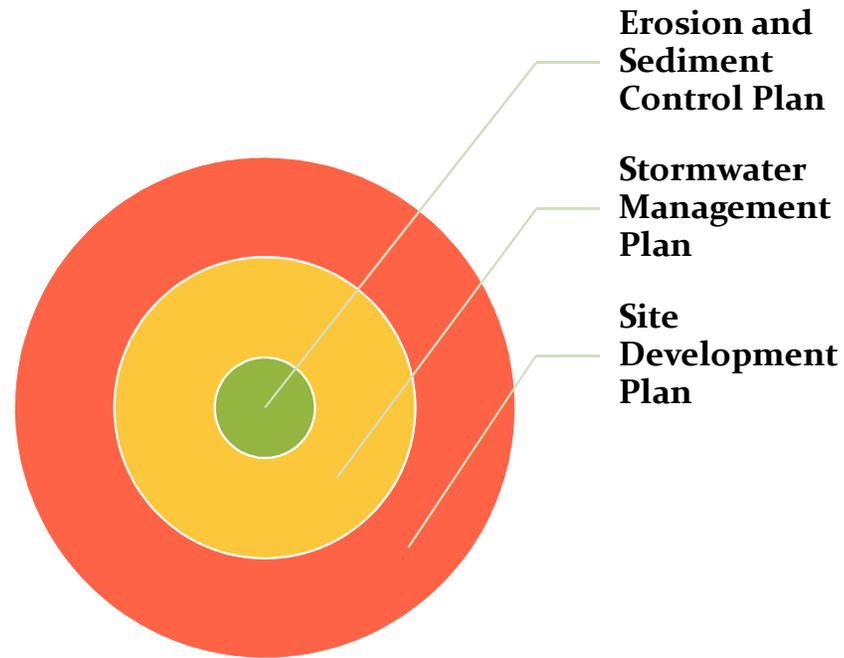


5d. ESC Plan Elements



- **Erosion and sediment control planning should be an integral part of site planning and not an afterthought.**

ESC Plan Preparation should NOT be a result of ESC plan review!



An erosion and sediment control plan should be stand-alone component of the entire site development plan



Written
portion or
"Narrative"



Illustrative
portion or
"Plan"

ESC
Plan



READING CONTOUR LINES

- Shown as two-dimensional lines on a topographic map - the scaled distance between them is exactly the same as in the field.
- Line that passes through points having the same elevation
- Contour intervals can range from 1 feet to 100 feet

dashed lines



solid lines

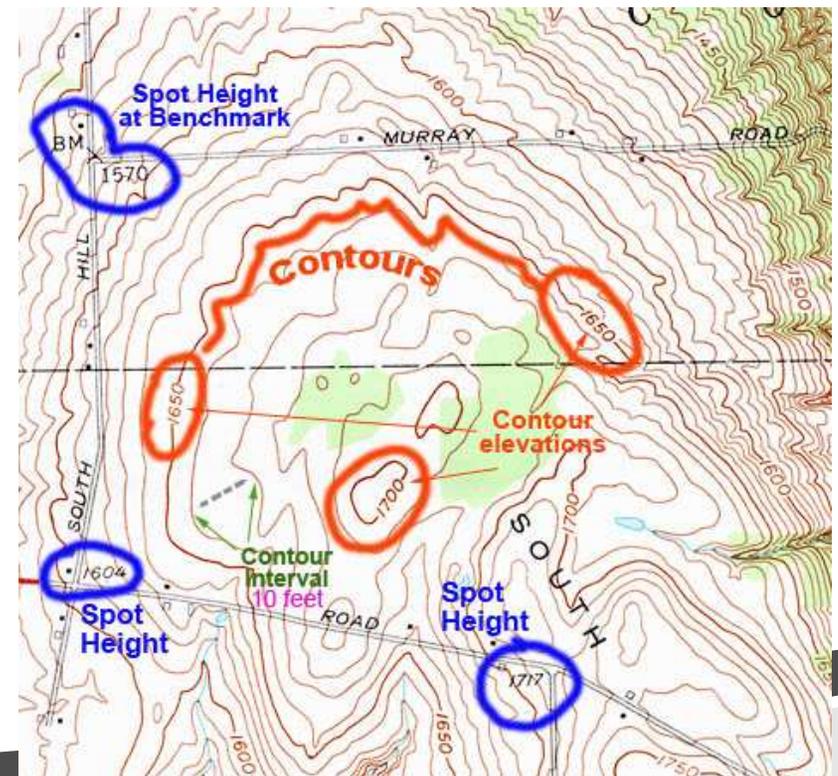




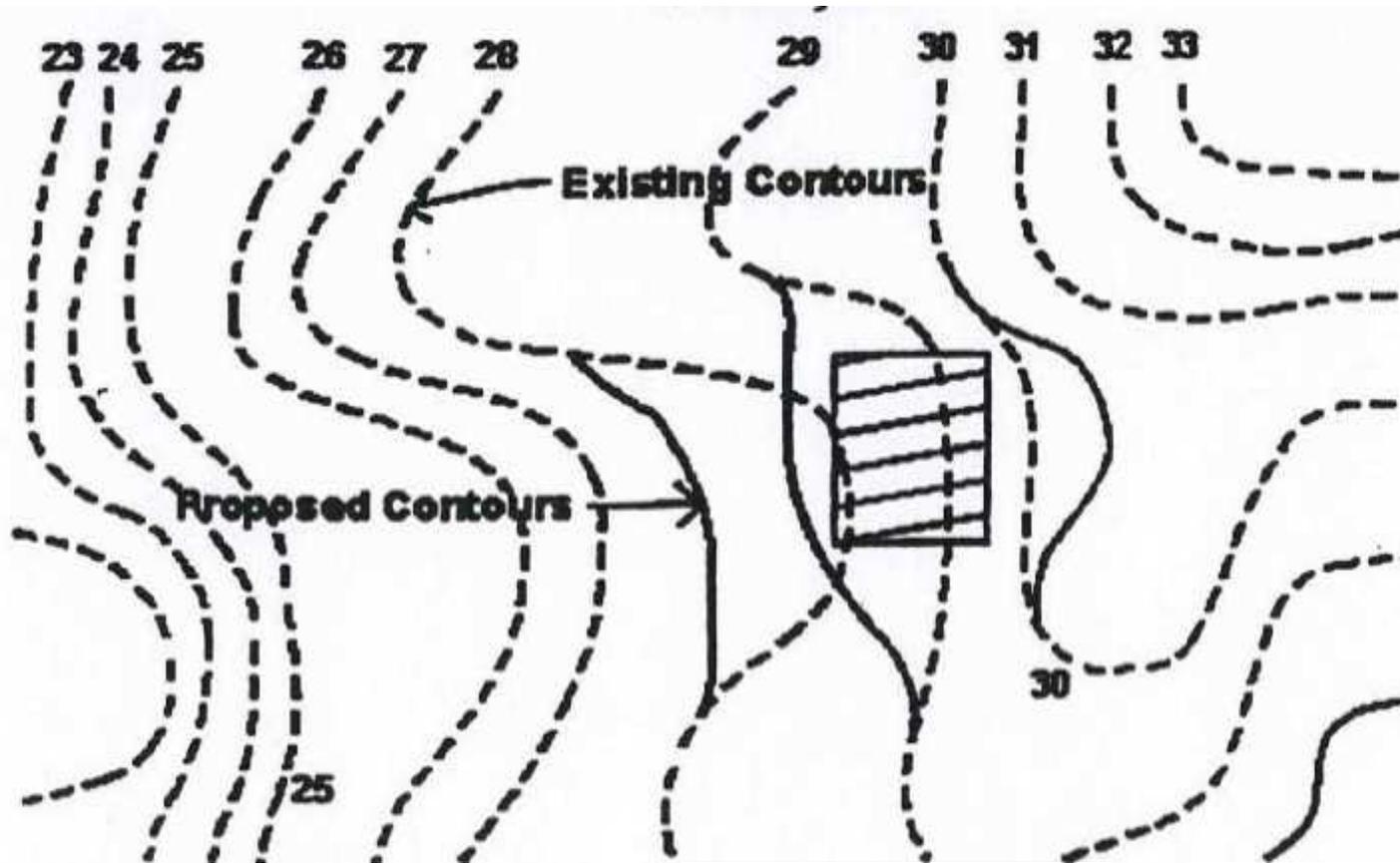
READING CONTOUR LINES

Contour lines indicate the steepness of the terrain

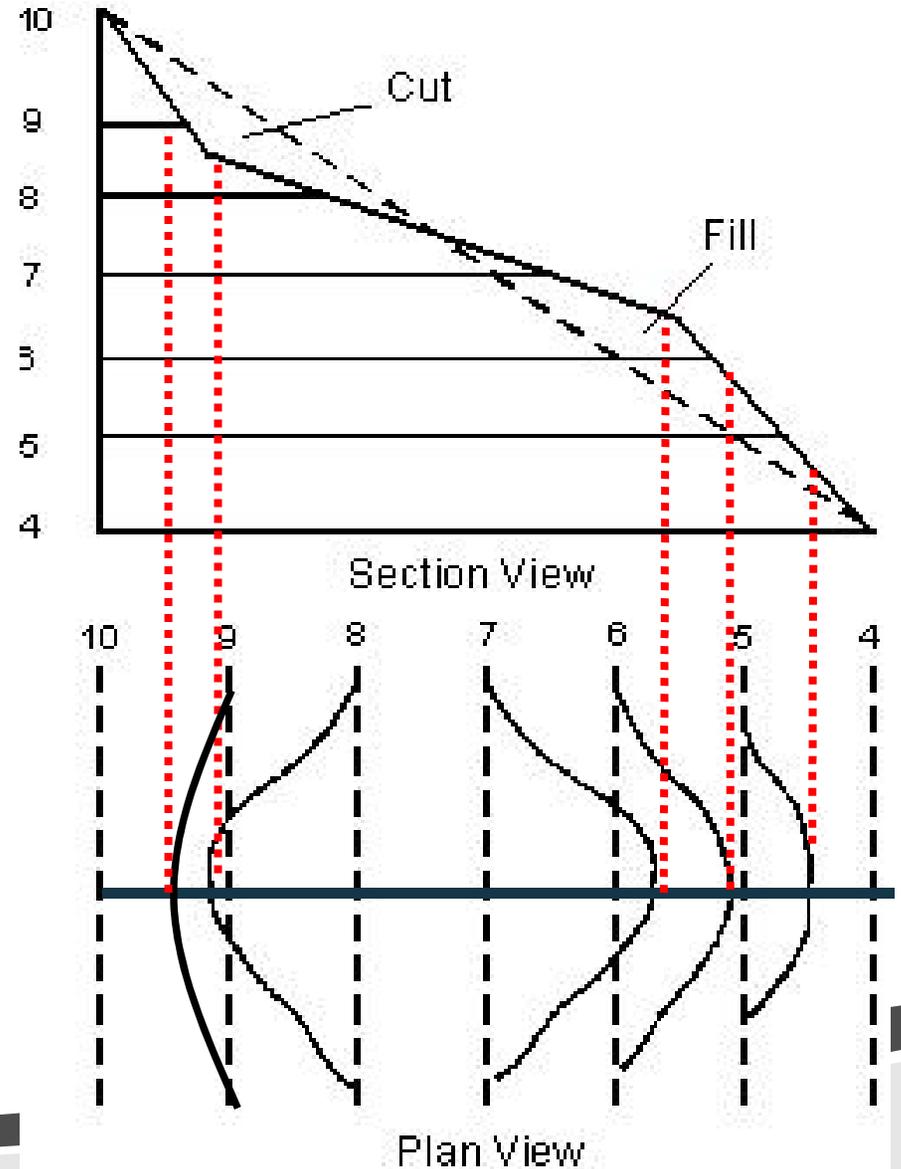
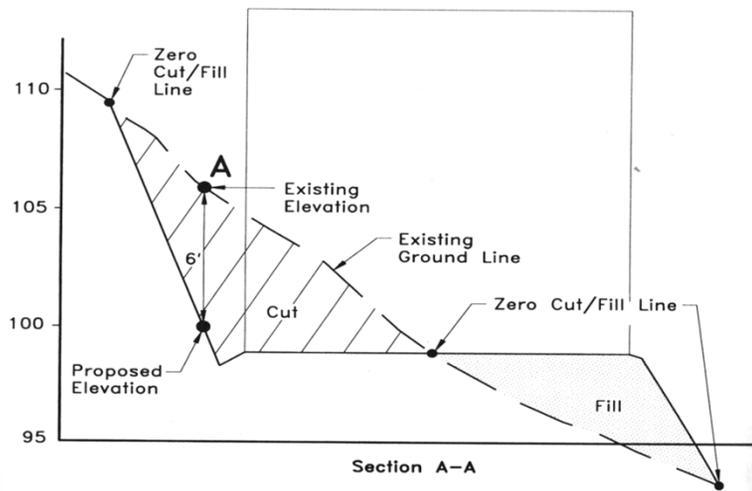
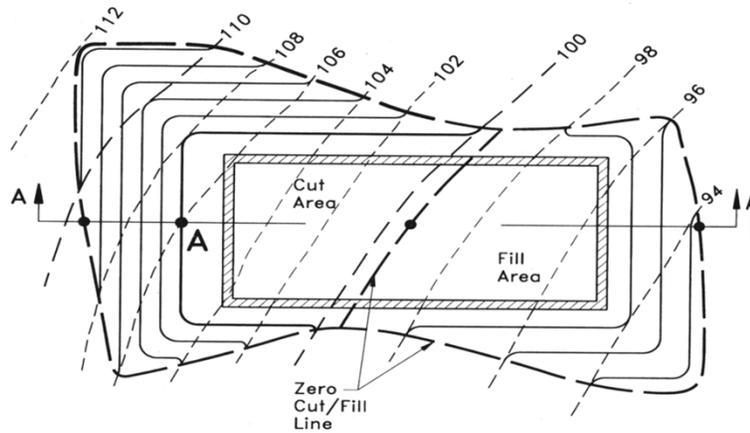
- The closer the lines are together, the steeper the terrain.
- Further apart means less steep.



Cut & Fill Slopes

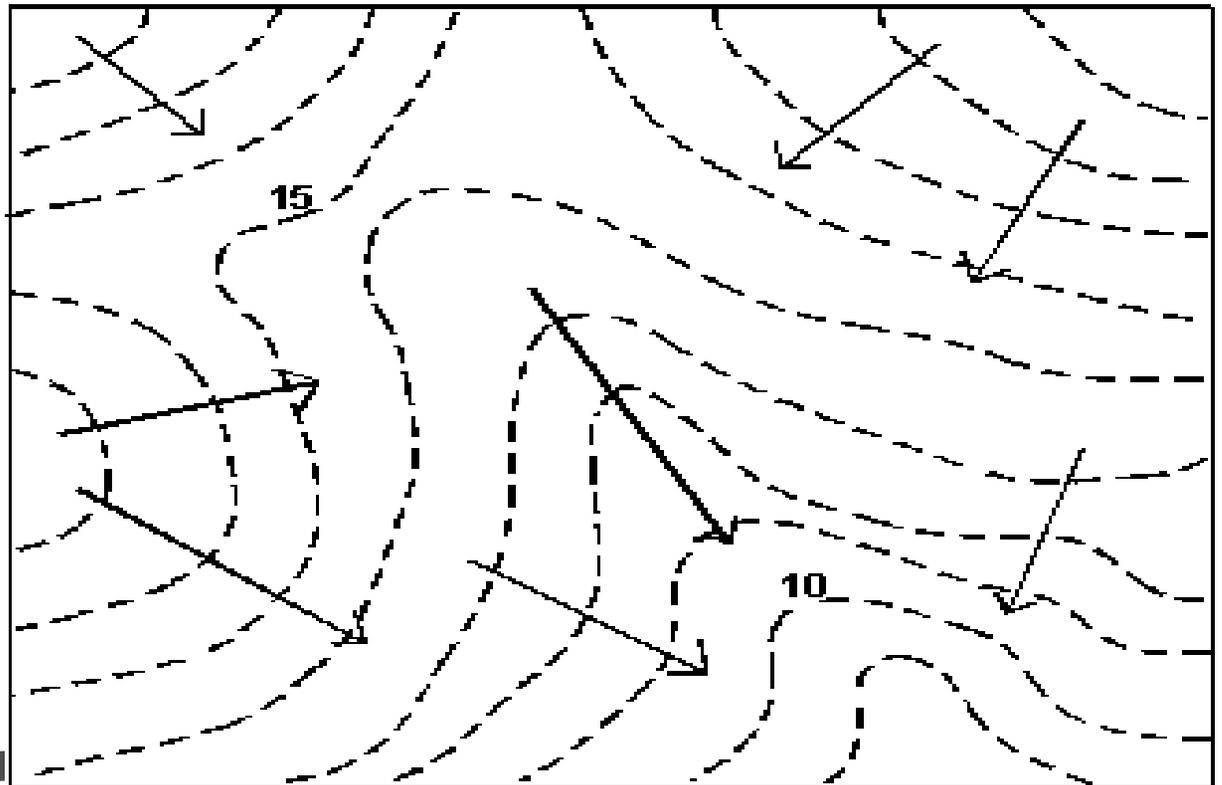


Cut & Fill Slopes

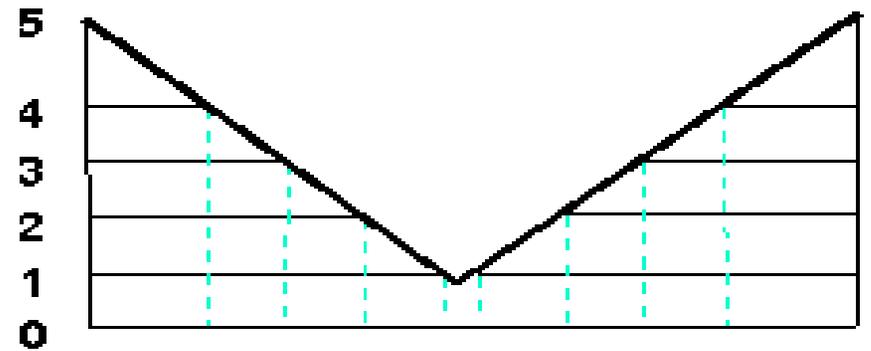


Reading Contours

- Water always flows perpendicular to contour lines.



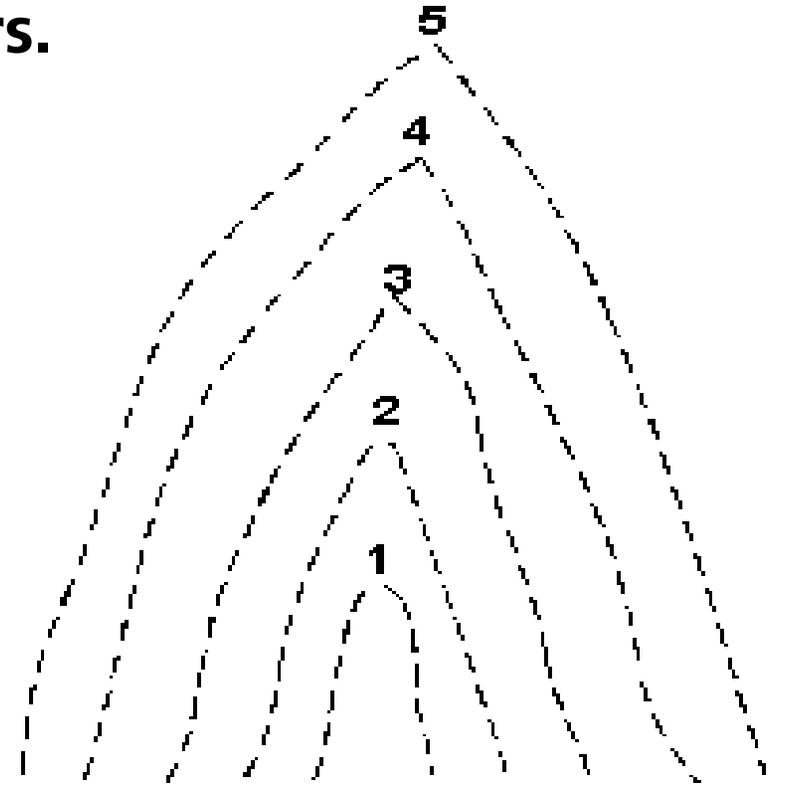
Valley or Swale



Section C

Represented by contours which point toward the higher numbers.

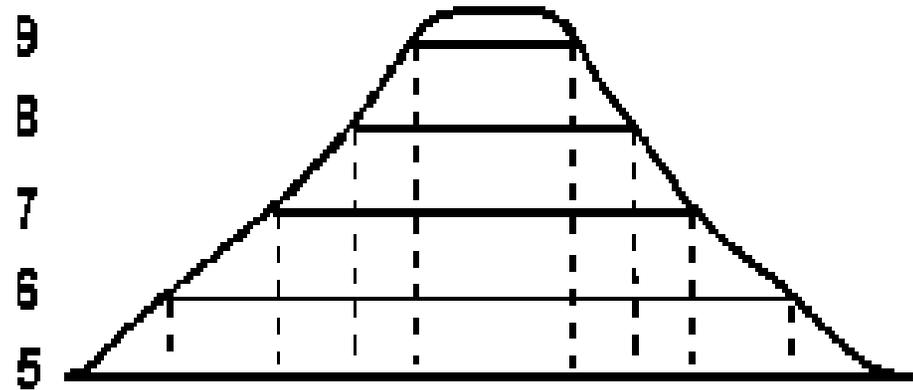
Inverted V – points to higher numbers.



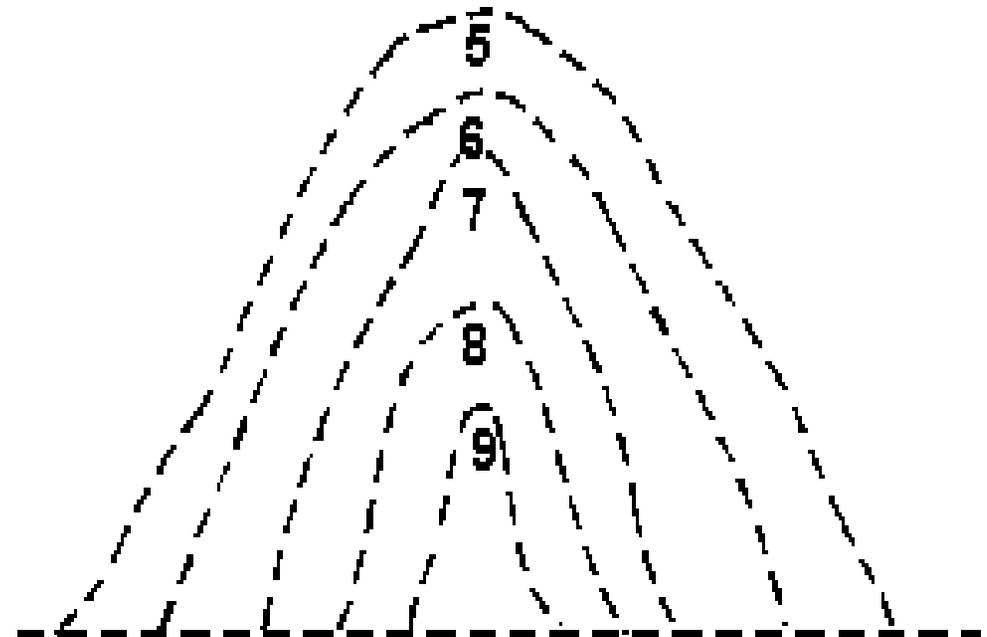
Plan View

Ridge

Similar to a valley, but represented by contours which point toward the lower numbers.



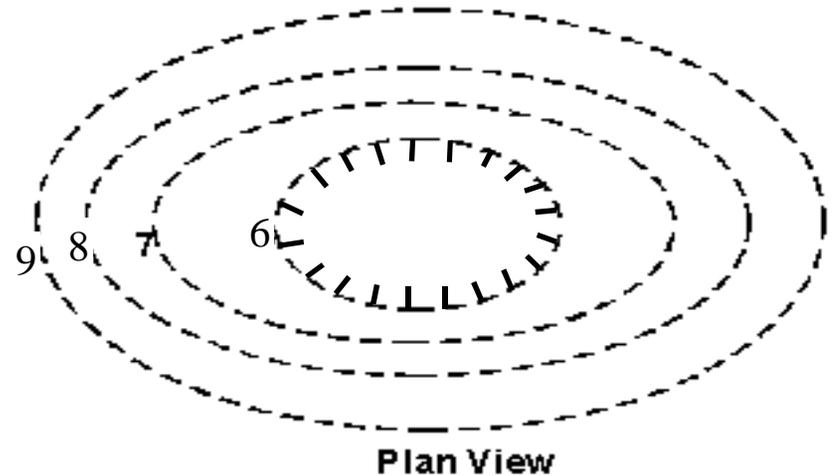
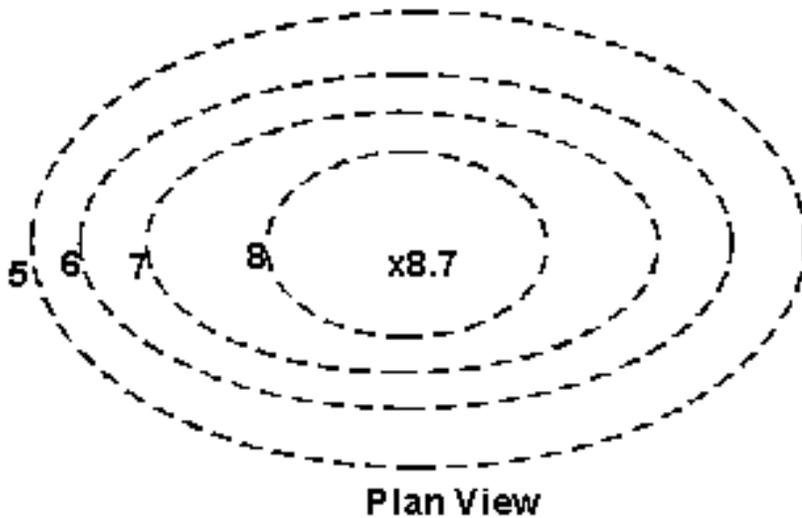
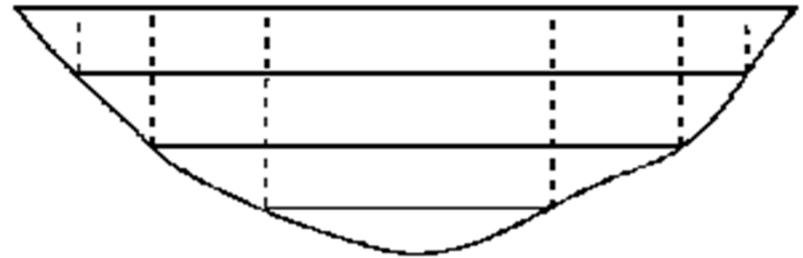
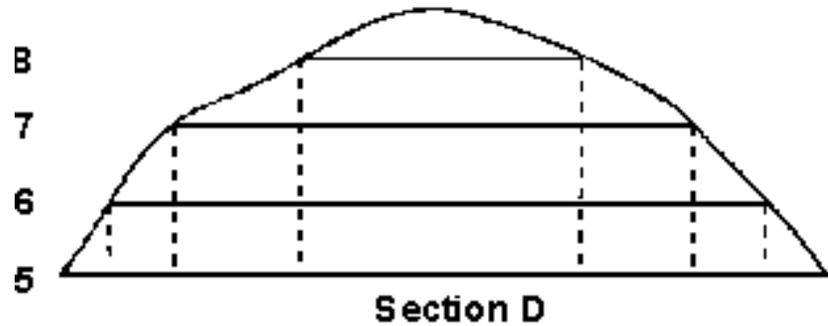
Section E

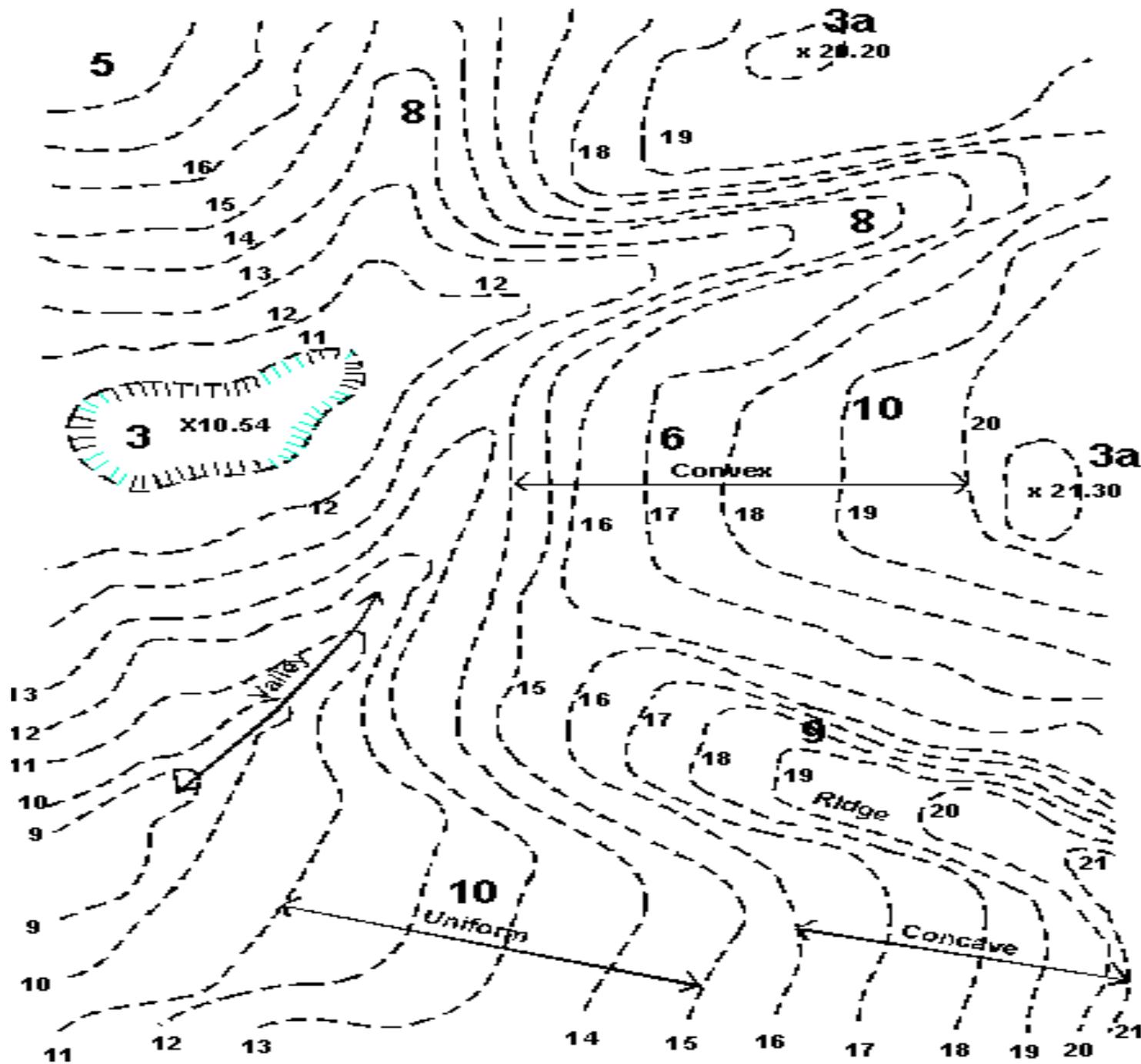


Plan View



Summit and Depression





What is an Adequate Plan?

The primary guidelines for determining E&S plan adequacy are:

- **Minimum Standards of the Virginia Erosion and Sediment Control Regulations.**
- **Specifications of the Virginia Erosion and Sediment Control Handbook (chap. 3).**
- **Local ordinance requirements.**
- **Plan review checklist (Guidance)**



What is an Adequate Plan?

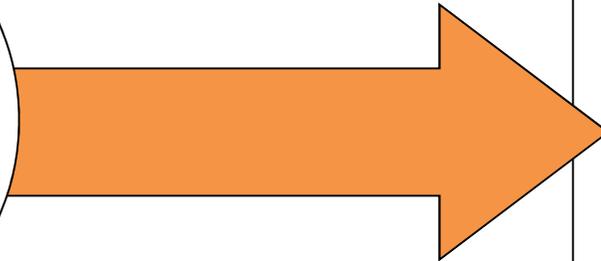
- **Contains enough information to satisfy the plan approving authority to ensure that the problems of erosion and sedimentation have been adequately addressed.**



Plan Review



Questions?



Reject



End of Module 5