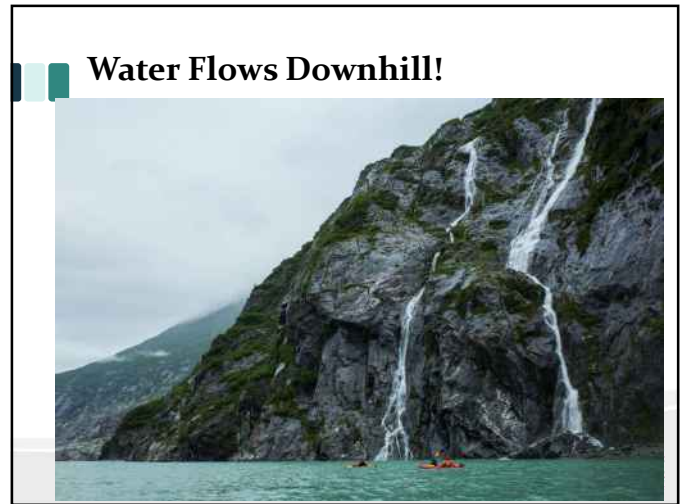


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3



4

What do we have in ESC that directly deal with water and slopes?

- Minimum Standards 7, 8, and 9
- Stormwater Handbook, Chapter 7:
 - C-ECM-01 Straw Wattles
 - C-ECM-06 Temporary Fill Diversion
 - C-ECM-07 Temporary Right-of-Way Diversions
 - C-ECM-12 Temporary slope drains
 - C-ECM-11 Pave flumes



5

What do we have in ESC that directly deal with water and slopes?

- Minimum Standards 7, 8, and 9
- Stormwater Handbook, Chapter 7:
 - C-ECM-13 Riprap
 - C-SCM-07 Rock Check Dams
 - C-SSM-03 Surface Roughening
 - C-SSM-04-05 Soil Stabilization Blankets and Matting



6

Additional ESCHB Measures that deal with slopes (and other areas)

- ESCHB Standards and Specifications:
 - 3.04 Straw Bale Barrier
 - 3.05 Silt Fence
 - 3.09 Temporary Diversion Dike
 - 3.12 Diversion
 - 3.21 Level Spreader
 - 3.31/32 Seeding (Temporary and Permanent)



7

MS-7

Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. Slopes that are found to be eroding excessively within one year of permanent stabilization shall be provided with additional slope stabilizing measures until the problem is corrected.



8



9

MS-8

Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume or slope drain structure.

10

MS-9

Whenever **water seeps** from a slope face, adequate drainage or other protection shall be provided.

11

Excavation and a perched water table

12

Strategies for Dealing with Slopes

Remember:
Critical slope

Remember:
K-factor
Revised Universal Soil Loss Equation (RUSLE)

They help us estimate/model how much sediment we potentially lose from a slope or project site



13

Revised Universal Soil Loss Equation (RUSLE)

$$A = R \times K \times LS \times C \times P$$

A = Annual Soil Loss

R = Rainfall-Runoff Erosivity

K = Soil Erodibility

LS = Length and Steepness of Slope

C = Cover Management

P = Support Practice (controlling flow)



14

$$A = R \times K \times LS \times C \times P$$

Controlling Slopes (LS)

- Grading
- Diversions (*diversion dike, temporary diversions, fill diversion, ROW diversion*)
- Permanent terraces
- Check dams



15

Critical Slope Length

Slope Gradient

0 - 7%

7 - 15%

15 % and higher

25% and higher

Slope Length

300 feet (100 yards)

150 feet (50 yards)

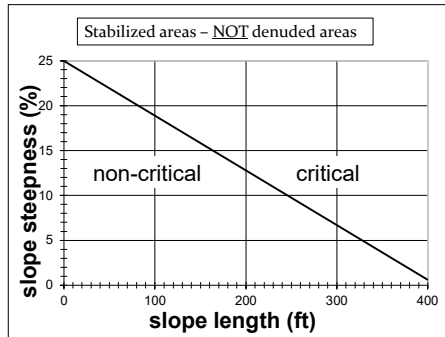
75 feet (25 yards)

Immediate erodibility



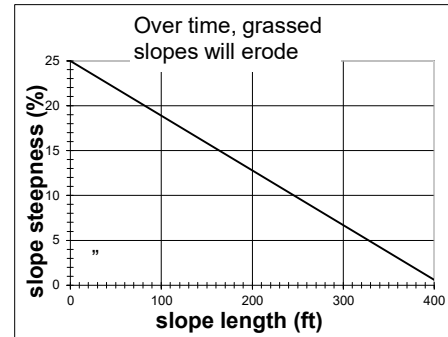
16

Critical Slope for Erosion Potential



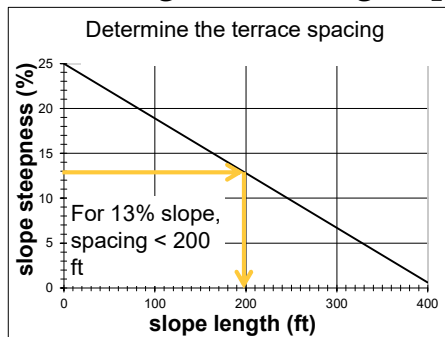
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Permanent Stabilization



18

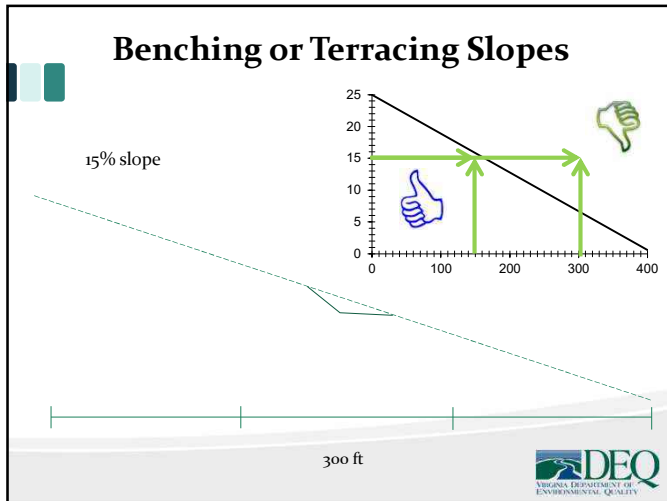
Terracing or Benching Slopes



19



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22

$A = R \times K \times LS \times C \times P$

Controlling Cover (C)

- Preserve vegetation
- Stage clearing & grading operations
- Maintain vegetated buffers
- Promptly apply stabilization
- Consider options to seed and straw

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23

Temporary Stabilization of Slopes

What is the best \$20 spent on a million dollar project?

A soil test

- Target application of nutrients
- Avoids excess nutrient runoff
- Measures organic material in soil
- Matting
- Temporary diversions & slope drains

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Temporary Stabilization of Slopes

What other practices improves success of seed & straw?

- Topsoiling, compost amendments
- Fertilizer & lime
- Tracking
- Hydraulic mulching
- Matting
- Temporary diversions & slope drains



25



26

Temporary vs. Permanent Measures

Plan ahead, but live in the moment

1st question: What is required for permanent stabilization?

2nd question: What is required to stabilize now so we can achieve permanent stabilization?



27



28

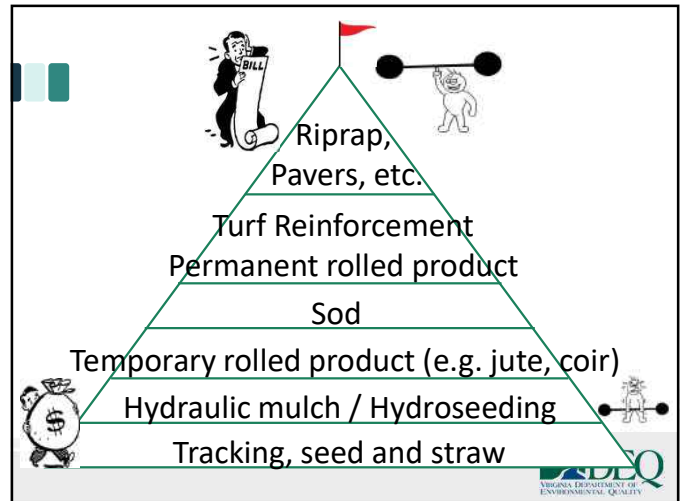
Temporary vs. Permanent Measures

If grass alone will stabilize the slope, how do we stabilize now to allow the grass to grow?

Depends on how water flows!



29



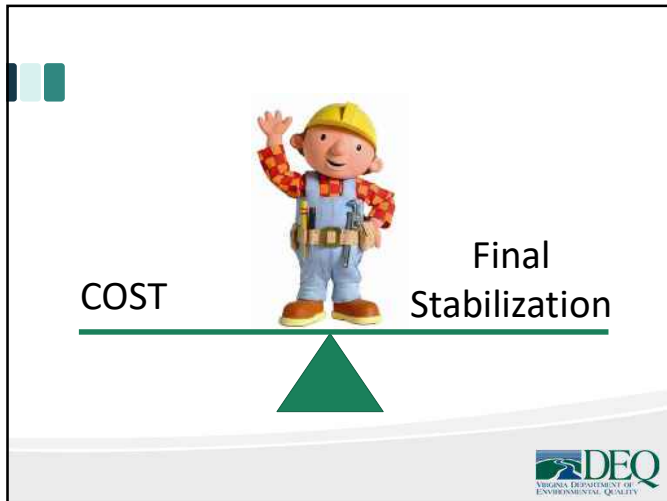
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31



32



33

$$A = R \times K \times LS \times C \times P$$

Controlling Practices (P)

- Treat smaller areas (divide & conquer)
- ESC in series
- Control runoff on the site
(SAD: spread, accommodate, or divert)

34

ESC Plans can be Changed!

§ 62.1-44.15:55.

C. The VESCP authority may require changes to an approved plan in the following cases:

1. Where inspection has revealed that the plan is inadequate to satisfy applicable regulations

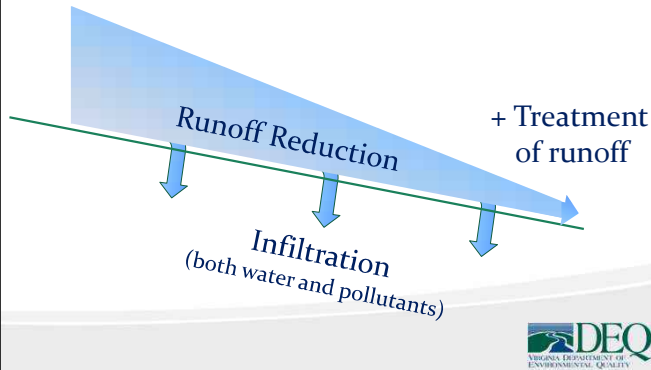
35

Module 5b

Stormwater and slopes

36

Stormwater Principles



37

Stormwater Principles & Slopes

1. Infiltration
2. Flow through the system (treatment train)
 - a. Slow enough to receive treatment
 - b. Fast enough not to back up the system and flood the site
 - c. Even (level) flow through the system
 - d. Free of trash, debris and sediment
3. Non-erodible flow

38

Slopes and the BMP Clearinghouse

BMP	Slope	BMP	Slope
1. Rooftop disconnection	<2%	9. Bioretention	1-5%
2. Sheet flow	6-8%	10. Dry swale	<4%
3. Grass channels	2-4%	11. Wet swale	<2%
4. Soil amendments	<10%	12. Filtering practices	No
5. Vegetated roof	No	13. Constructed wetland	No
6. Rainwater harvesting	No	14. Wet pond	No
7. Permeable pavement	1-3%	15. Extended detention	No
8. Infiltration	<5%		

39

Stormwater

Some minor sloping allowed!

2 Types:

- Sheet flow
 - Filter strips
 - Conserved open space
 - Permeable pavement
 - Infiltration areas
 - Bioretention areas

40

Stormwater

Some minor sloping allowed!

2 Types:

- Channelized flow
 - Grass channels
 - Dry swales
 - Wet swales
 - Infiltration areas
 - Bioretention areas



41

Last but not least

Outfall!

1. Smooth transition to receiving channel
2. Outlet protection
 - a. Installed according to plan
 - b. 0% grade
 - c. Filter cloth underneath
 - d. Smooth transition between the riprap and soil



42



43

One final thought

Make sure the site is stable or at least no fines can enter the SW BMPs when they are put into the system.



44

Burning questions?



45