Stormwater Management in Virginia for Contractors and Operators

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Ground Rules

- Please keep cell phones off during the training
- Questions and comments are encouraged
- Everyone will have an opportunity to speak and share their thoughts at the appropriate times
- Don’t shoot the messenger!

Agenda

Module 1: Stormwater Overview (8:30-9:30)

Module 2: Regulatory Overview (9:45-11:30)

Lunch Break (11:30-12:30)

Module 3: Onsite Practices (12:30-1:30; 1:40-2:50)

Module 4: Stormwater Inspections during Construction (3:00-3:30)

Module 1:

Stormwater Overview

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It’s more than just a little dirt we’re dealing with.

It's more than just a little dirt we're dealing with

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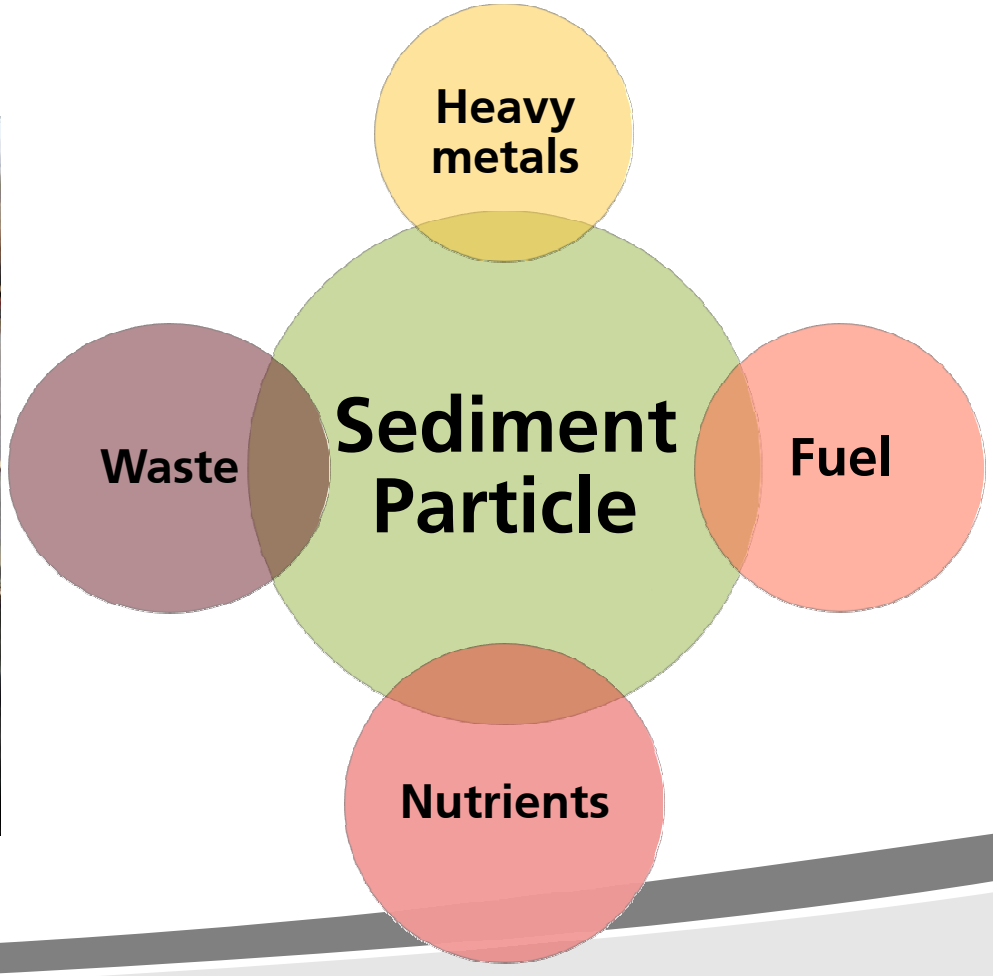
It's more than just a little dirt we're dealing with

Construction Sites & Water Quality



Nutrients

Nutrients attached to sediment in stormwater runoff entering the river are a major source of degradation to many of Virginia's water bodies (including Chesapeake Bay)

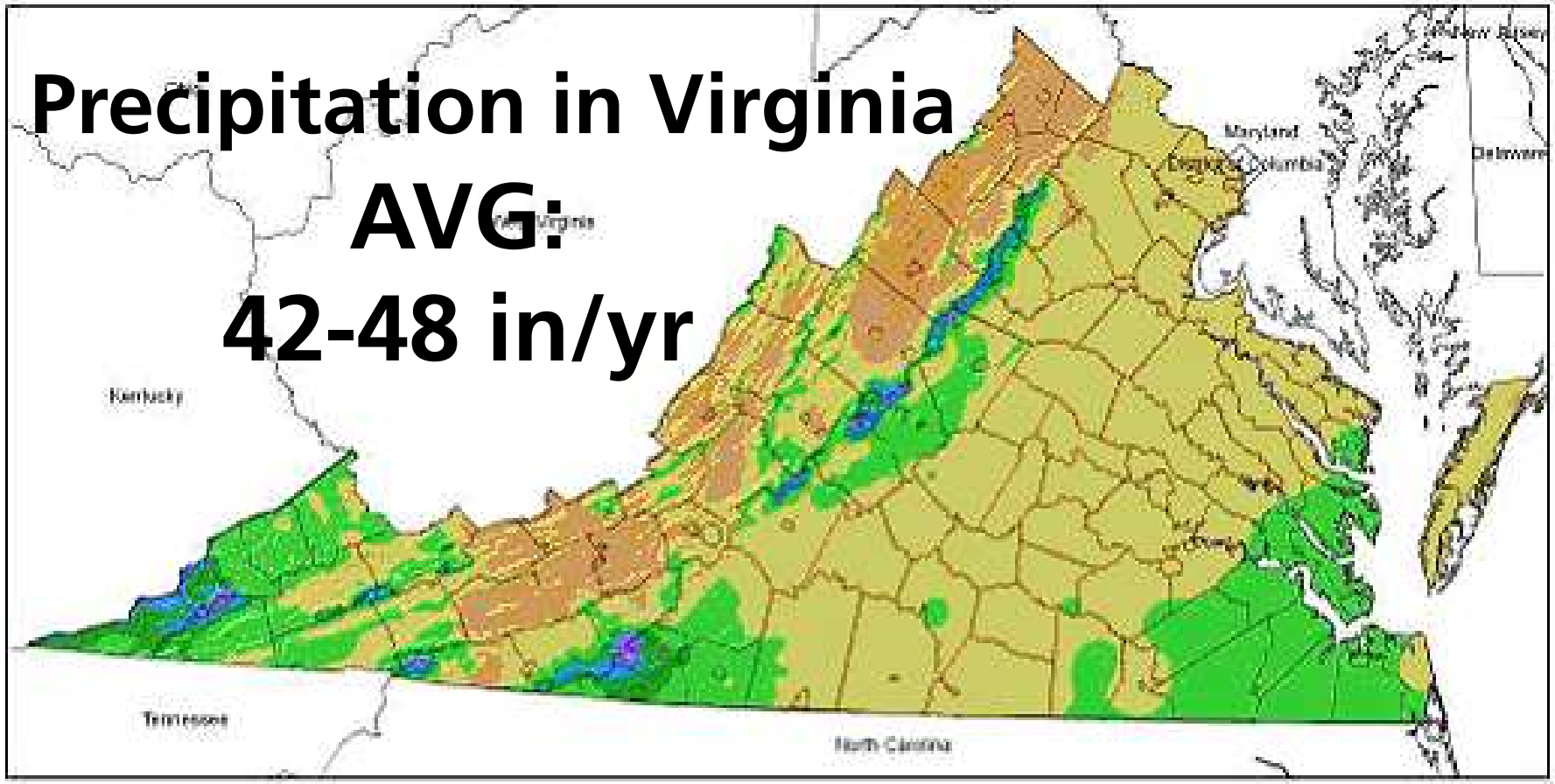
How does it all begin?

- Raindrops hit the exposed soil like tiny bombs
- Larger raindrops strike the soil surface harder

Precipitation in Virginia

AVG:

42-48 in/yr

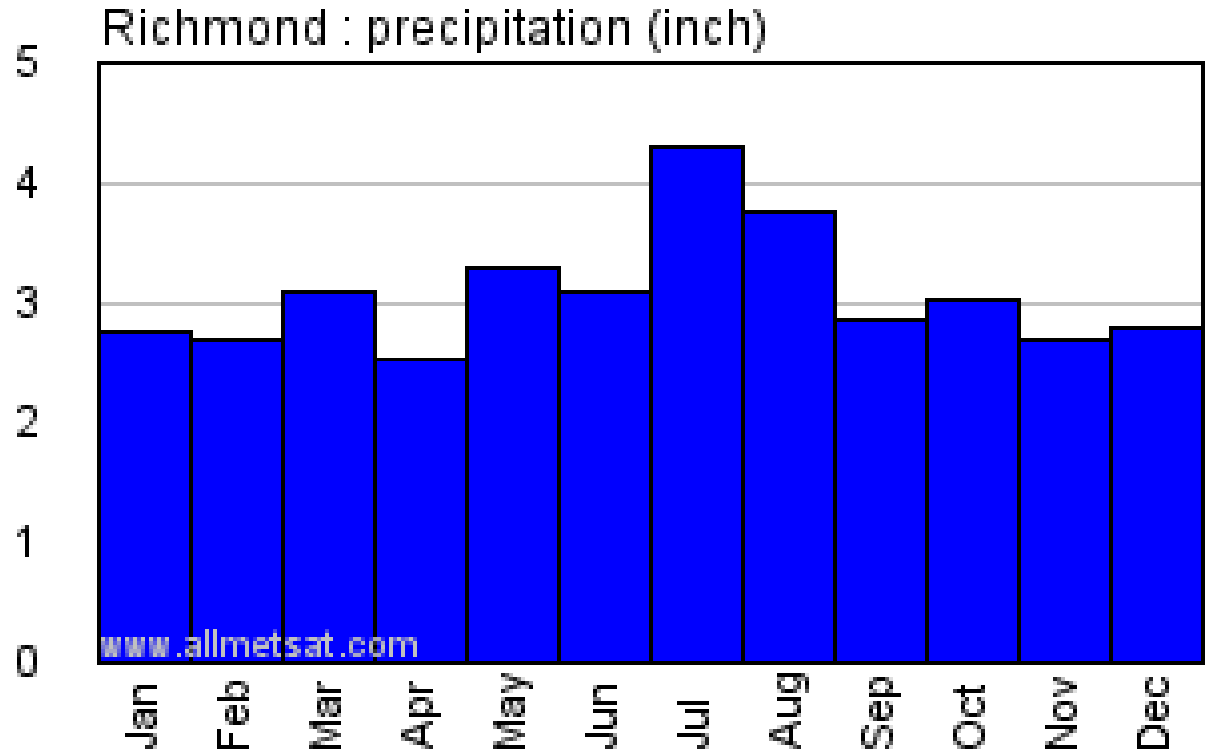


Precipitation (inches)

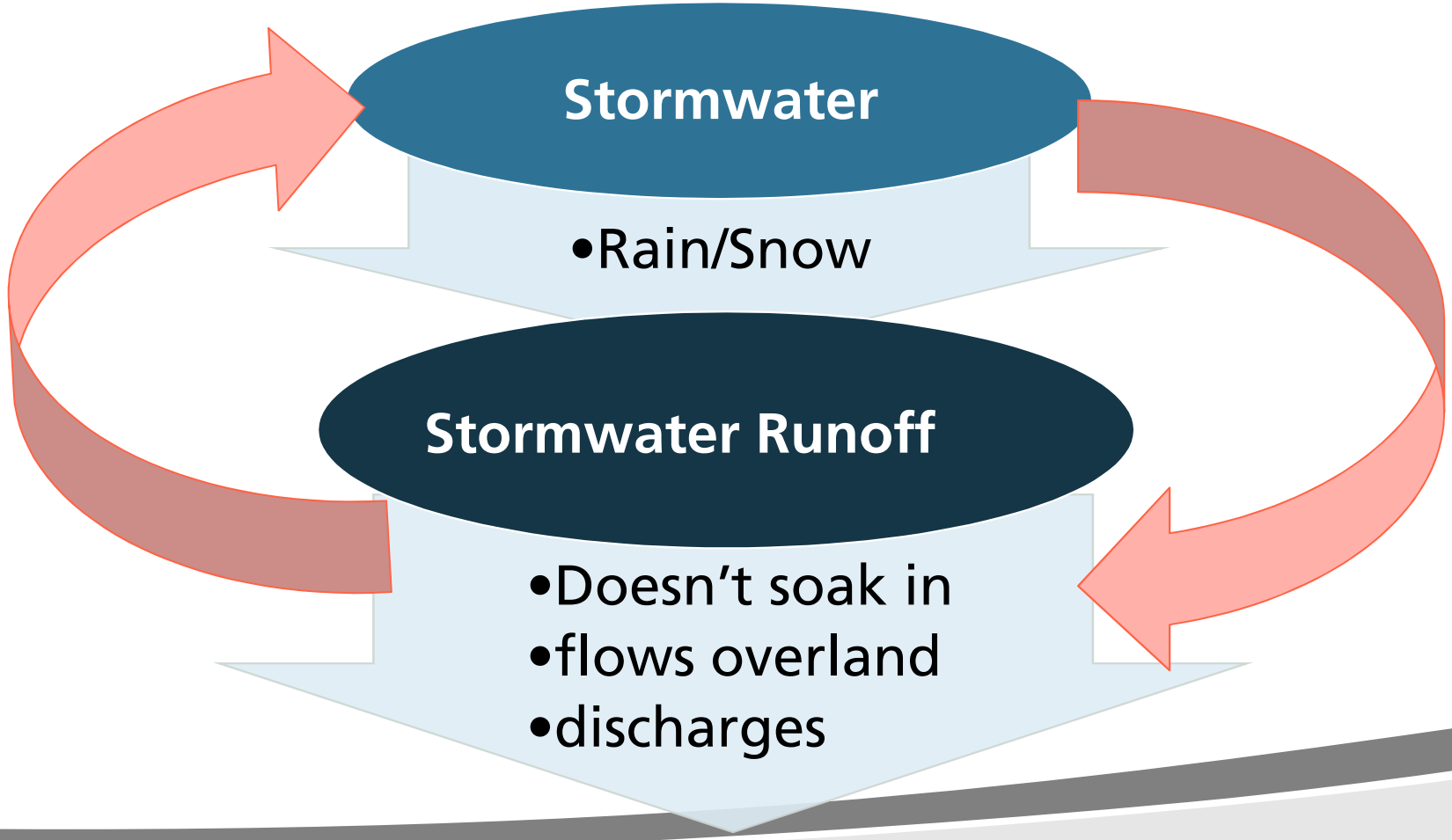
Less than 38	46 - 50	58-62
38-42	50 - 54	62-66
42-46	54 - 58	More than 66

Rainfall Distribution

- Rainfall is not evenly distributed throughout the year
- Most erosive rainfall is during the months of June – Sept.



Common Definitions:



Runoff

- Runoff begins when the amount of rainfall exceeds the soil's capacity to absorb water
- Runoff starts as sheet flow, which is a means of transporting soil particles that are detached

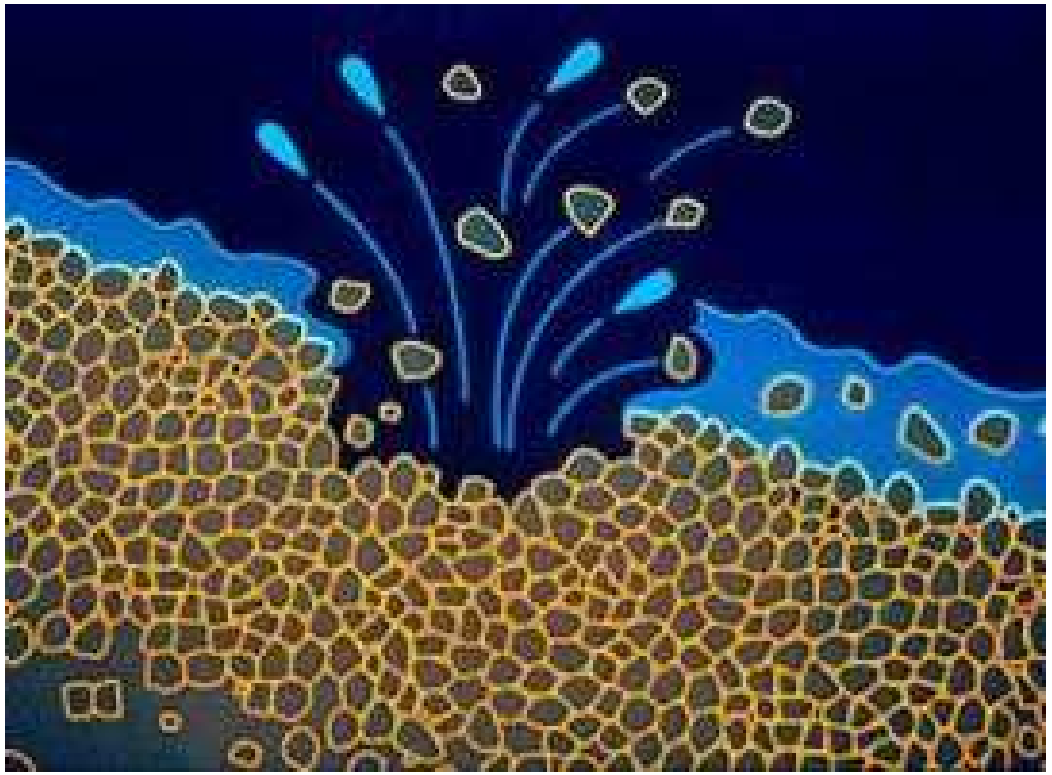
Runoff

- As the depth of sheet flow moves down-hill, it concentrates in low spots
- As runoff concentrates, it gains force & momentum to detach other soil particles
- A “chain reaction” occurs where depth & velocity of runoff increase

Raindrop Impact

- First effect on soil
- Dislodges soil particles
- Splashes
- Becomes sheet erosion

Raindrop Impact



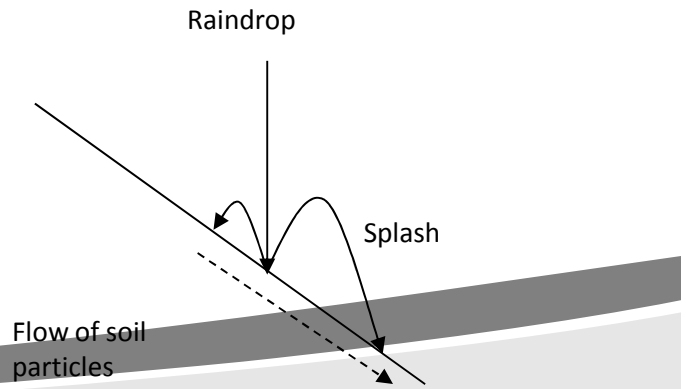
- Action of falling rain equals 90% or more of total soil erosion

Raindrop Impact

- Soil surfaces that are covered from the raindrop impact are protected

Raindrop Impact

- Particles can be moved as far as 2 feet vertically to 5 feet horizontally
- On a 10% slope, 75% of the soil particle movement is down-slope



Raindrop Impacts

- Rain also compacts the soil on impact
- Repeated strikes change the surface of the soil into a slurry
- The slurry seals the soil pore space and prohibits the water from infiltrating

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Sheet Erosion

- Shallow sheets of water run across the surface
- Seldom detaches soil particles but…
- Transports detached soil
- Sheet flow moves only a short distance before it either concentrates or diminishes

Rill Erosion

- Shallow water collects in low spots
- Deeper flow means more concentrated quantity of water
- Velocity of water becomes greater
- Creates tiny channels down the slope
- Usually easily repaired

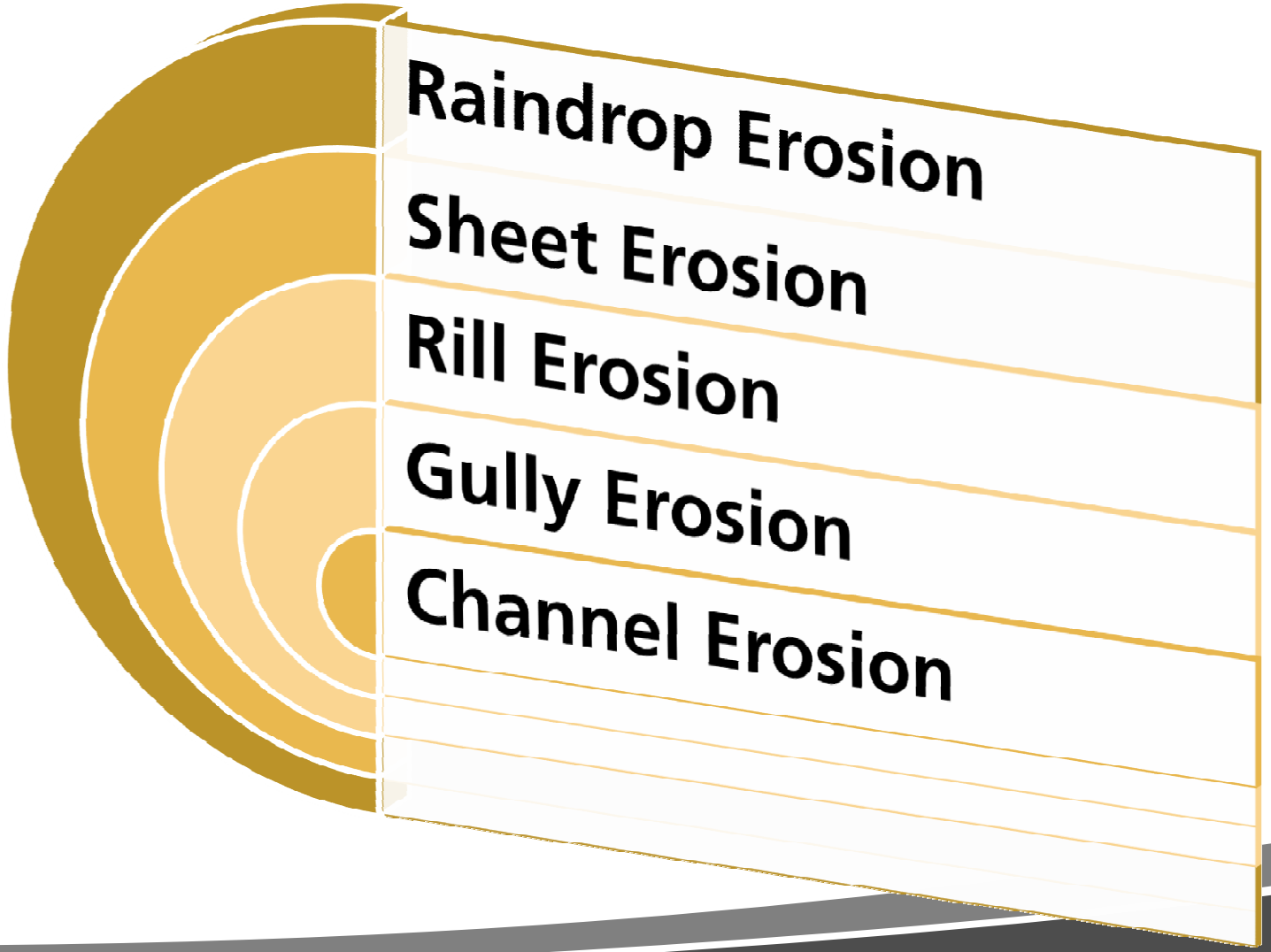
Gully Erosion

- Volume and velocity increases
- Creates larger channels or cuts
- Too large to be easily repaired
- May Require Heavy Equipment to repair

Channel Erosion

Greater volume & velocity of water.

Causes movement of materials within the stream bed & banks.



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So how do we prevent this?

- Take proactive approaches (before, during, and after land development)
- Control erosion & maintain natural land conditions as much as possible
- Minimize denuded soil
- Prevent hazardous materials from polluting environment

Sound like Common Sense?

Two Principles of Erosion & Sediment Control

Erosion Control - **first** line of defense. "If there is no erosion, there can be no sediment."

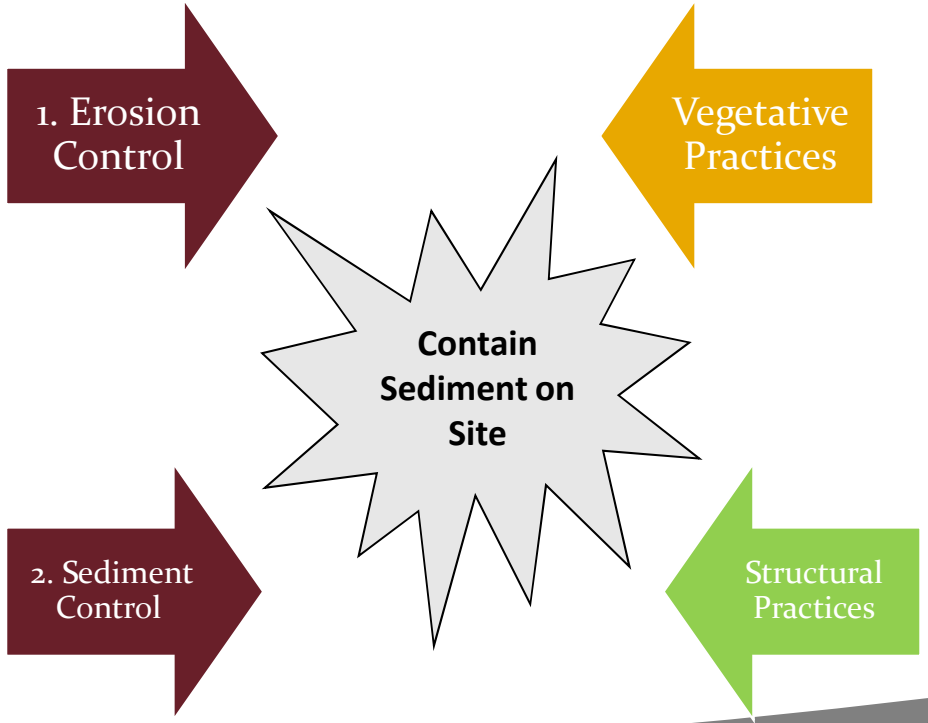
- Prevents damages associated with both erosion and sediment control
- The only practical approach in some instances (e.g., very fine sediments)

Two Principles of Erosion & Sediment Control

Sediment Control - backup for erosion control measures; second line of defense.

Coordination of erosion control, sediment control and management of stormwater leaving the site is necessary for a well-integrated program

The TAKE AWAY



Four Factors Influencing Runoff and Erosion

Climate

Groundcover

Soil

Topography

The BIG Factor!

Groundcover

- **Most important** factor from the standpoint of controlling erosion.
- Amount of erosion is directly proportionate to the amount of bare soil exposed to raindrop impact
- Dramatic reductions in soil loss can be obtained simply by covering the soil surface to protect it from raindrop impact

EFFECTIVENESS OF VARIOUS GROUND COVERS IN PREVENTING SOIL EROSION

(this table compares fully established stands of groundcover with bare soil)

Type of Ground Cover	Percent Reduction
Permanent grass	99
Perennial ryegrass	95
Annual ryegrass	90
Small grains	95
Millet or Sudan grass	65
Grass sod	99
Hay or straw mulch (@2 tons/acre)	98

Soil Properties

Some General Concepts

Infiltration rate – speed water enters soil

Permeability rate – speed water moves through soil

Are influenced by: soil texture, percent organic matter, & bulk density

Slope Steepness

The steepness of a slope causes velocity (speed) of the runoff to increase.

Less chance for water to infiltrate on a steep slope
➔ More runoff

Energy=Volume x Speed

Three categories of erodibility potential

Slope gradient	Erosion hazard
0-7%	Low
7-15%	Moderate
15% & over	High

Slope Length

The longer the slope

- the greater the depth of runoff
- the greater the velocity (speed of the runoff)

Energy=Volume x Speed

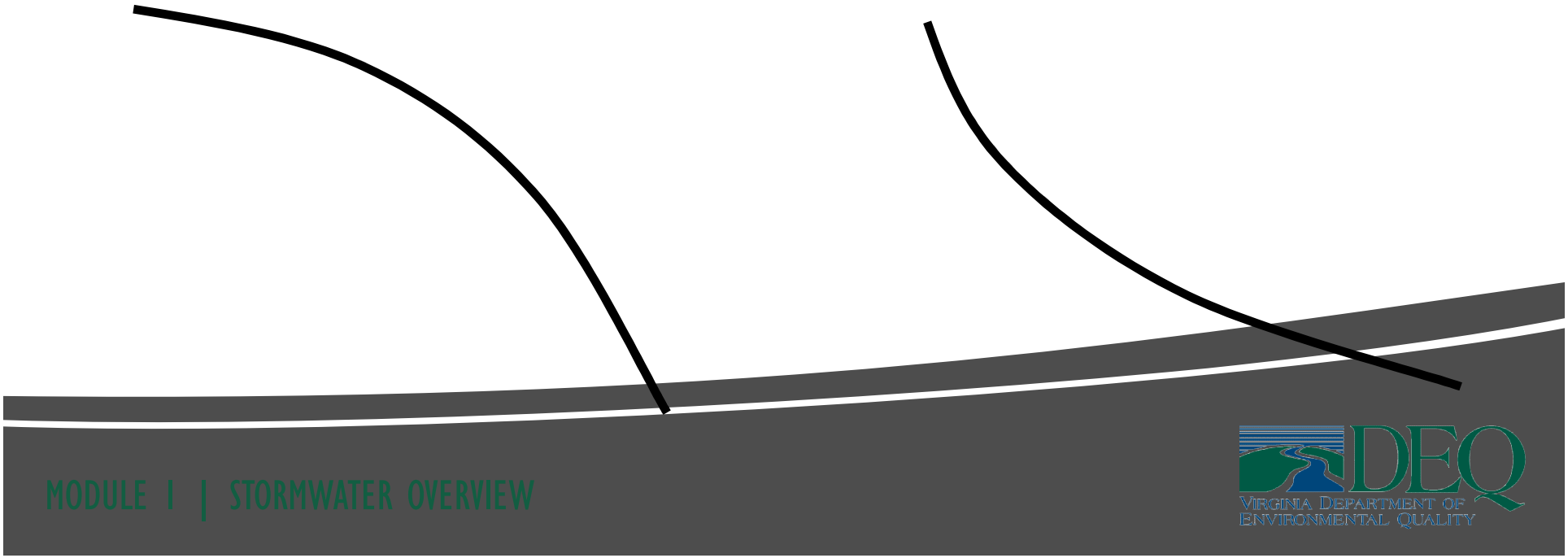
SLOPE GRADIENT AND LENGTH COMBINATIONS AT WHICH THE EROSION HAZARD WILL BECOME CRITICAL

Slope gradient	Slope length
0-7%	300 feet (100 meters)
7-15%	150 feet (50 meters)
15% & over	75 feet (25 meters)

Slope Shape

Convex slopes (steeper at the lower end) have more erosion potential

Concave slopes (steeper at the top or upper end & flatter at the lower end) have less potential for erosion



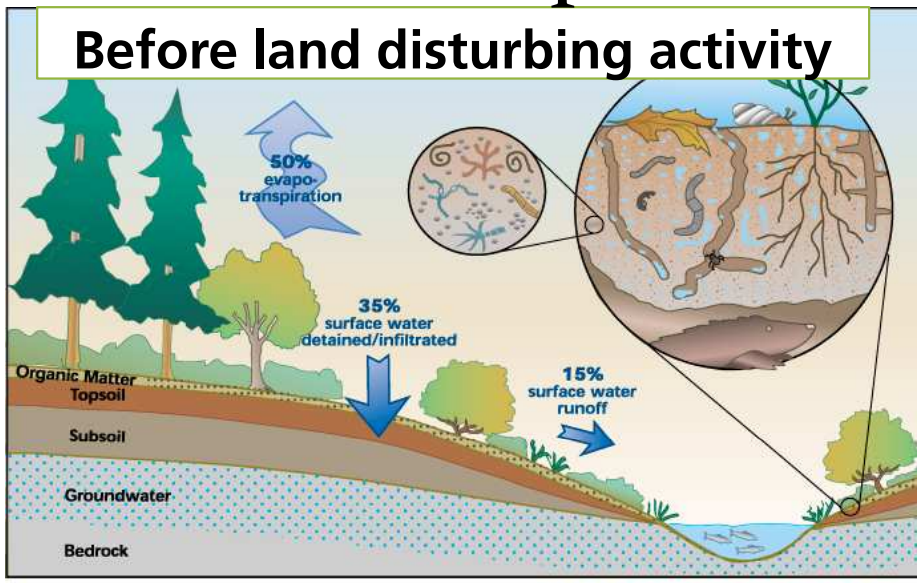
Another Problem on Construction Sites Is...

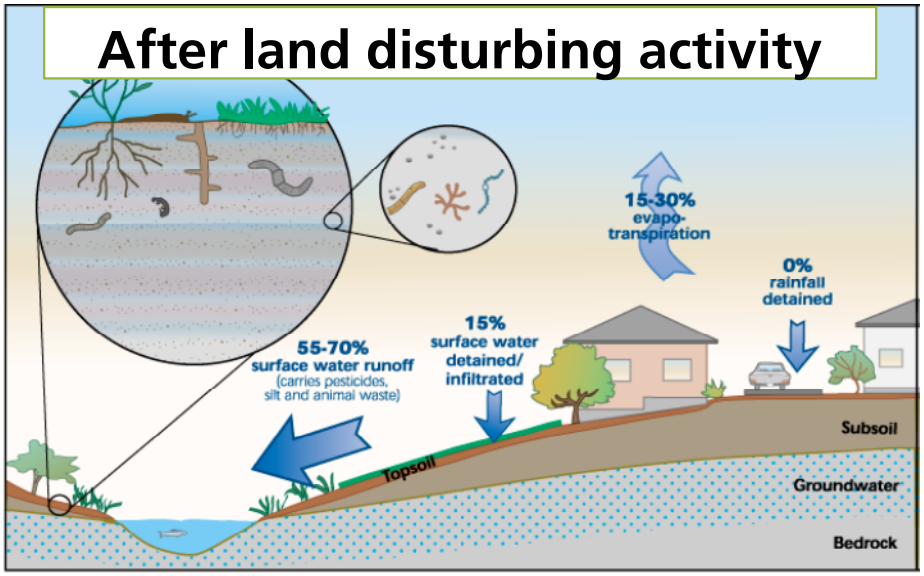
Soil Compaction

Bulk Density Comparison

Common Bulk Density Measurements	
Land Surface/Use	**Bulk Density**
Undisturbed Lands Forest & Woodlands	1.03 g/cc
Residential Neighborhoods	1.69 to 1.97 g/cc
Golf Courses - Parks Athletic Fields	1.69 to 1.97 g/cc
Concrete	2.2 g/cc

Soil Compaction





Thick topsoil

Organic matter

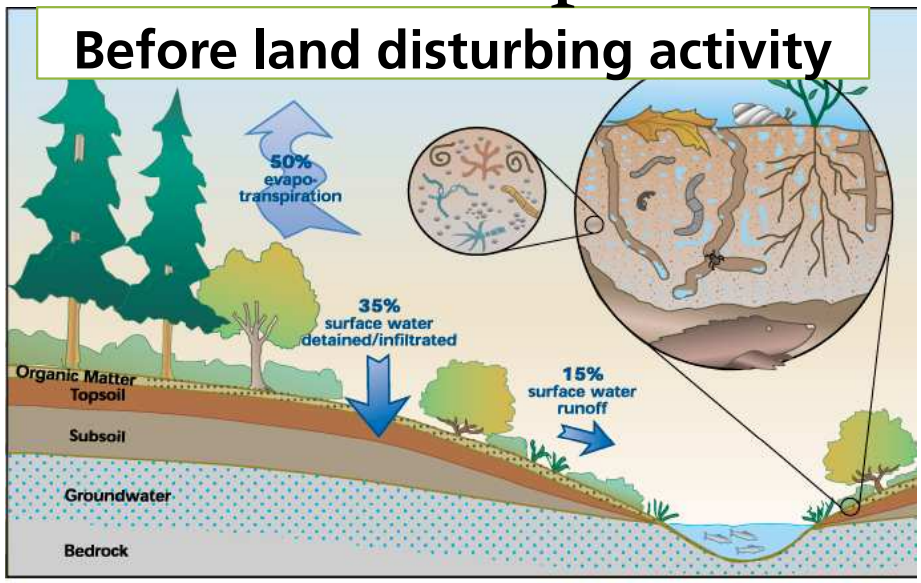
Soil structure and texture intact

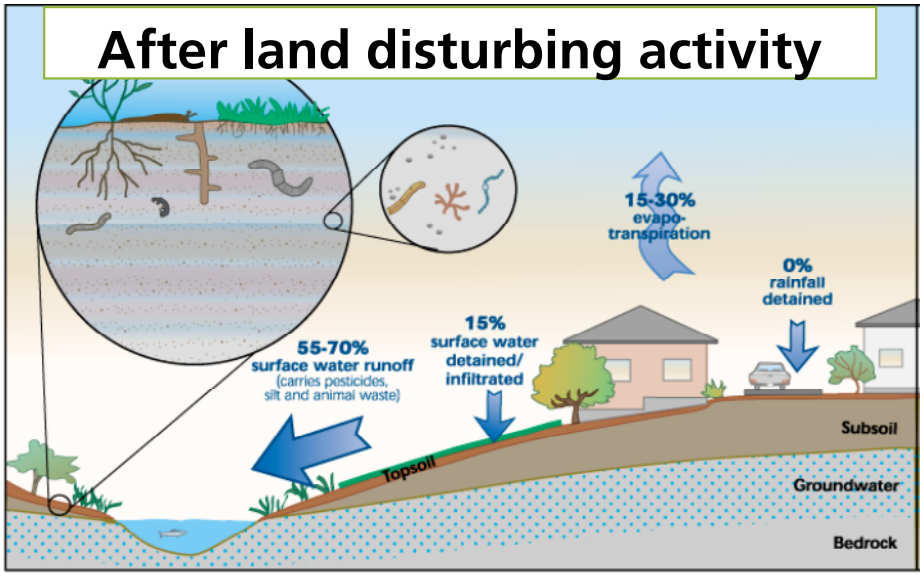
Thin topsoil or none

Loss of organic matter

Compacted soil

Soil Compaction





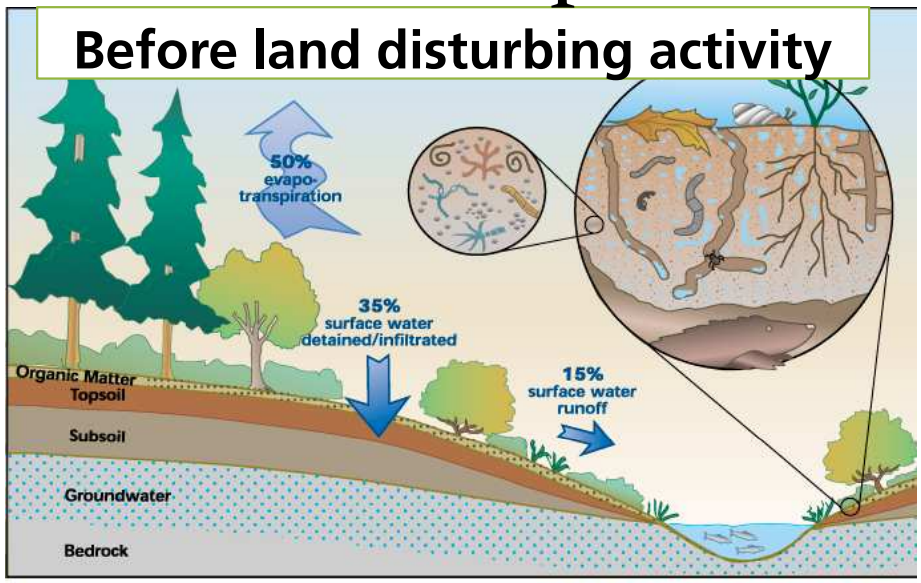
Good soil porosity

Good soil permeability

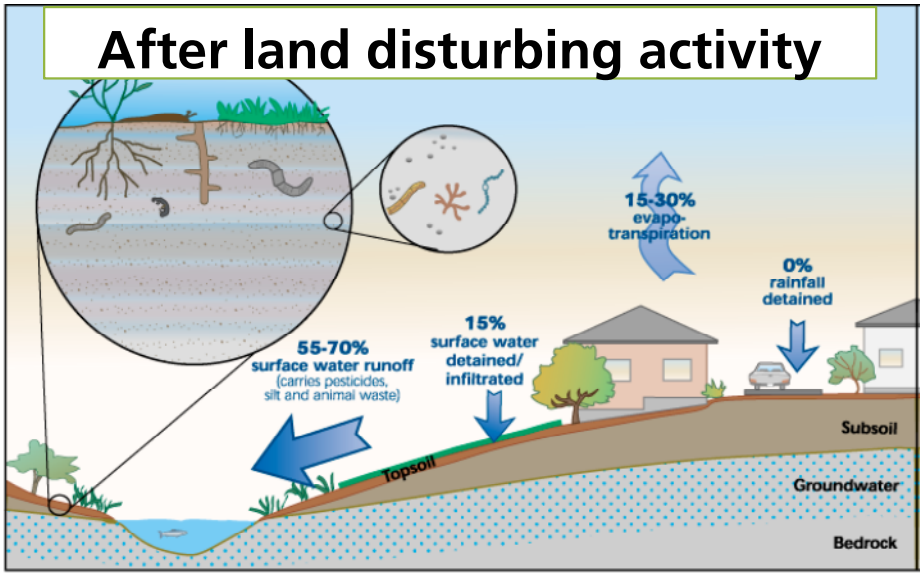
Decreased soil porosity

Decreased soil permeability

Soil Compaction



Very little surface runoff



More surface runoff

Impervious Surfaces-Post Construction

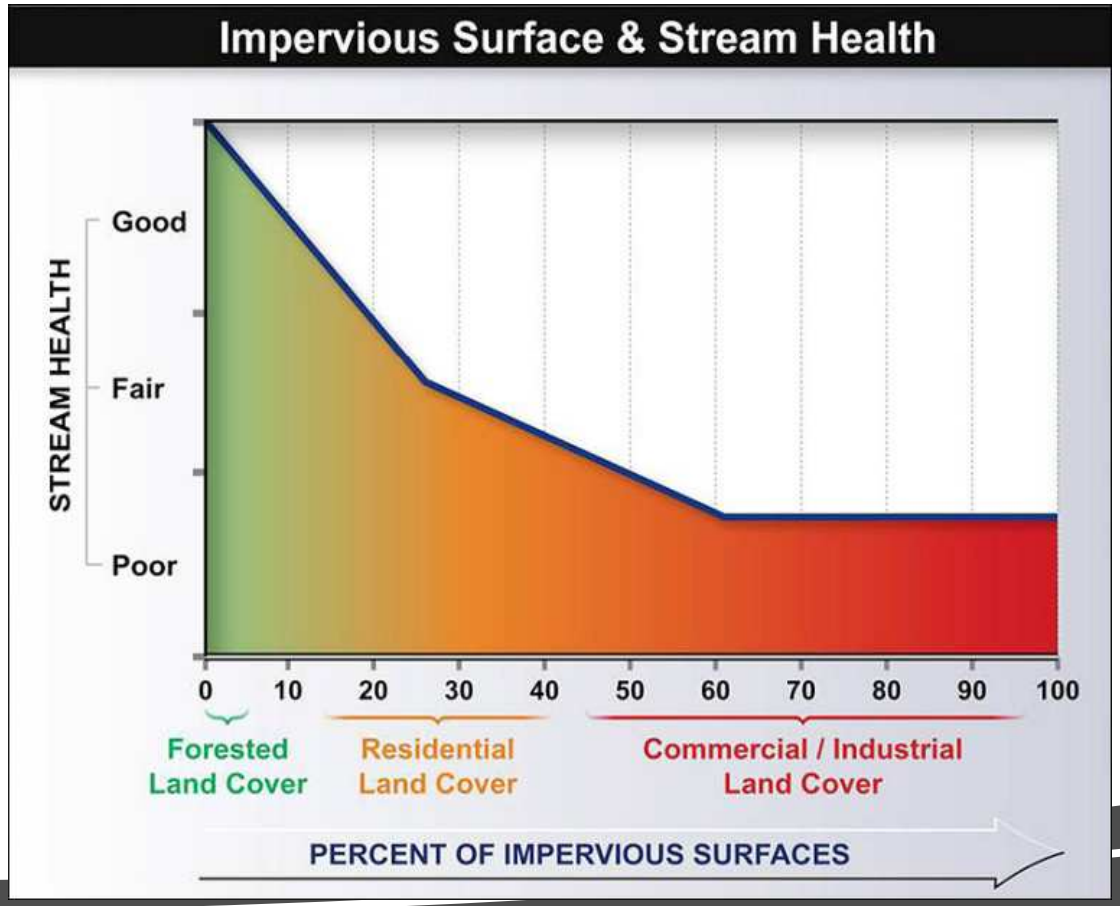
Buildings, roadways, parking lots and other impervious surfaces further:

•reduce infiltration &
•increase runoff

Impervious Surfaces

Typical Site Impervious Coverage of Land Uses in the Northeast U.S.	
Land Use	**% Impervious Cover**
Commercial and Business District	65-100
Industrial	70-80
High Density Residential	45-60
Medium Density Residential	35-45
Low Density Residential	20-40
Open (Natural Areas)	0-10

Impervious Surface & Stream Health



- Greater flows, more often, for longer duration, erode stream banks and cut down channel bottom
- Stream channel geometry configures for these larger flows

In a developing watershed:

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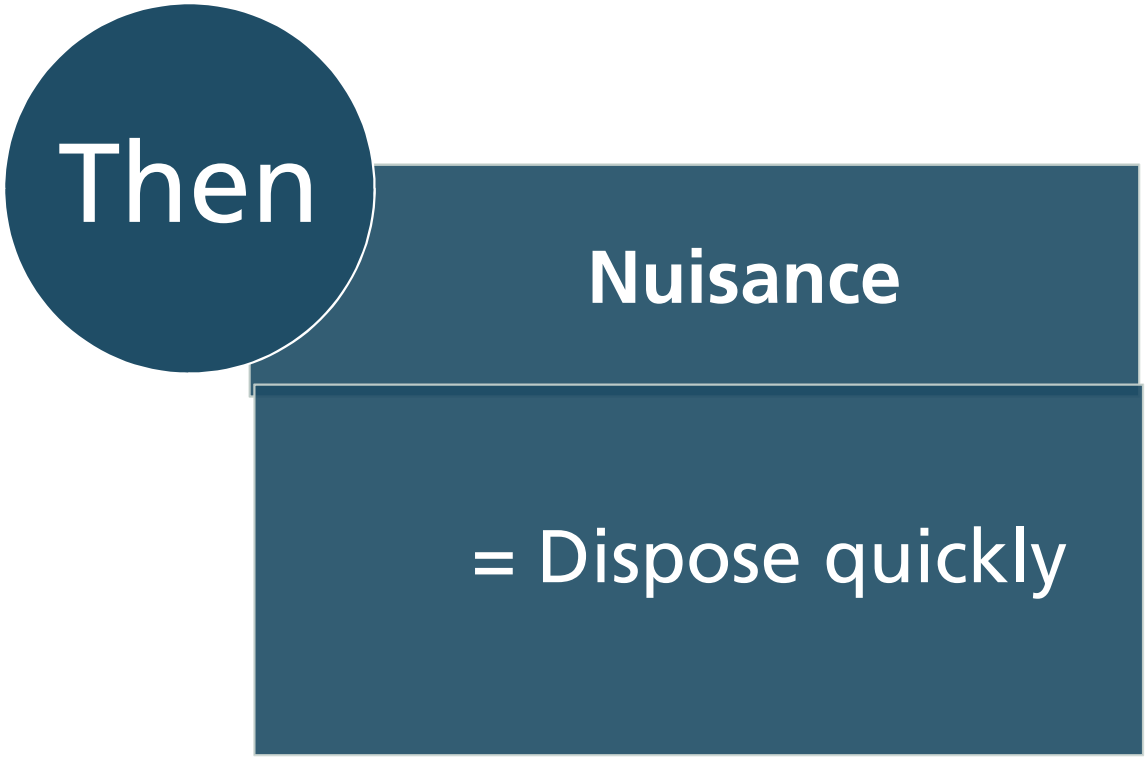
- Increased elevation
- Stream path unstable
- Leads to increased velocities and triggers further channel erosion both upstream and downstream

Stormwater: Then



Stormwater: Now

Valuable Resource
(if managed wisely)

= Supply underground aquifers (drinking water)

= Provide additional source of non-potable water

= Prevent/minimize damage to public and private resources

END OF MODULE 1

QUESTIONS?

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