Post-Flood Emergency Stream Intervention Training

Water Quality Improvement Projects – Round IX
Training Pilot Grant

by

Delaware County Soil & Water Conservation District
Stream Corridor Management Program

- This presentation is located on the Delaware County Soil and Water Conservation District's website:

www.dcswcd.org

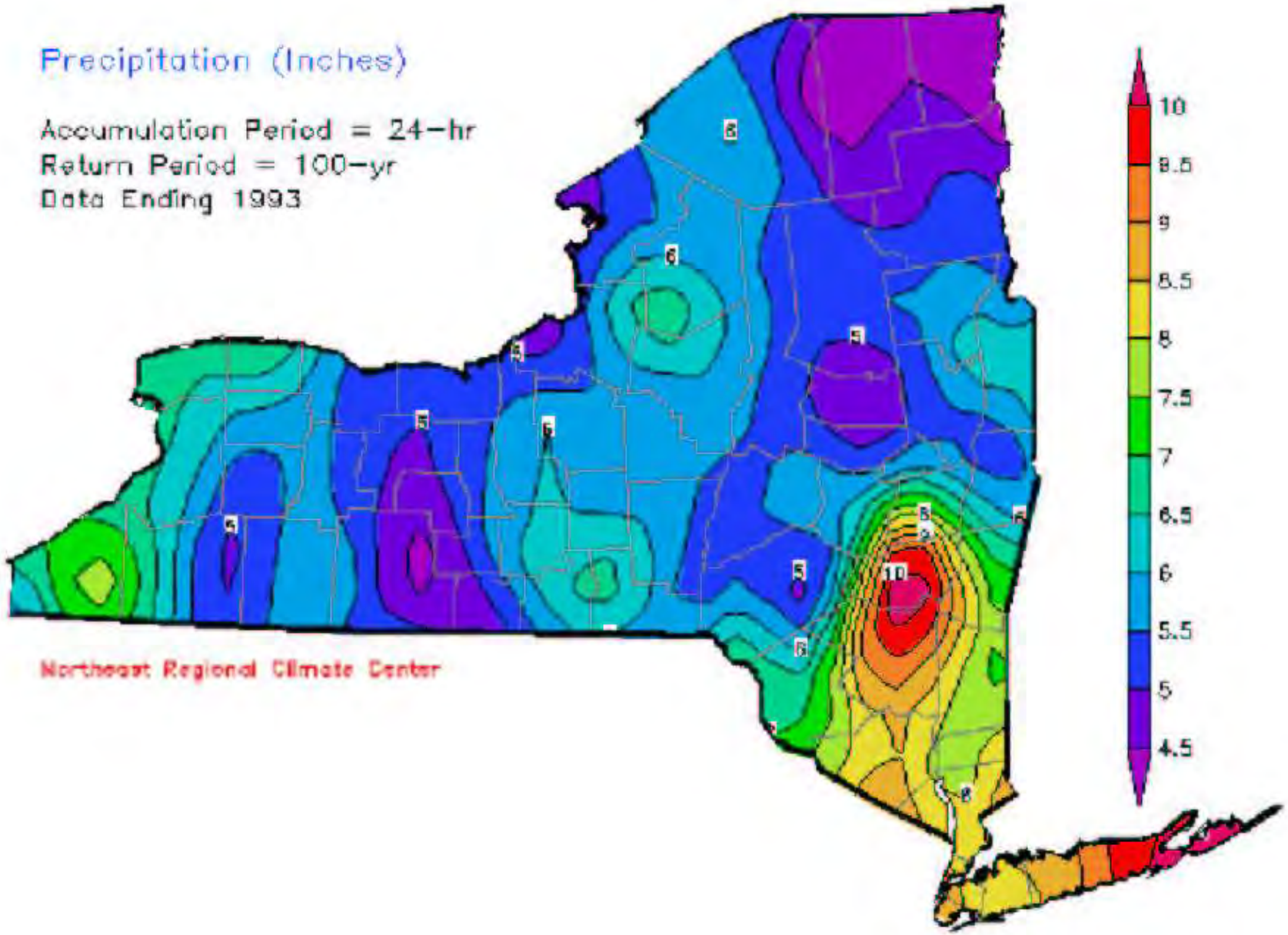
or

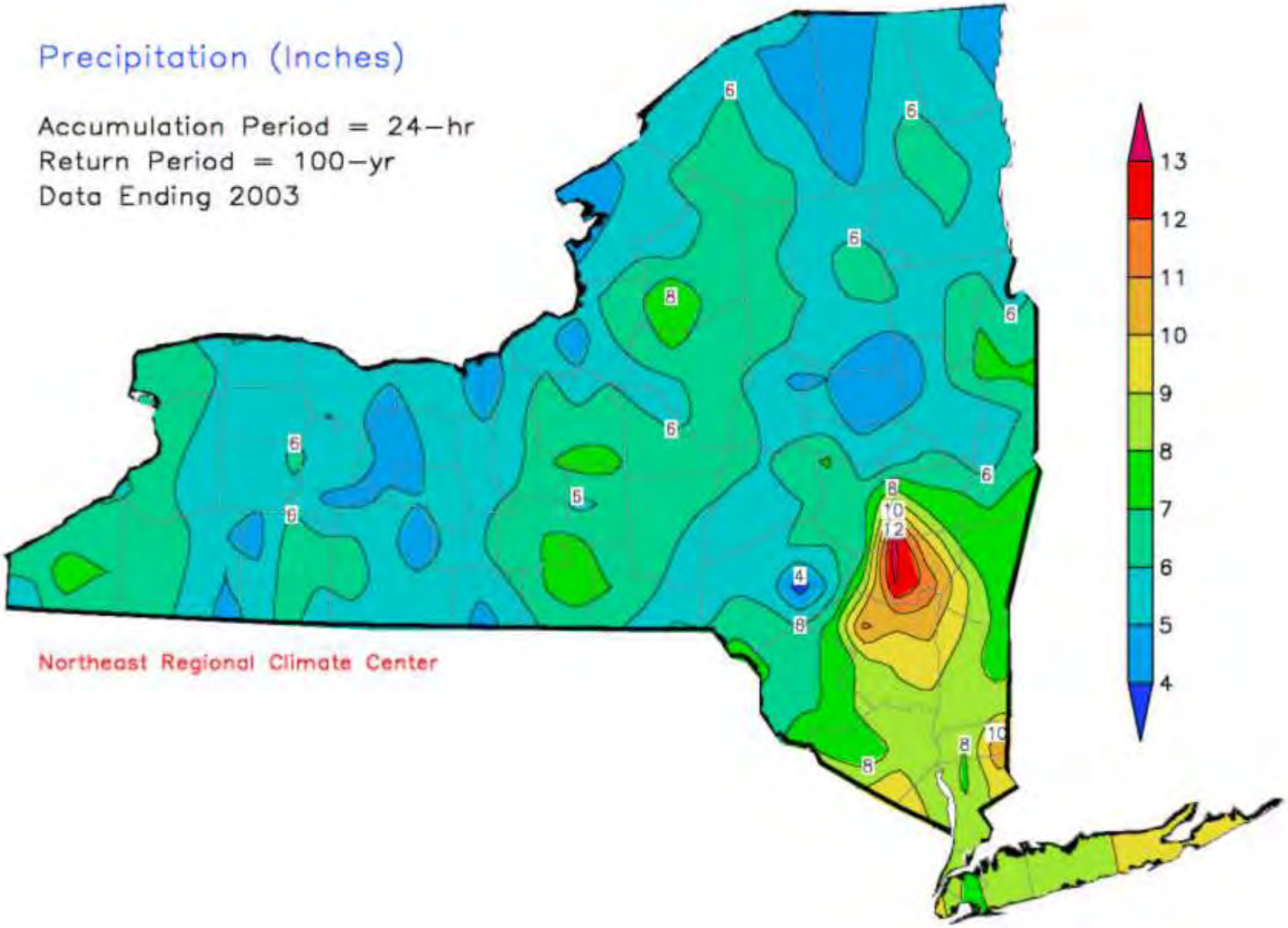
http://dcswcd.org/Stream%20Program/Training%20Manual%202012/Presentation%20AA_Print%20Contact%20Sheet.pdf

Overview

- Precipitation
- Stream Mechanics
- Stream Types
- Floodplains
- Stream Instability
- Unstable Channels
- Avulsion
- Flood Response
- Channel Sizing
- Classroom Examples
- Work Methods
- Bioengineering Techniques
- Natural Channel Design Structures
- De-watering
- Questions

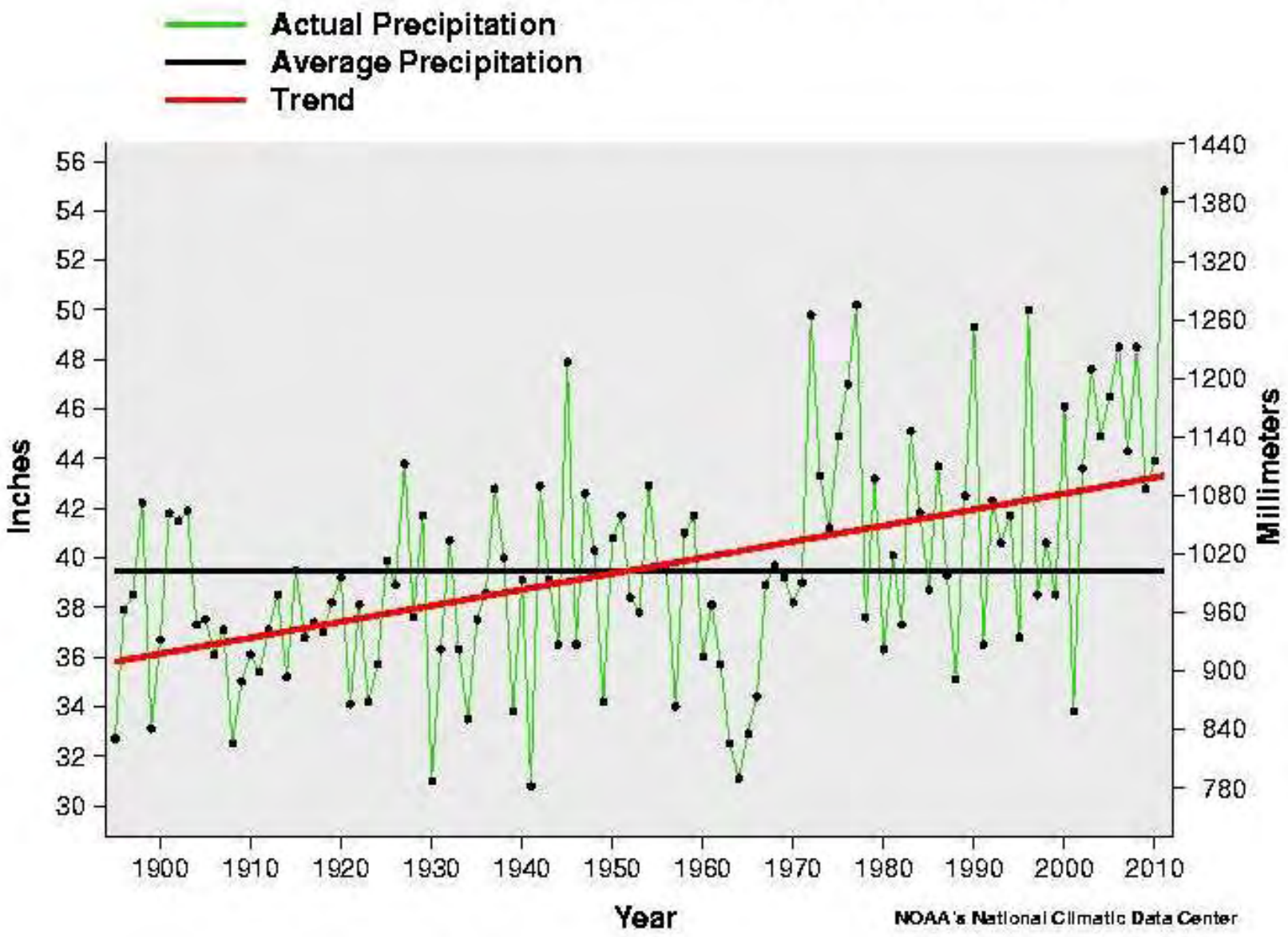
Precipitation


Precipitation (Inches)
Accumulation Period = 24-hr
Return Period = 100-yr
Data Ending 1993
Northeast Regional Climate Center
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5


Precipitation (Inches)
Accumulation Period = 24-hr
Return Period = 100-yr
Data Ending 2003
Northeast Regional Climate Center
13
12
11
10
9
8
7
6
5
4

Catskill Climate (Precipitation)

- High rainfall compared to rest of state
- Climate change causes increasing precipitation levels and variability (more extremes)
  - Streams are adjusting to increase flows
- Difficult to predict local severity of forecasted rain event


Annual 1895 - 2011 Average = 39.54 Inches
Annual 1895 - 2011 Trend = 0.65 Inches / Decade
Actual Precipitation
Average Precipitation
Trend
Inches
Millimeters
Year
NOAA's National Climatic Data Center

Tropical Storm Irene

August 28, 2011

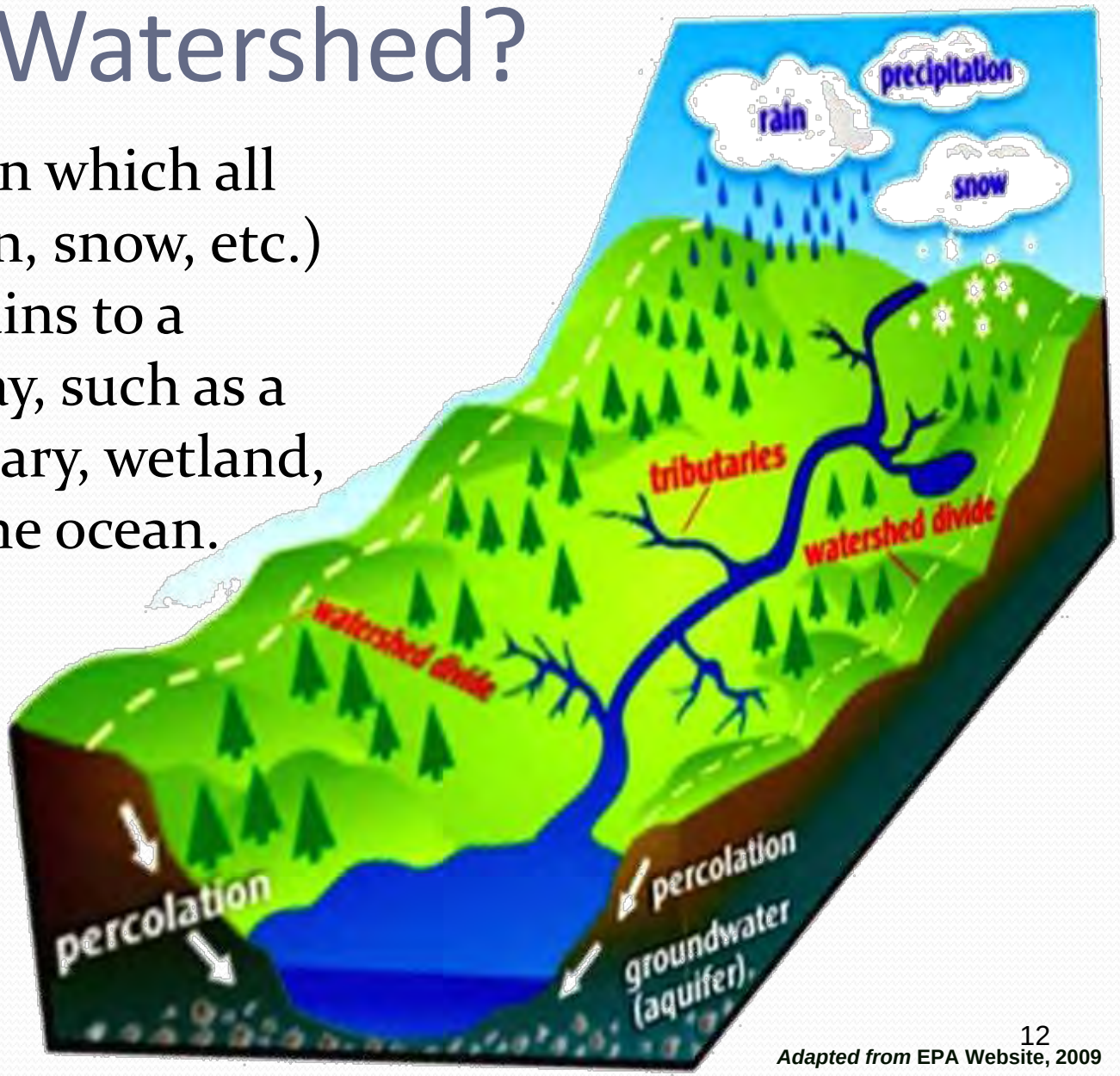
Tropical Storm Sandy

October 29, 2012

Stream Mechanics

What is a Watershed?

The area of land in which all precipitation (rain, snow, etc.) that falls on it drains to a common waterway, such as a stream, lake, estuary, wetland, aquifer, or even the ocean.

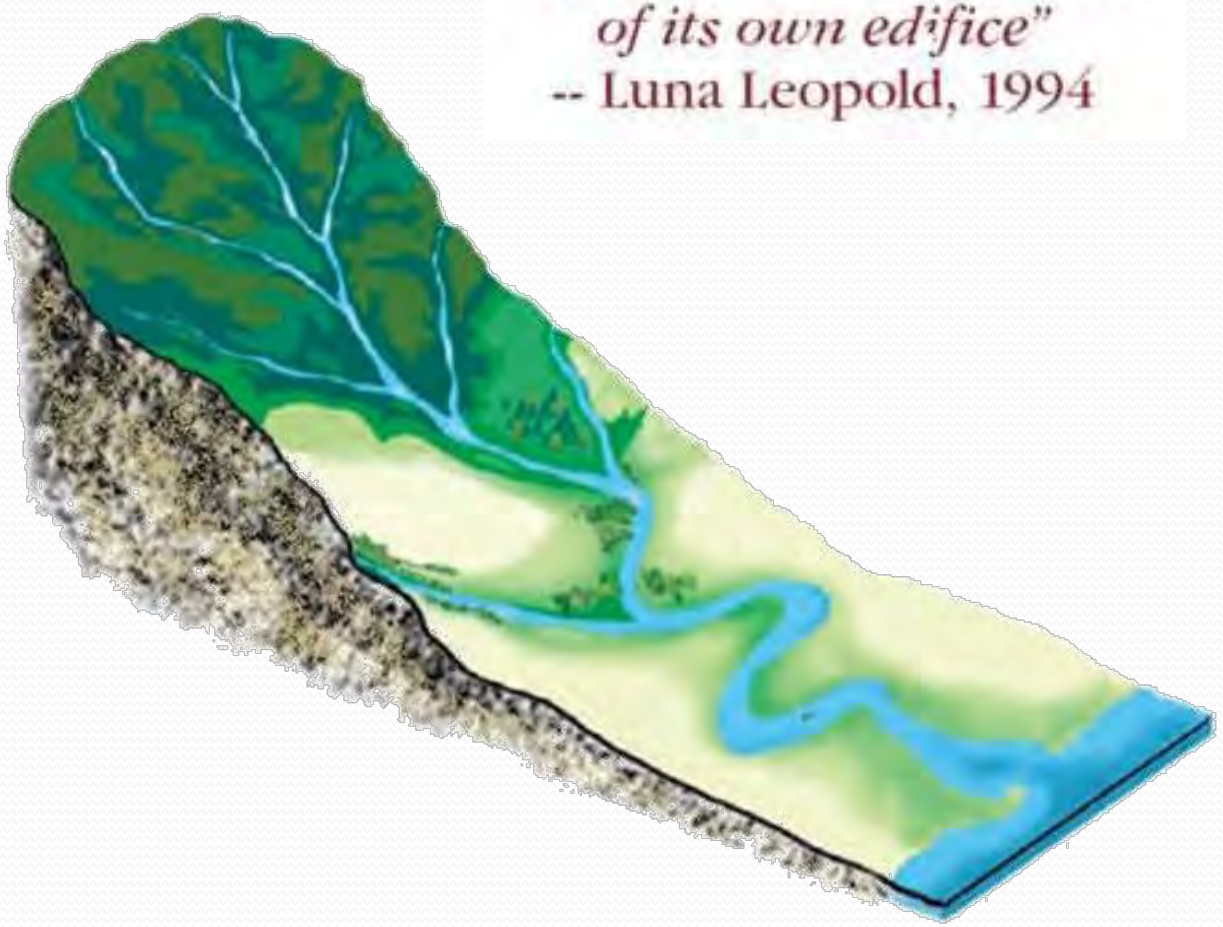


Adapted from EPA Website, 2009

Why Do Streams Look the Way They Do?

- Geology
  - Slope
  - Soils
- Amount of water
  - Timing
  - Duration
  - Magnitude
- Landuse
  - Vegetation
  - Infrastructure

"The river is the carpenter of its own edifice"
-- Luna Leopold, 1994

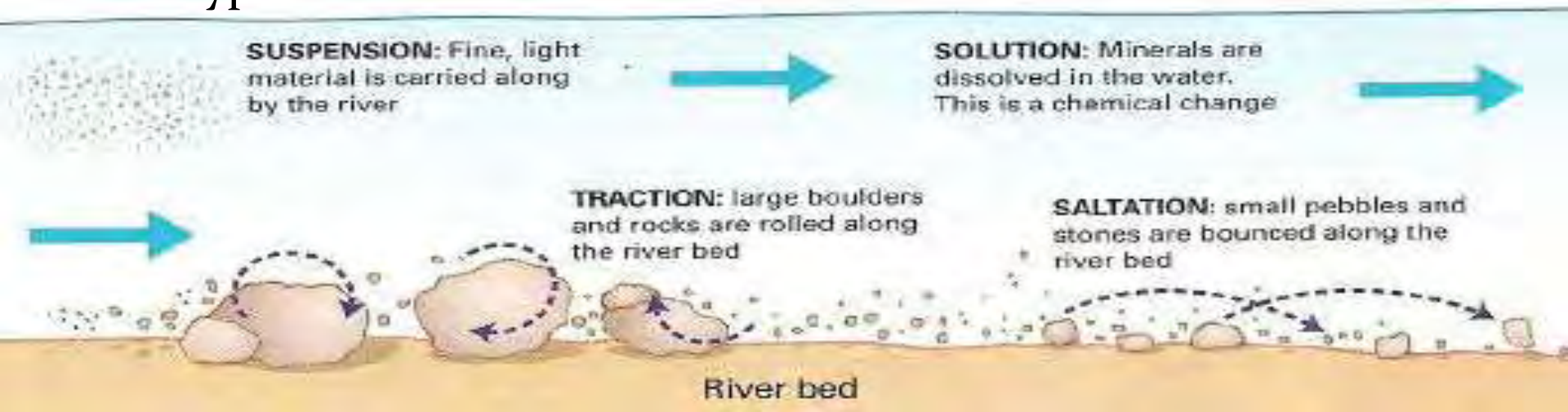


Streams Obey Certain Physical Laws

- Properly size itself to transport water and sediment
- Maintain its dimension, pattern and profile

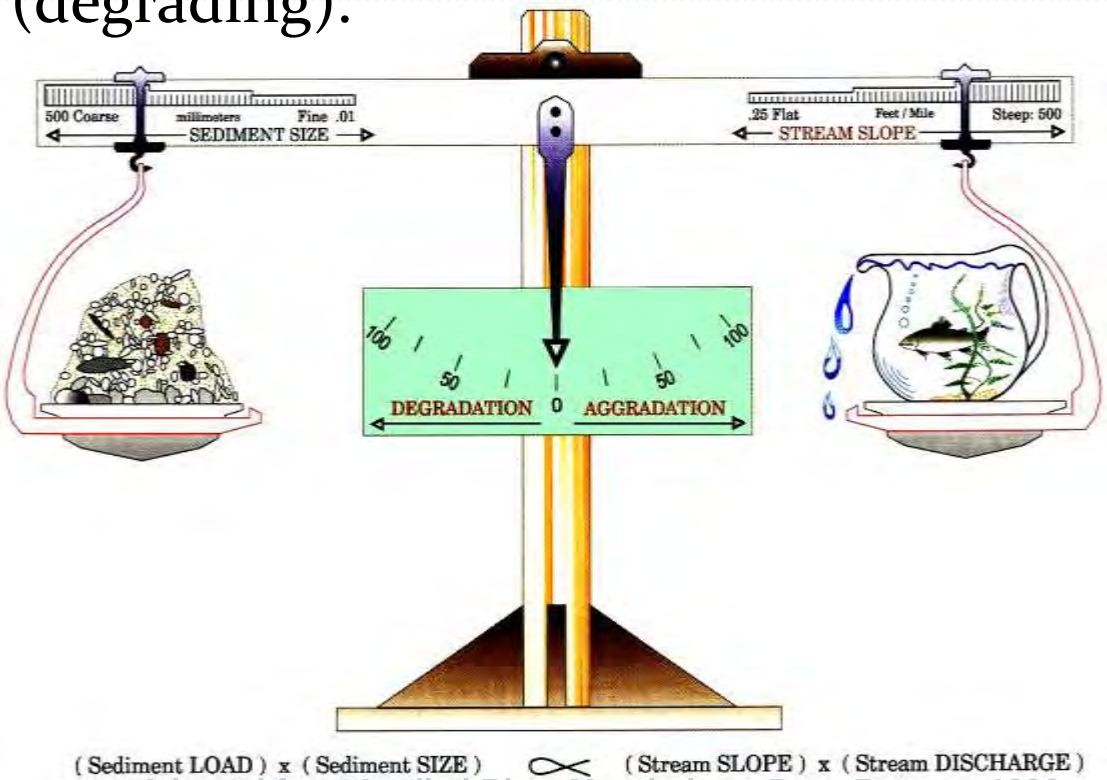
Streams Move More Than Water

- As water moves over the land it picks up sediment, forming the stream channel
- Streams create and maintain their shape and size themselves, a result of:
  - Volume of water
  - Amount of sediment
  - Type of sediment



Sediment Balance

- Streams are said to be in equilibrium when the volume of water is enough to transport the available sediment without building up the channel (aggrading) or cutting down the channel (degrading).



Adapted from Applied River Morphology, Dave Rosgen, 1996

Sediment Balance

- Based on their ability to transport sediment, streams adjust their:
  - Shape
  - Slope
  - Size

Sediment Balance

- Shear Stress
  - Measure of the force that makes the sediment move
    - The deeper the water the greater the stress
    - The steeper the stream the greater the stress

You must take these factors into account

How Does the Sediment Stay in Balance?

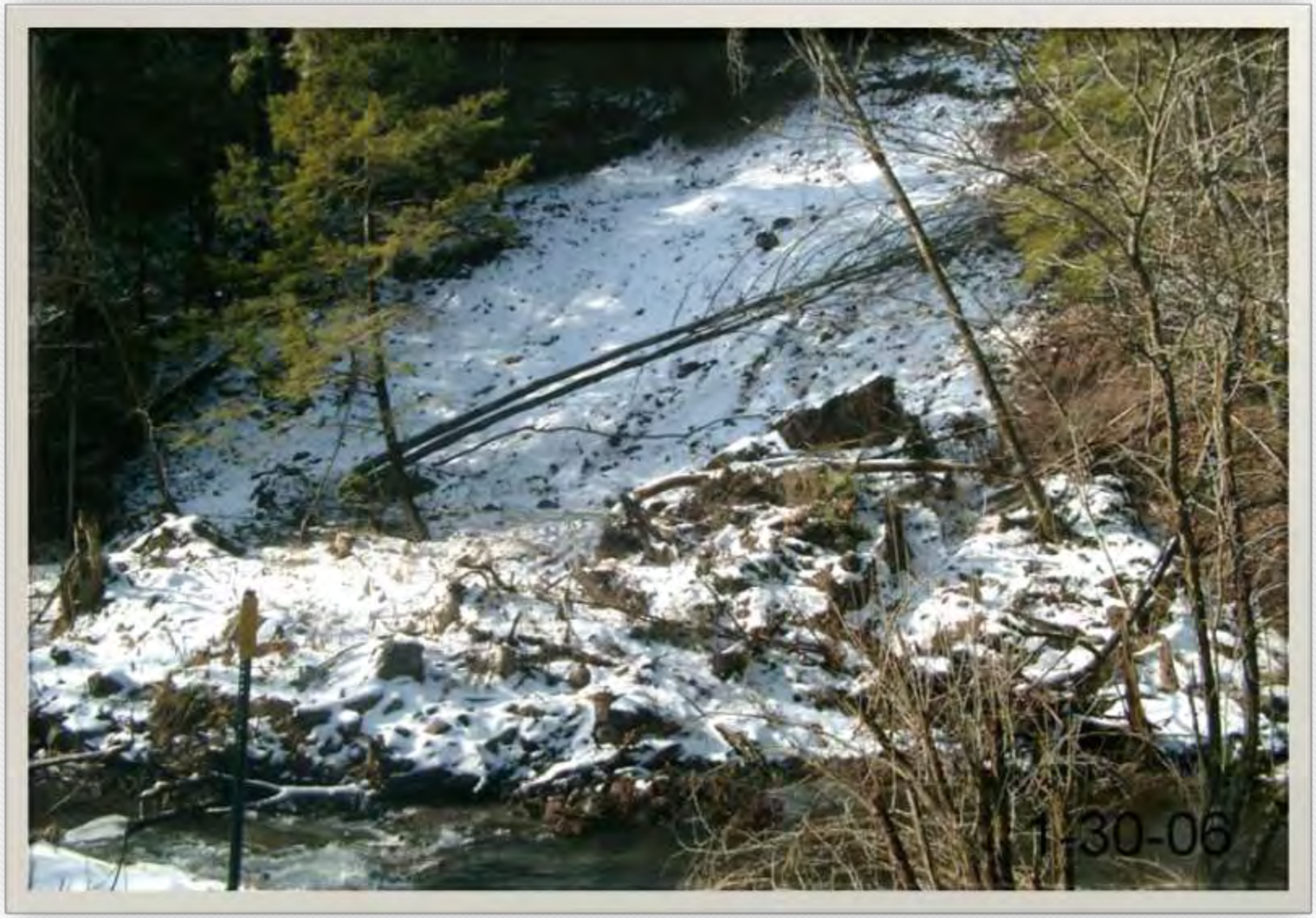
- Erosion:
  - The wearing away of rocks, sediment and soils by the action of water, wind or a glacier.
    - Degradation
- Deposition:
  - The accumulation or laying down of matter by a natural process.
    - Aggradation

Examples of Erosion

- Streambank
- Mass Failures
- Lateral Migration
- Hoof Shear
- Bedrock Weathering

Erosion – Streambank

Erosion – Mass Failures



Erosion – Mass Failures

Erosion – Mass Failures

Erosion – Lateral Migration

Erosion – Hoof Shear

Erosion – Bedrock Weathering

Examples of Deposition

- Center Bar
- Transverse Bar
- Side Bar
- Point Bar
- Mouth of Tributary
- Undersized Hydraulic Structure
- On the Floodplain
- Point Bar

Deposition – Center Bar

Deposition – Transverse Bar

Deposition – Side Bar

Deposition – Mouth of Tributary

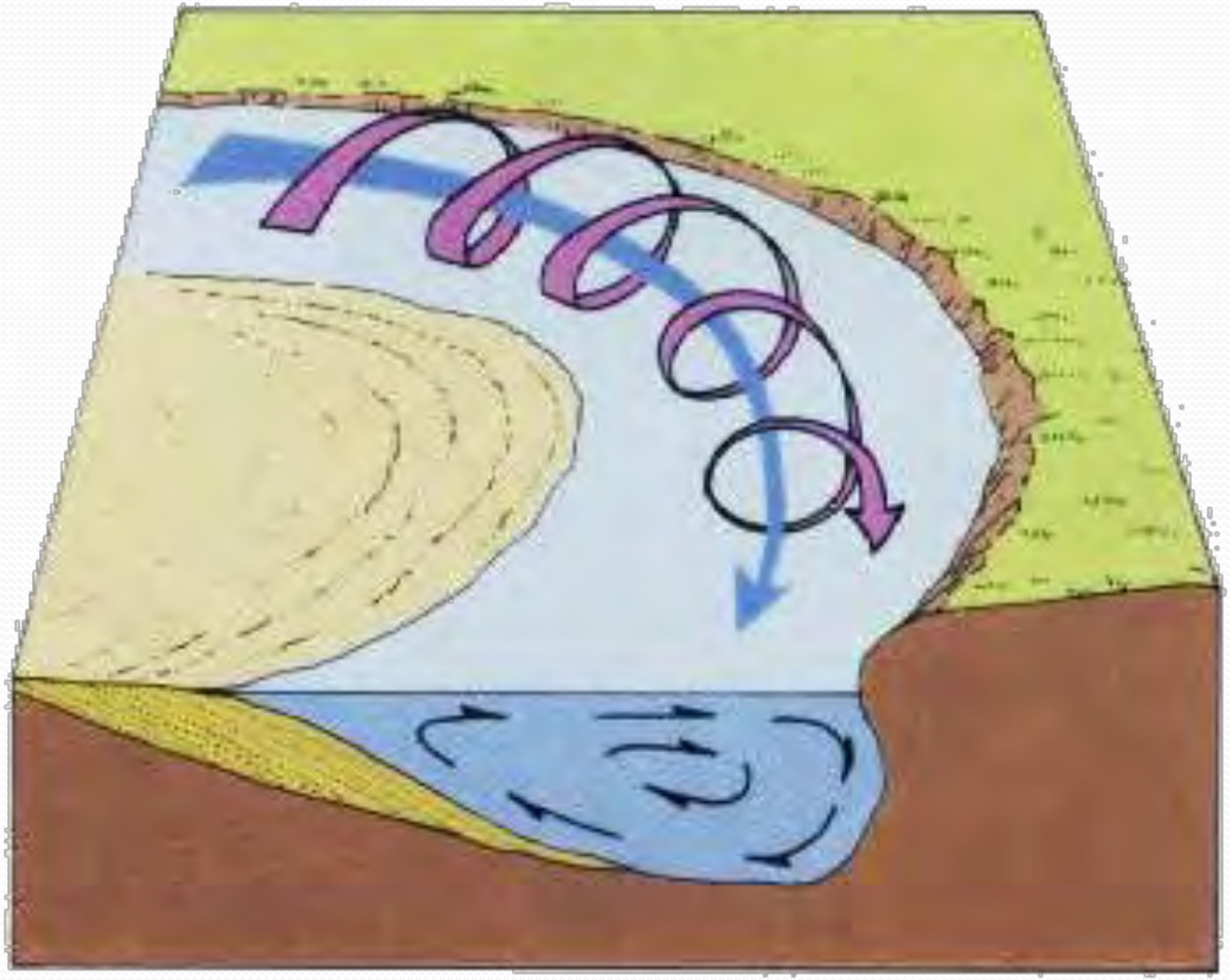
Deposition–Undersized Hydraulic Structure

Deposition–Undersized Hydraulic Structure

Deposition – On Floodplain

Deposition – Point Bar

Point Bar Formation



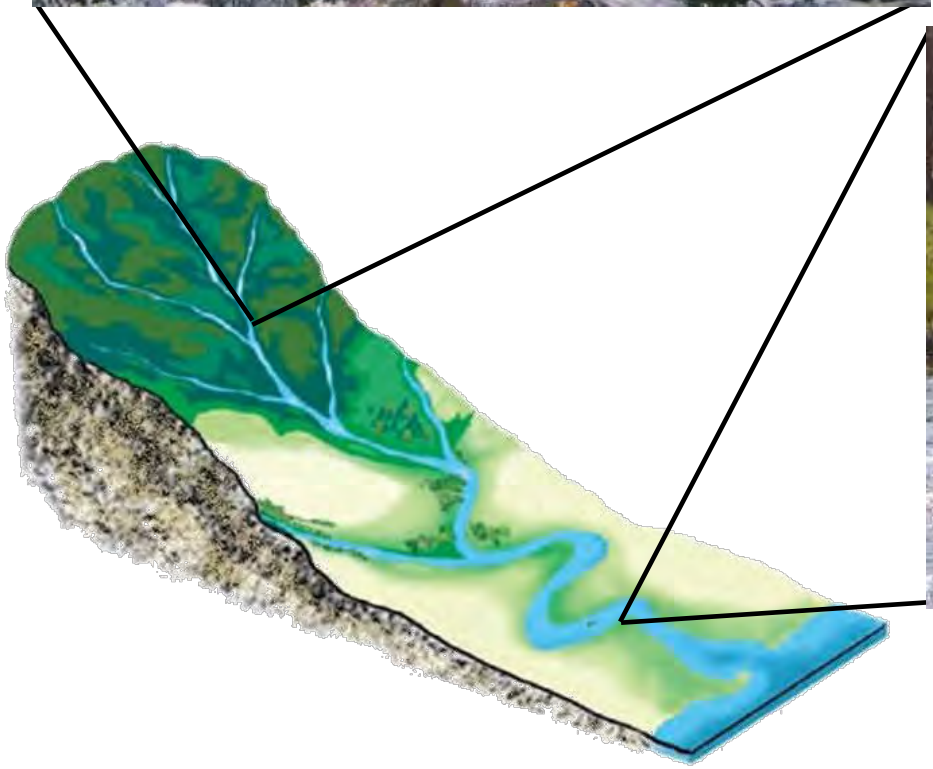
Stream Types

Two Main Stream Types

- **Step - Pool Sequence** - streams are usually found in the headwaters or on steep slopes

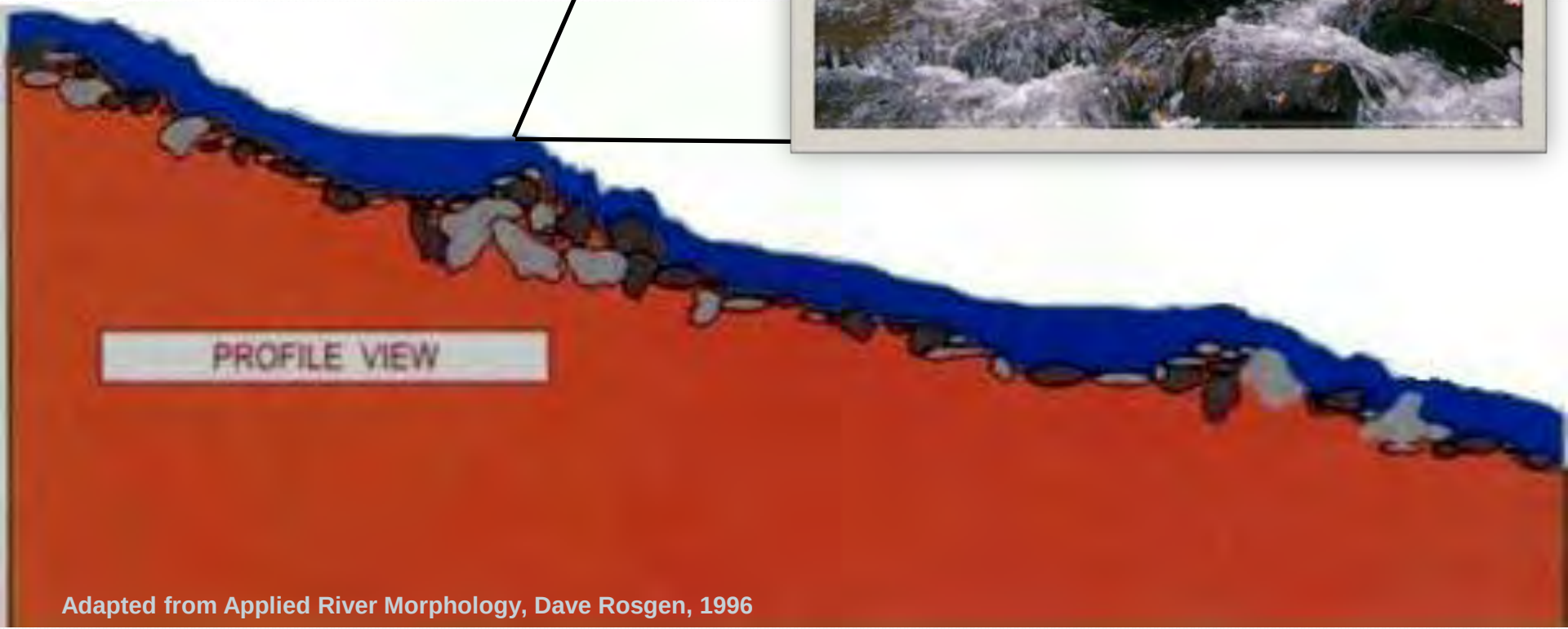
- **Riffle - Pool Sequence** - streams are usually found in the broad valleys and on flat slopes

Step-Pool



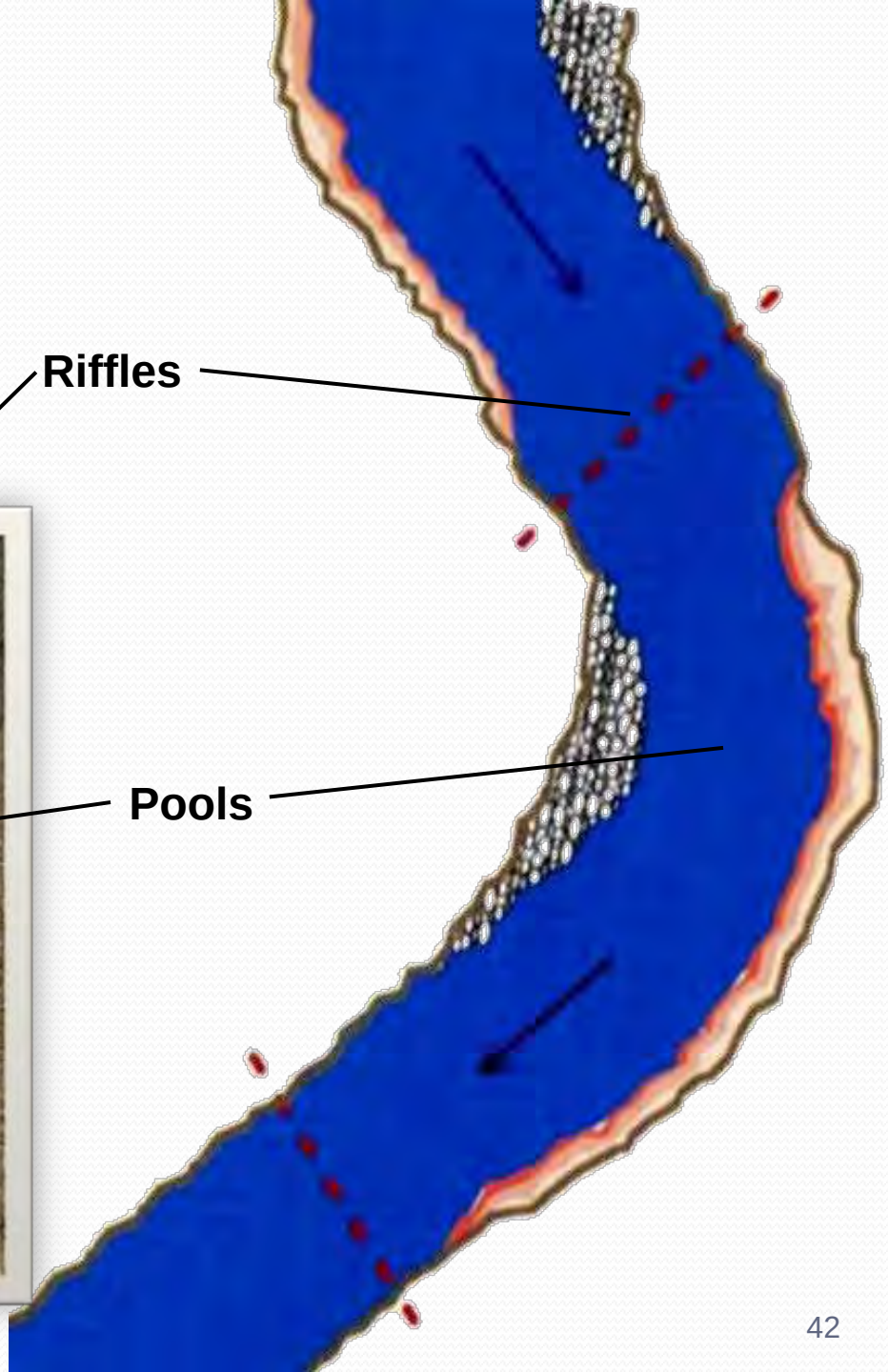
Riffle-Pool

Stream Type: Step - Pool



Adapted from Applied River Morphology, Dave Rosgen, 1996

Stream Type: Riffle - Pool



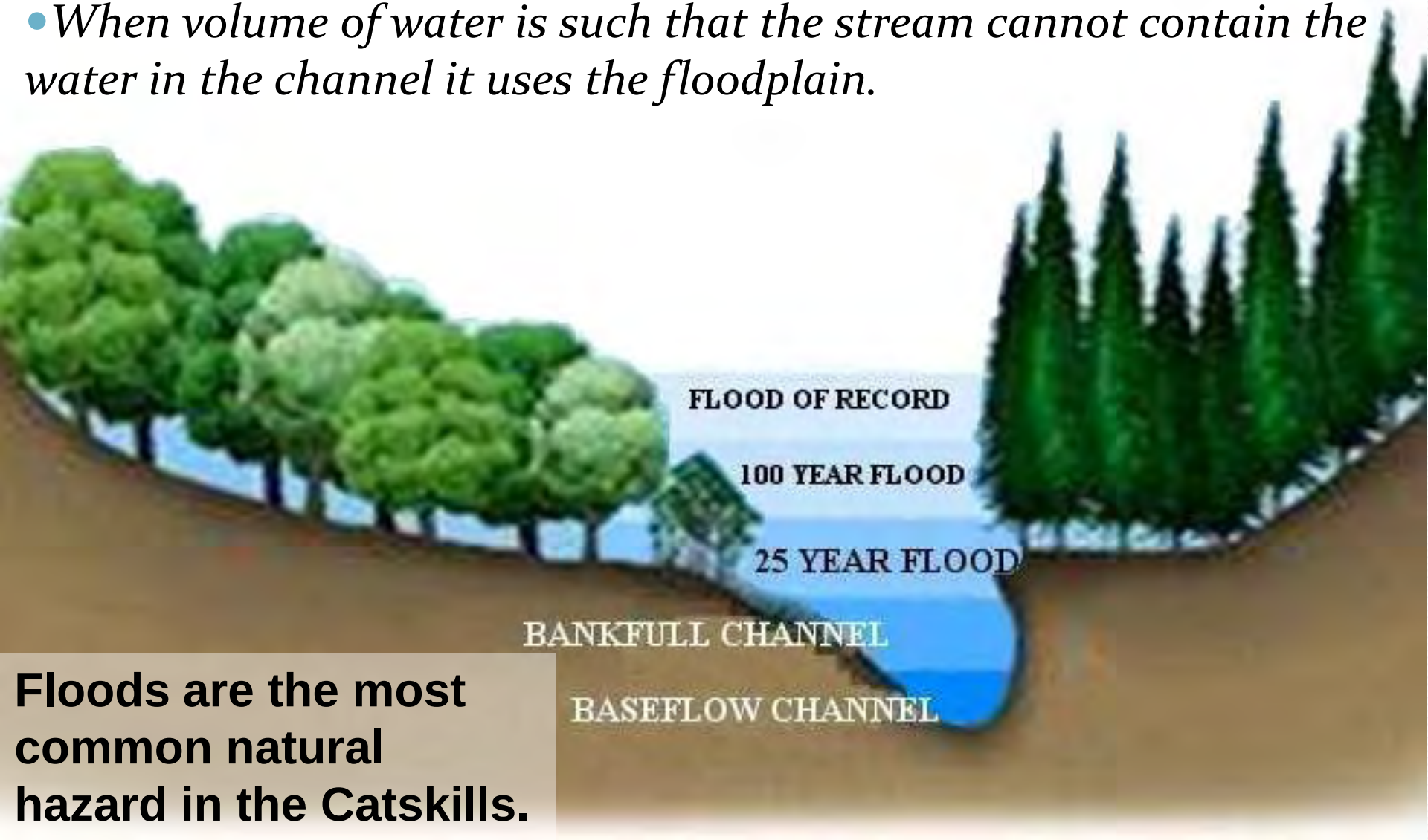
Floodplains

Floodplain Definition

- *The floodplain is the area bordering a stream, constructed by the river and inundated during periods of high flow.*

Flood Stage Definition

- *When volume of water is such that the stream cannot contain the water in the channel it uses the floodplain.*



Floods are the most common natural hazard in the Catskills.

Floodplain Function

- Energy dissipation during flooding events
  - Velocity and energy decreases
- Lowers flood peaks due to storage and infiltration
  - Water released more slowly downstream
- Provide a place for debris and sediment to be deposited
  - Natural process of topsoil formation

Floodplain Function – Continued

- Reduce the flood stage (height of flood water)
- Traps fine sediments
  - Keeps that material out of the bed
  - Provides a growth medium
  - Better vegetation stabilizes the floodplain

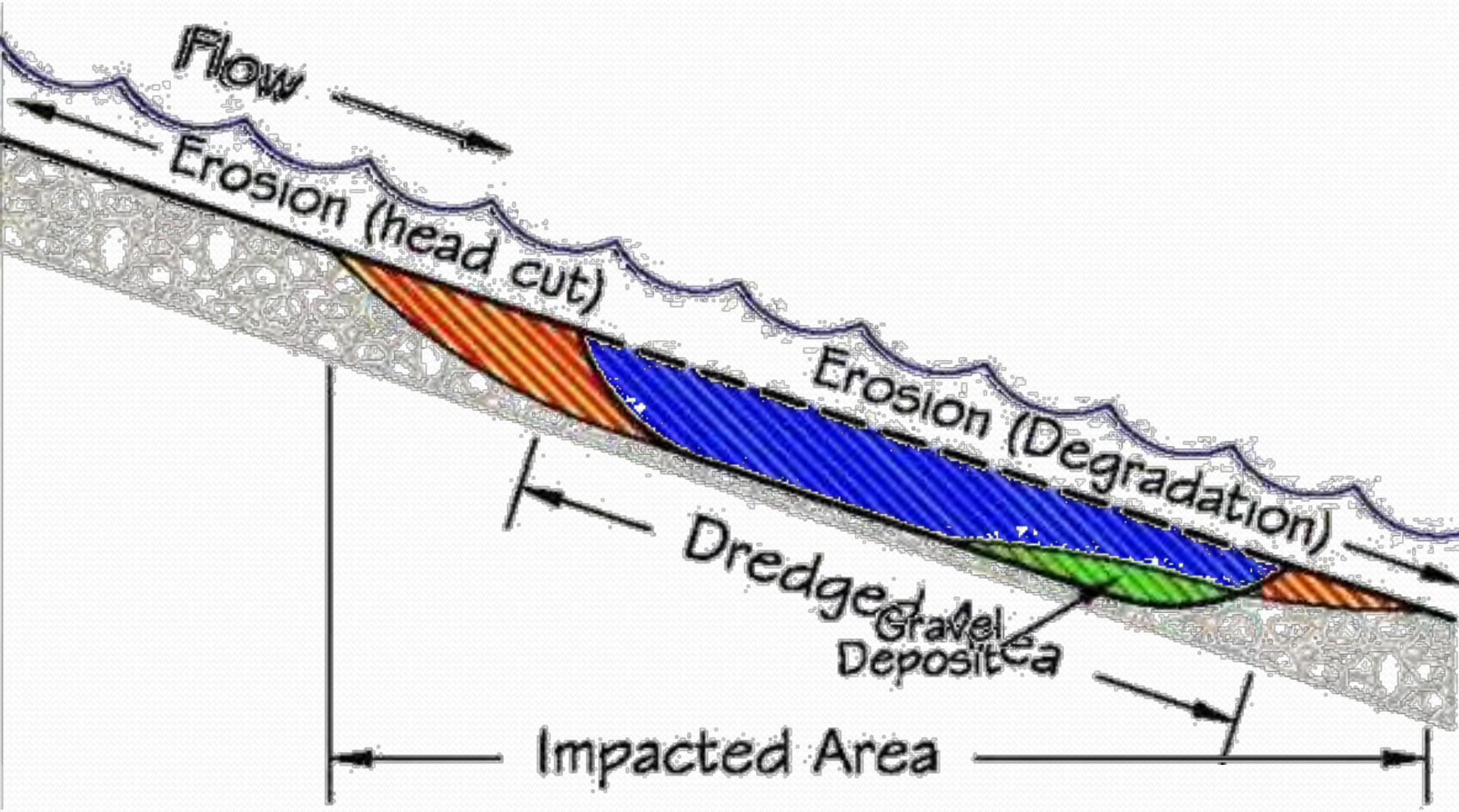
Ouleout Creek near Franklin, NY – 2006

Stream Instability

How Do Streams Become Unstable?

- Dredging
- Channel Straightening
- Berms
- Disconnecting floodplain from the channel
- Development on the Floodplain

Dredging

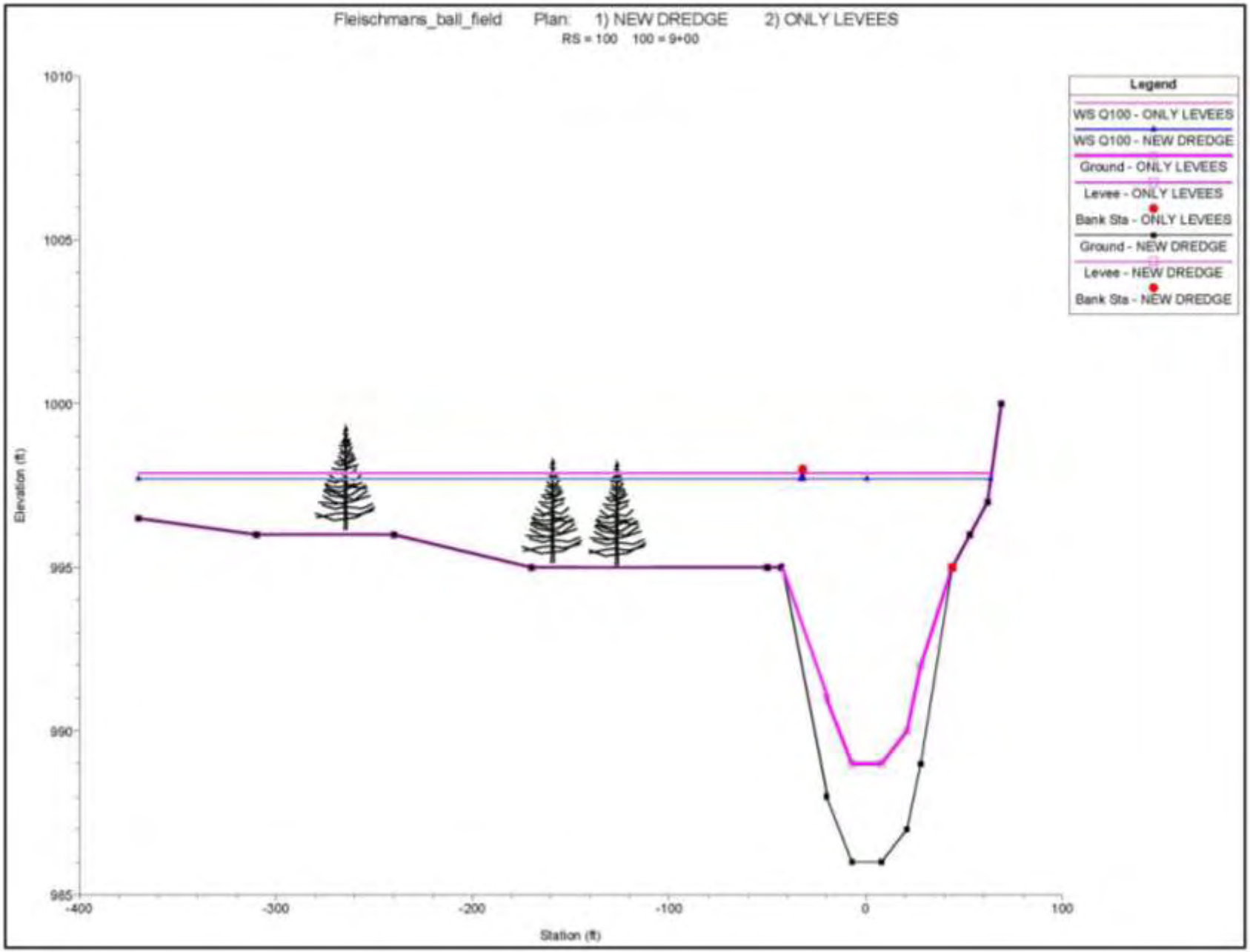


After R. Hey, 2003

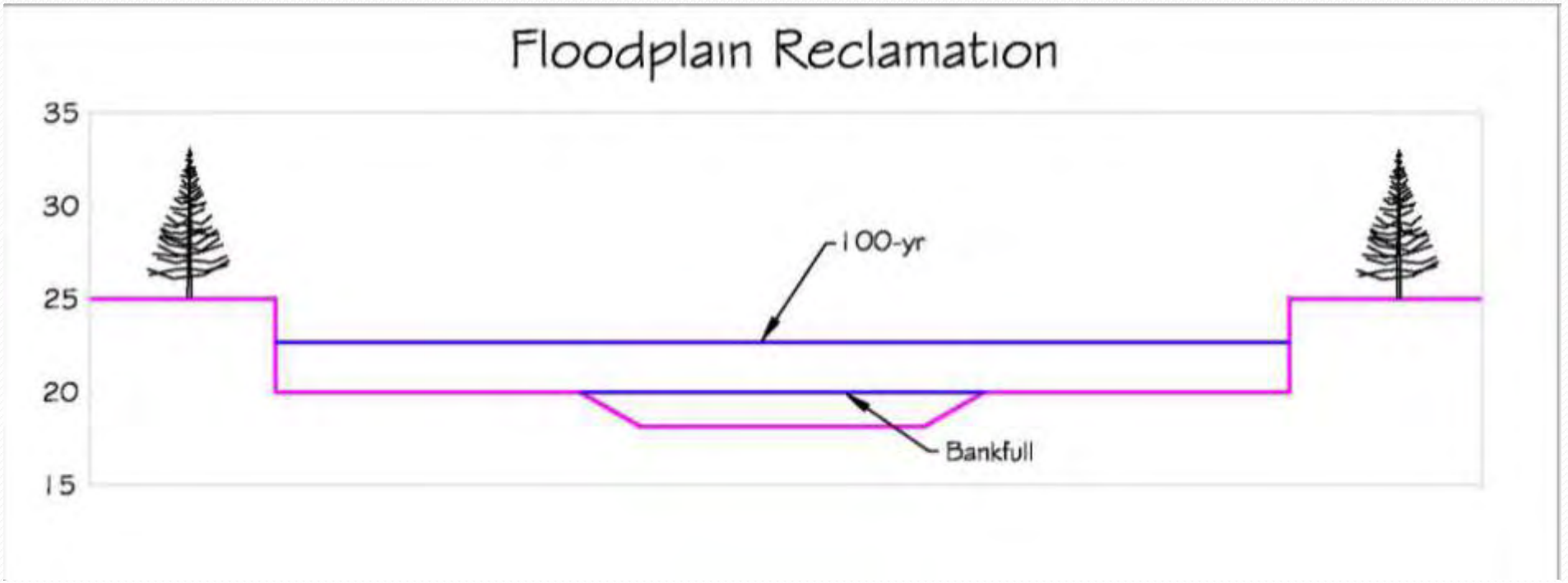

KOMATSU


Steep Riffle
Erosion
Channel is too wide
Gravel Deposition

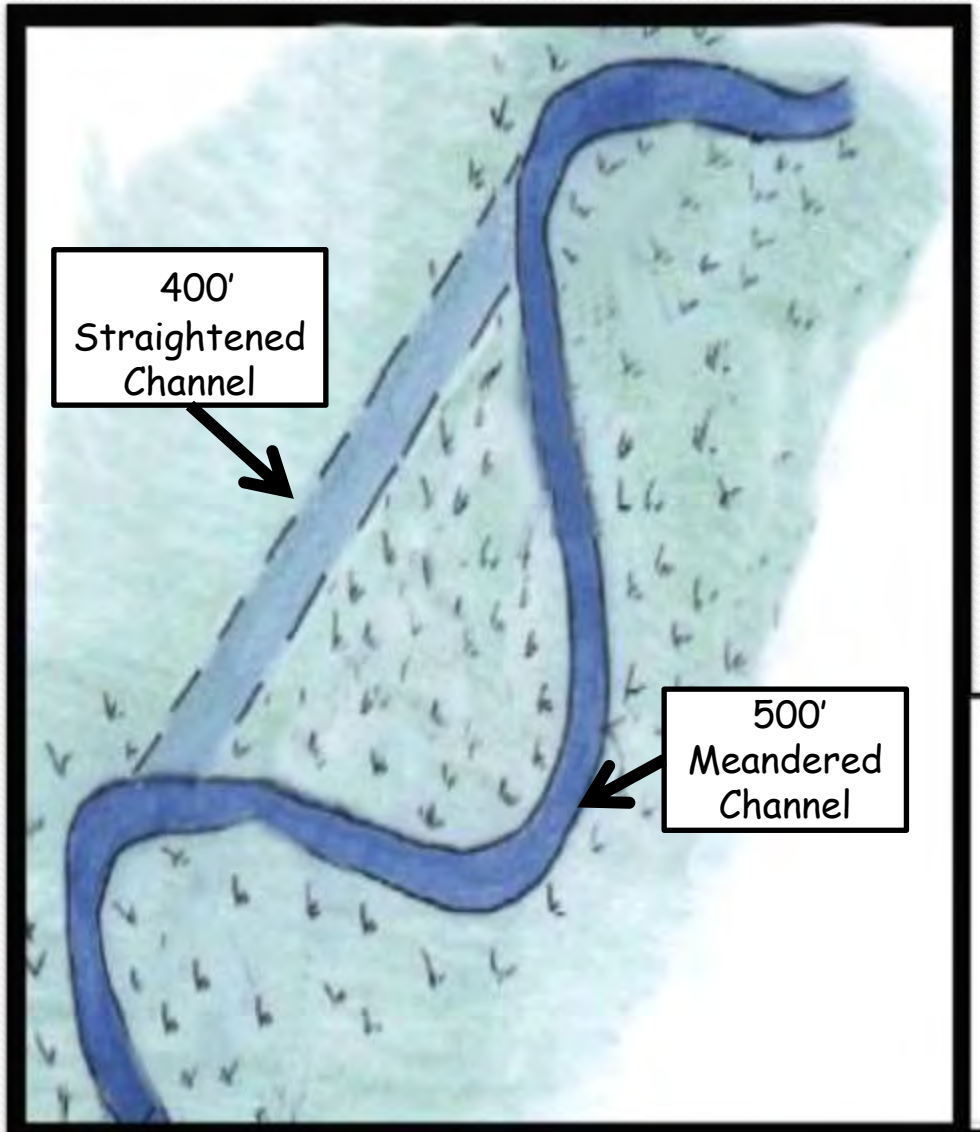
Does Dredging Help Flooding?



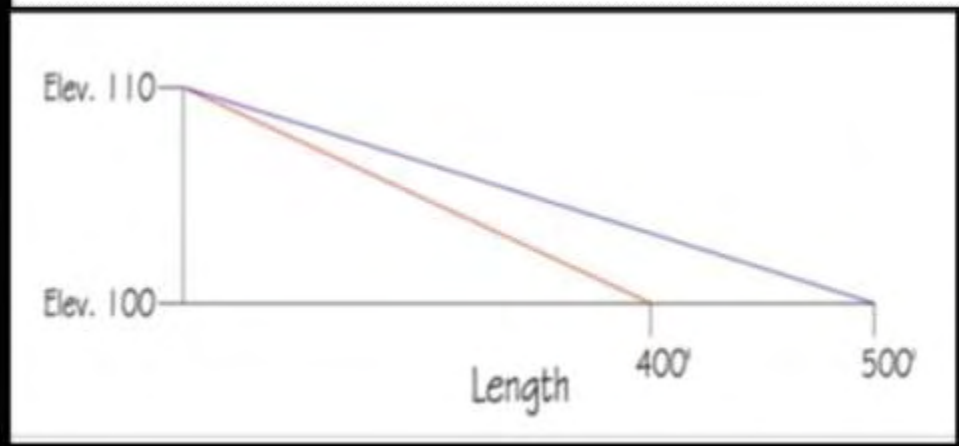
Channel Modifications



Channel Straightening



- Shorter distance means a steeper slope
- A steeper slope increases velocity
- A steeper slope increases erosion on the streambank and bed



Channel Straightening

Channel Straightening

Channel Straightening - Repair