Understanding the Water Resources HCP Take Model

Instream Habitat

Joseph A. Daraio, Ph.D, A.M. ASCE

Center for the Management, Utilization, and Protection of Water Resources
Tennessee Tech University
Cookeville, TN 38505

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Outline

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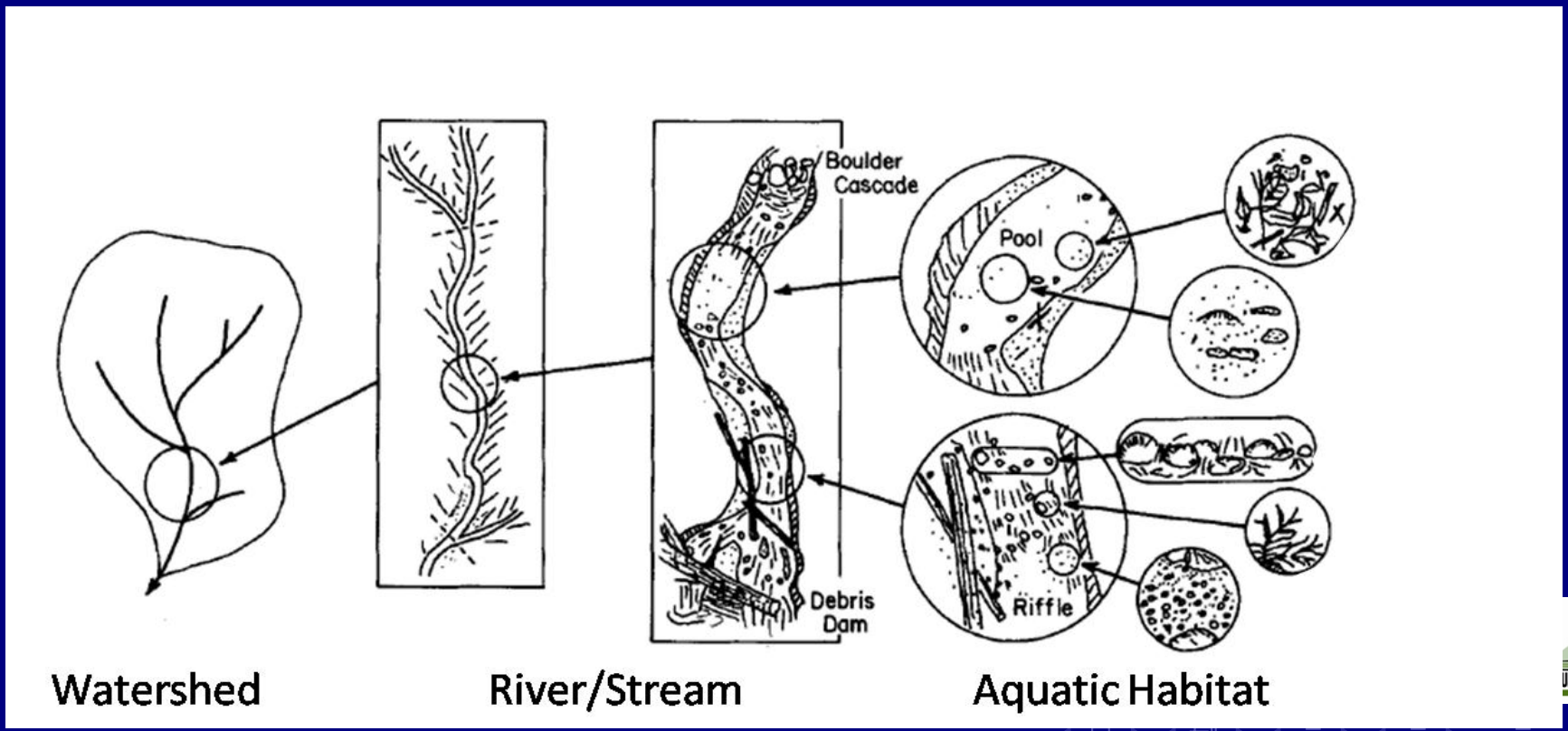
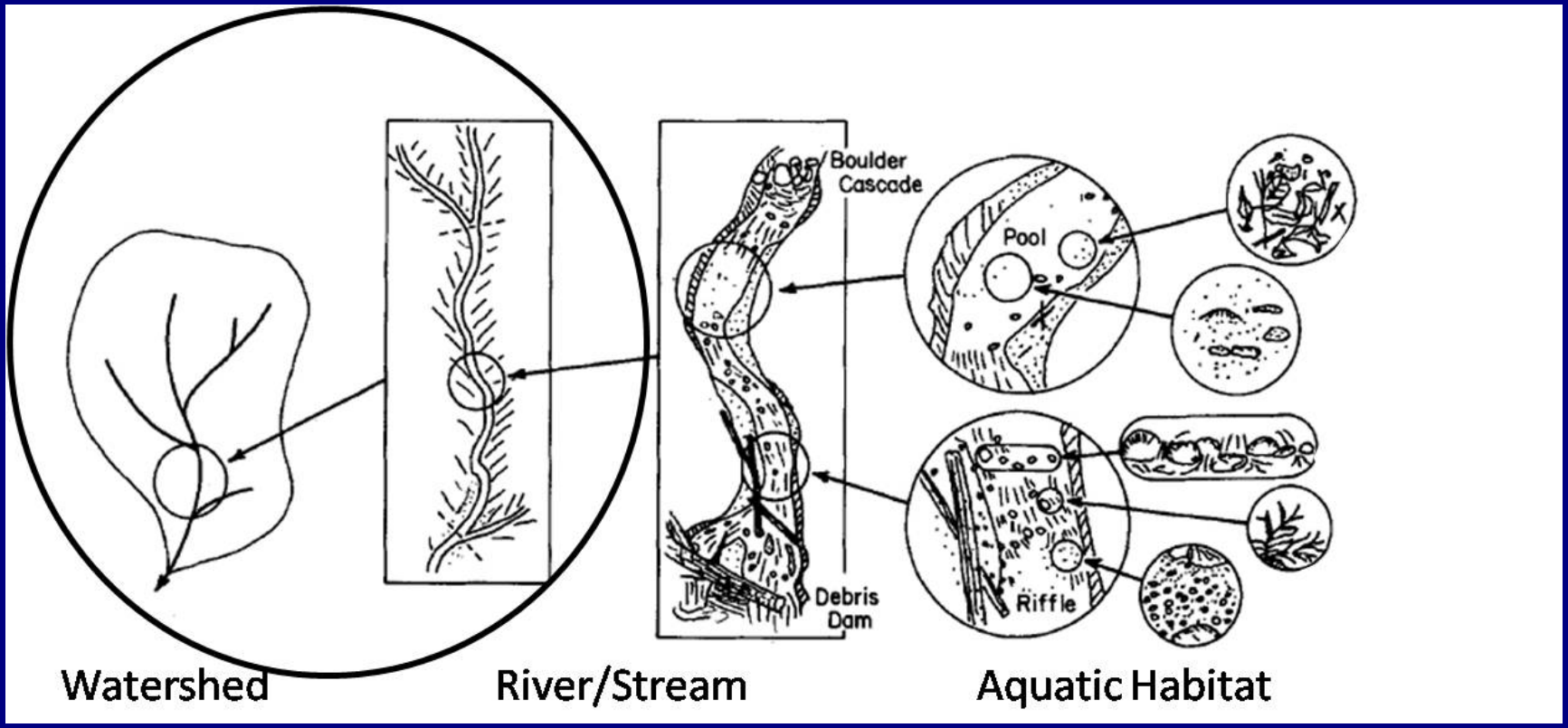
Take Model

- Quantifying take
  - Estimate take from habitat loss and degredation
    - ★ Hydrologic changes affect instream habitat (water quantity and water quality)
    - ★ Covered activities lead to changes in hydrology
    - ★ Covered activities can have direct effects on habitat



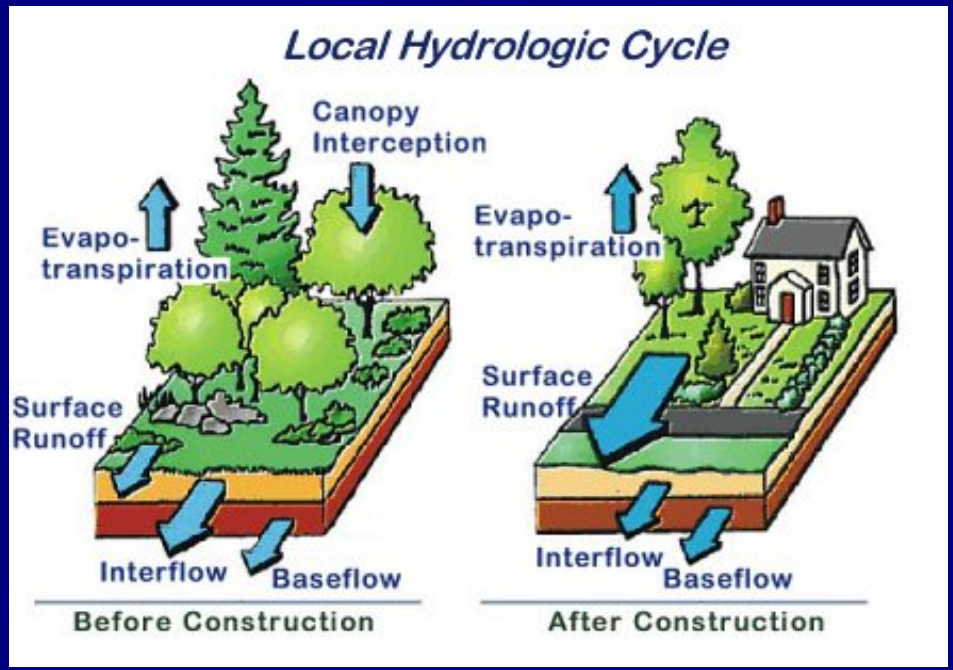
Watershed to River



Hydrologic Processes

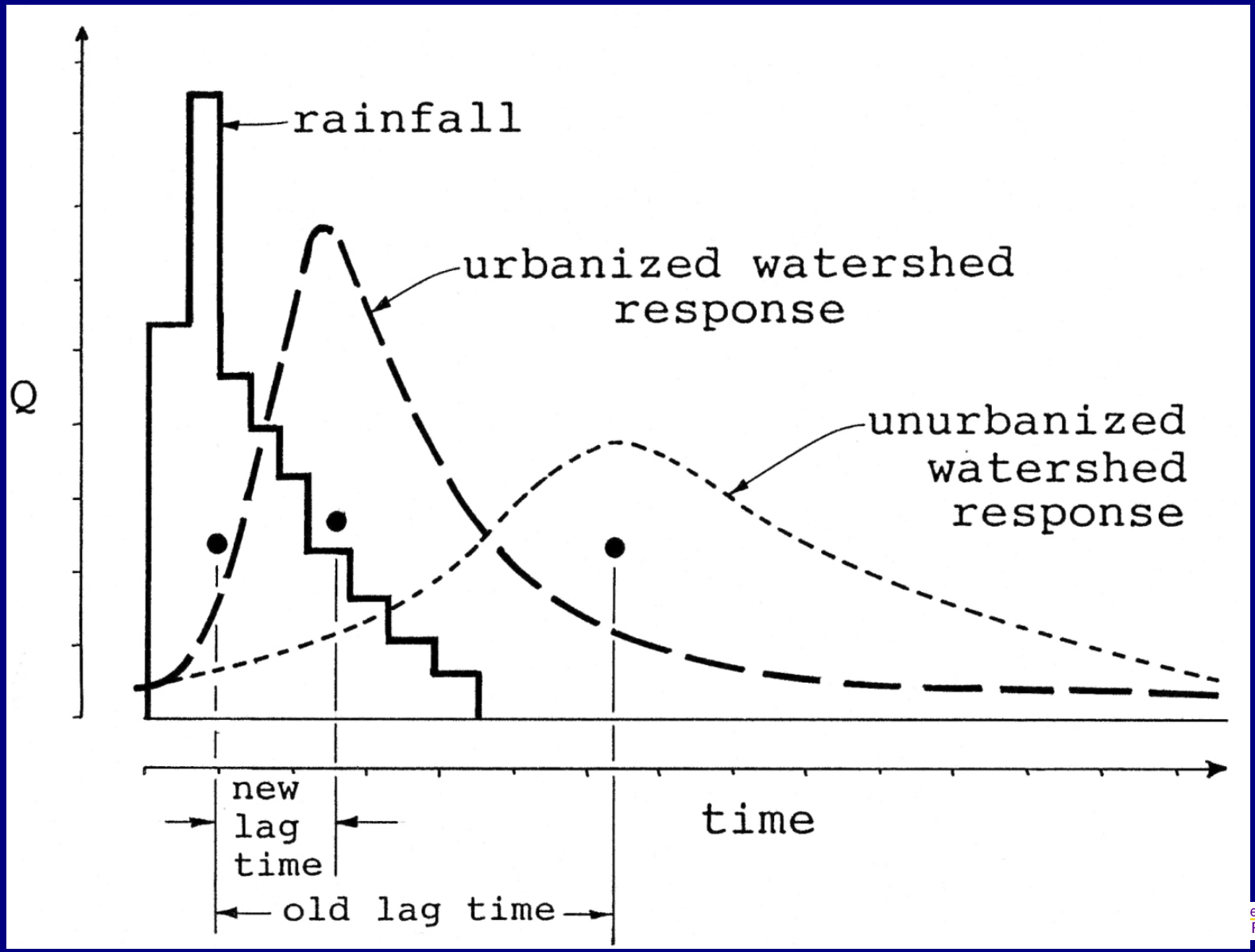
Watershed Response

- Precipitation
- Interception
- Evaporation and Transpiration
- Infiltration
- Groundwater
- Storage
- Runoff
- Streamflow



Hydrograph

Land use change alters the watershed response



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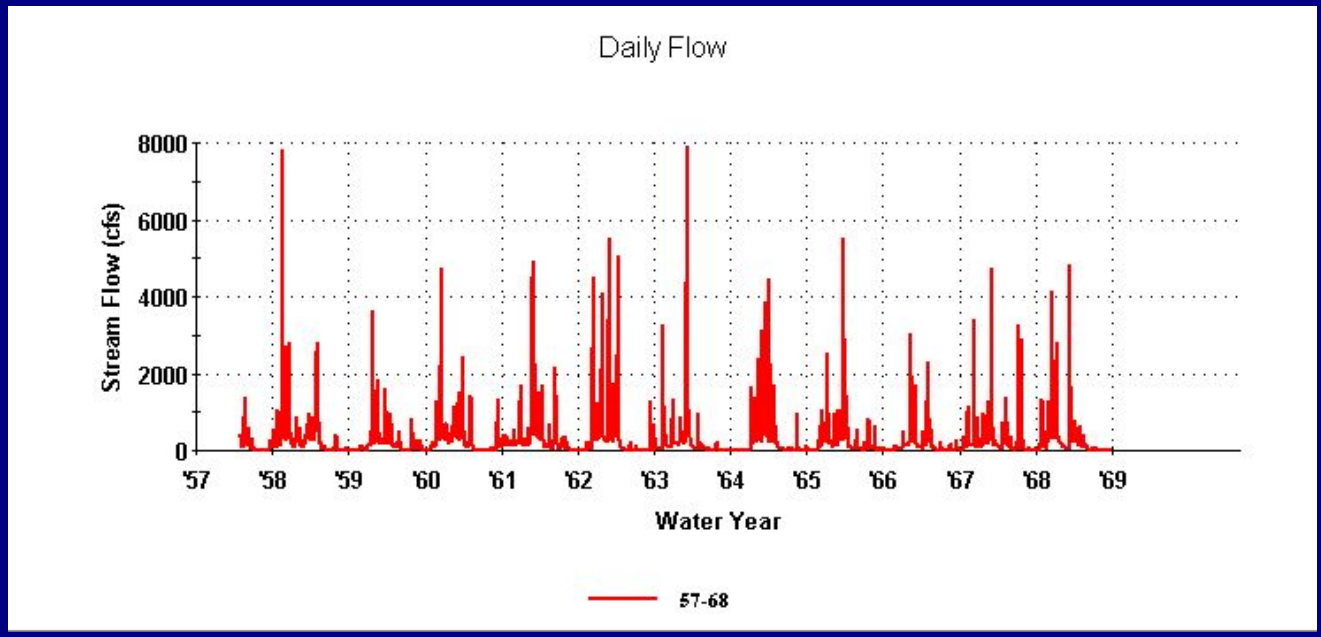
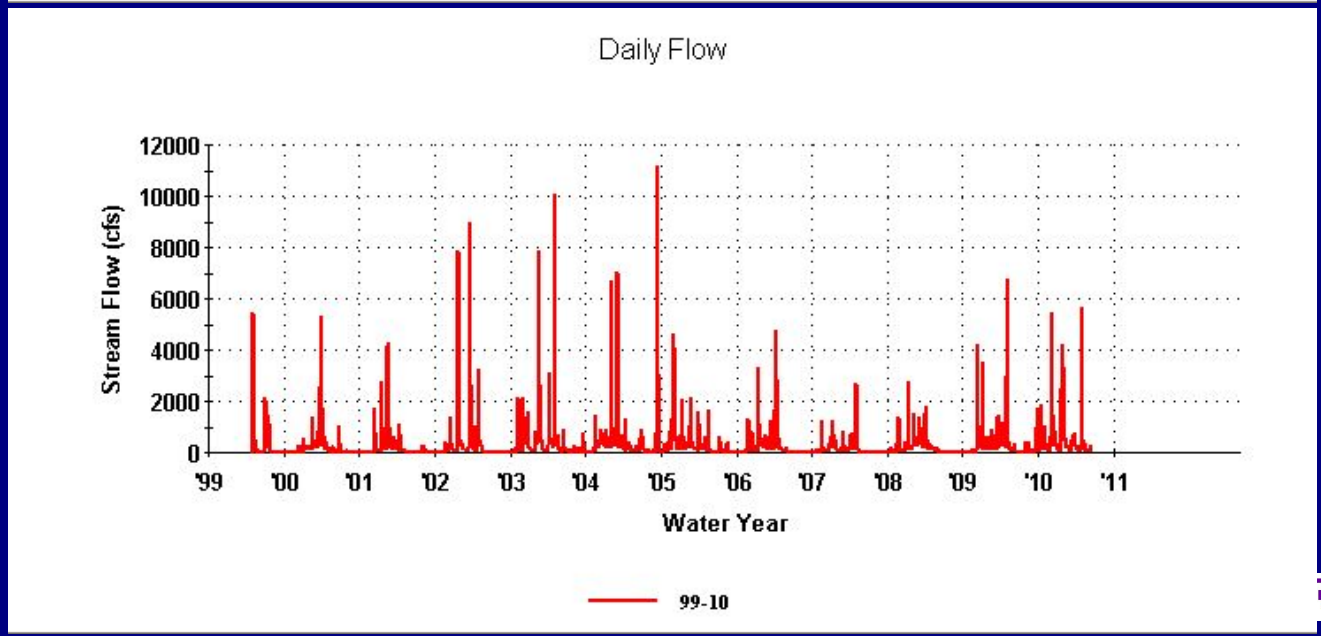
Daddys Creek Flow, USGS Gauge at Hebbertsburg





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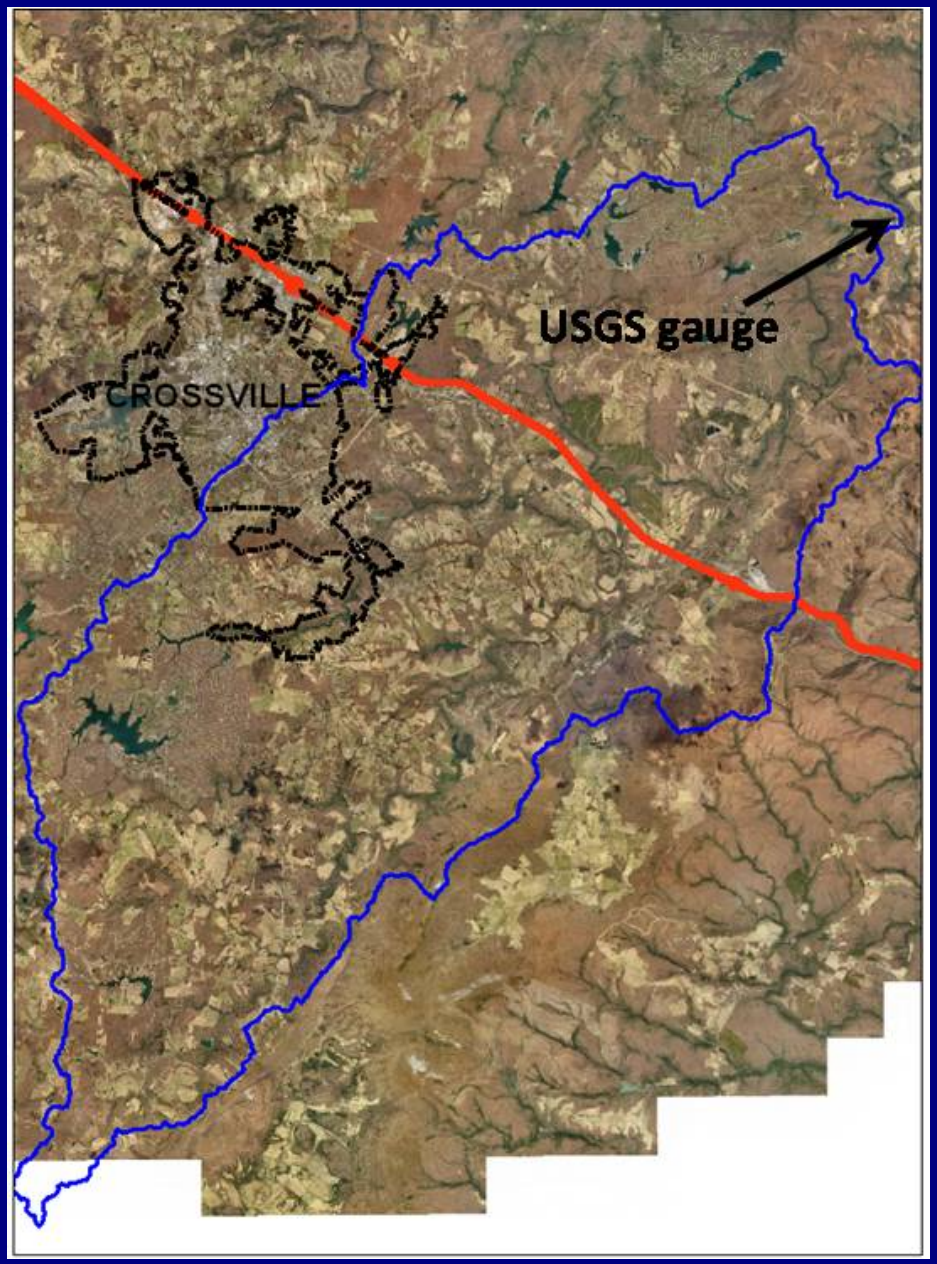

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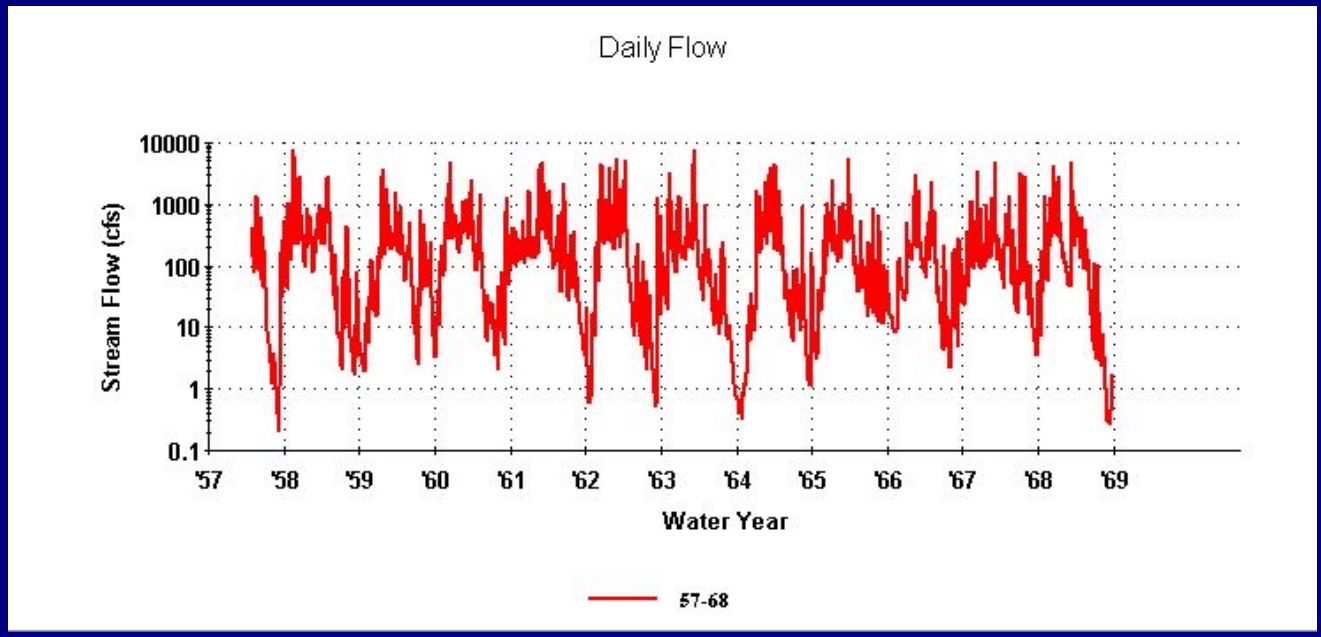

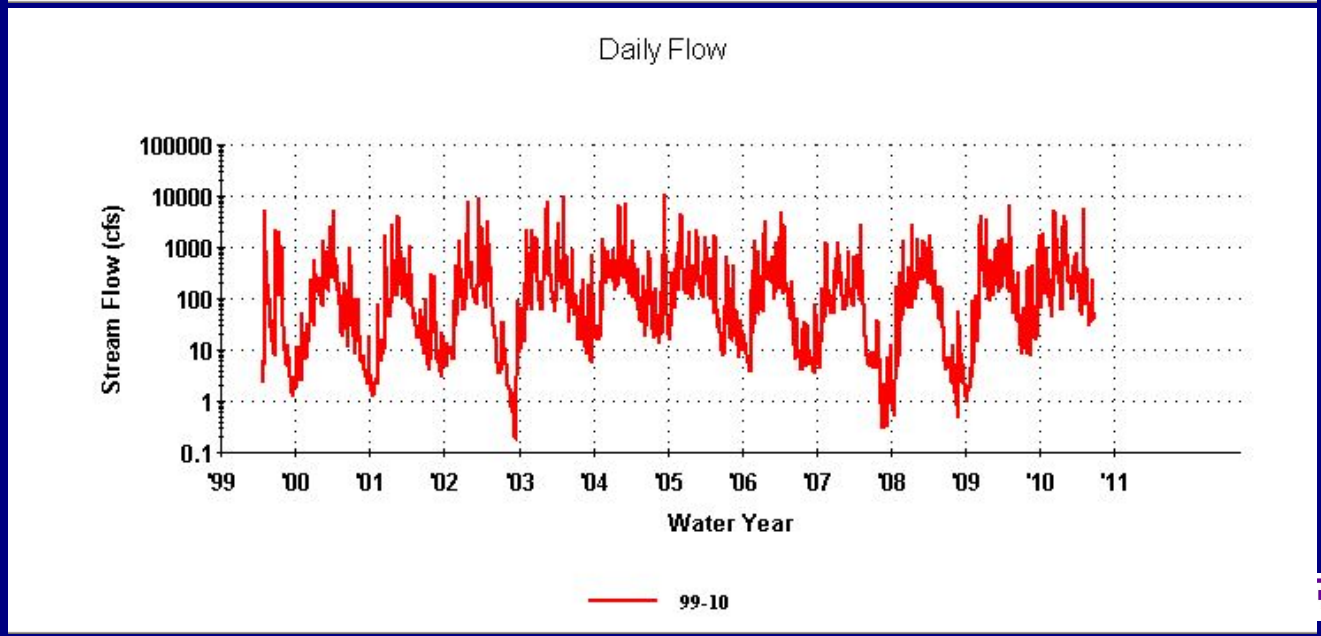

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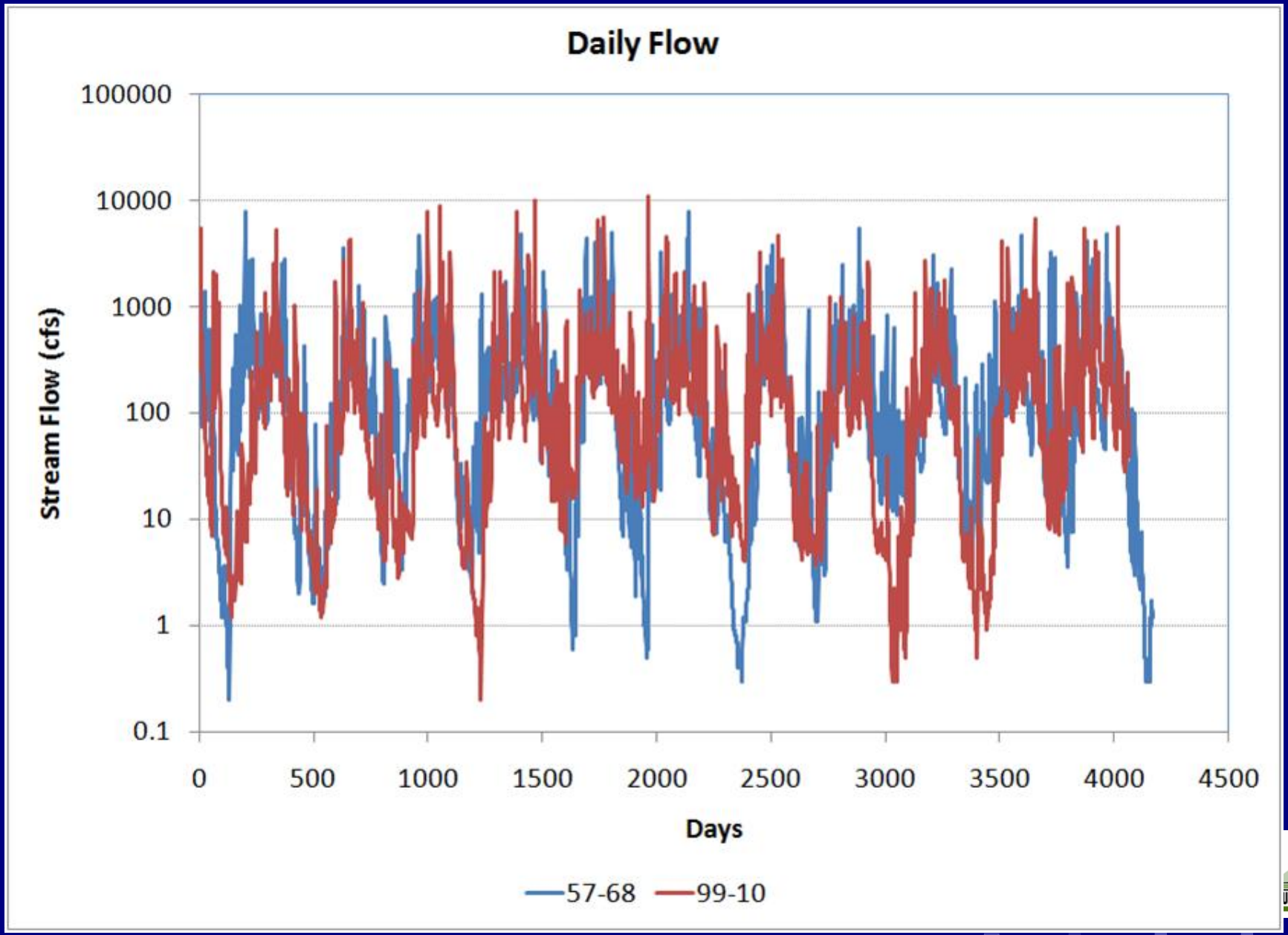
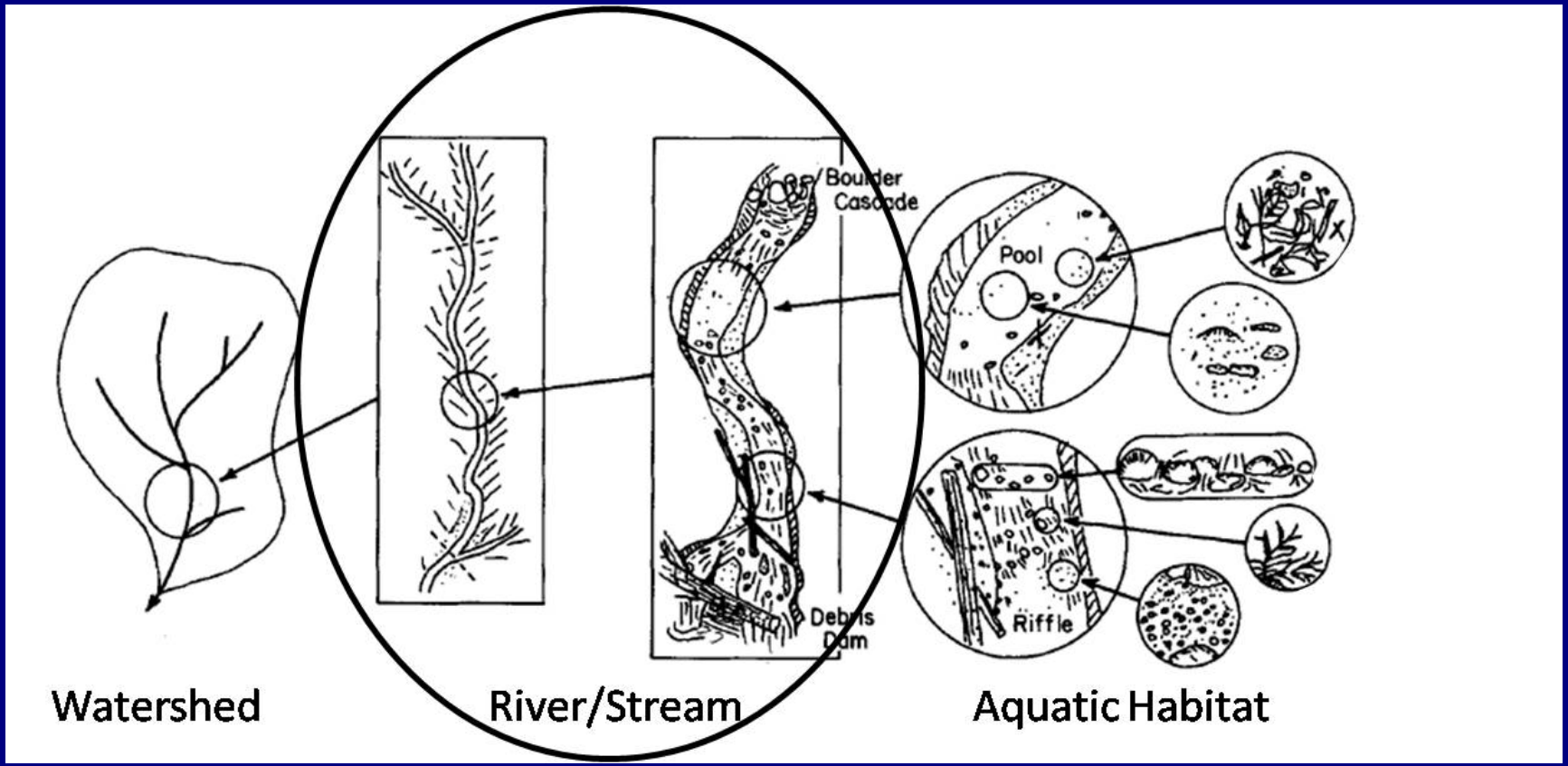


Outline

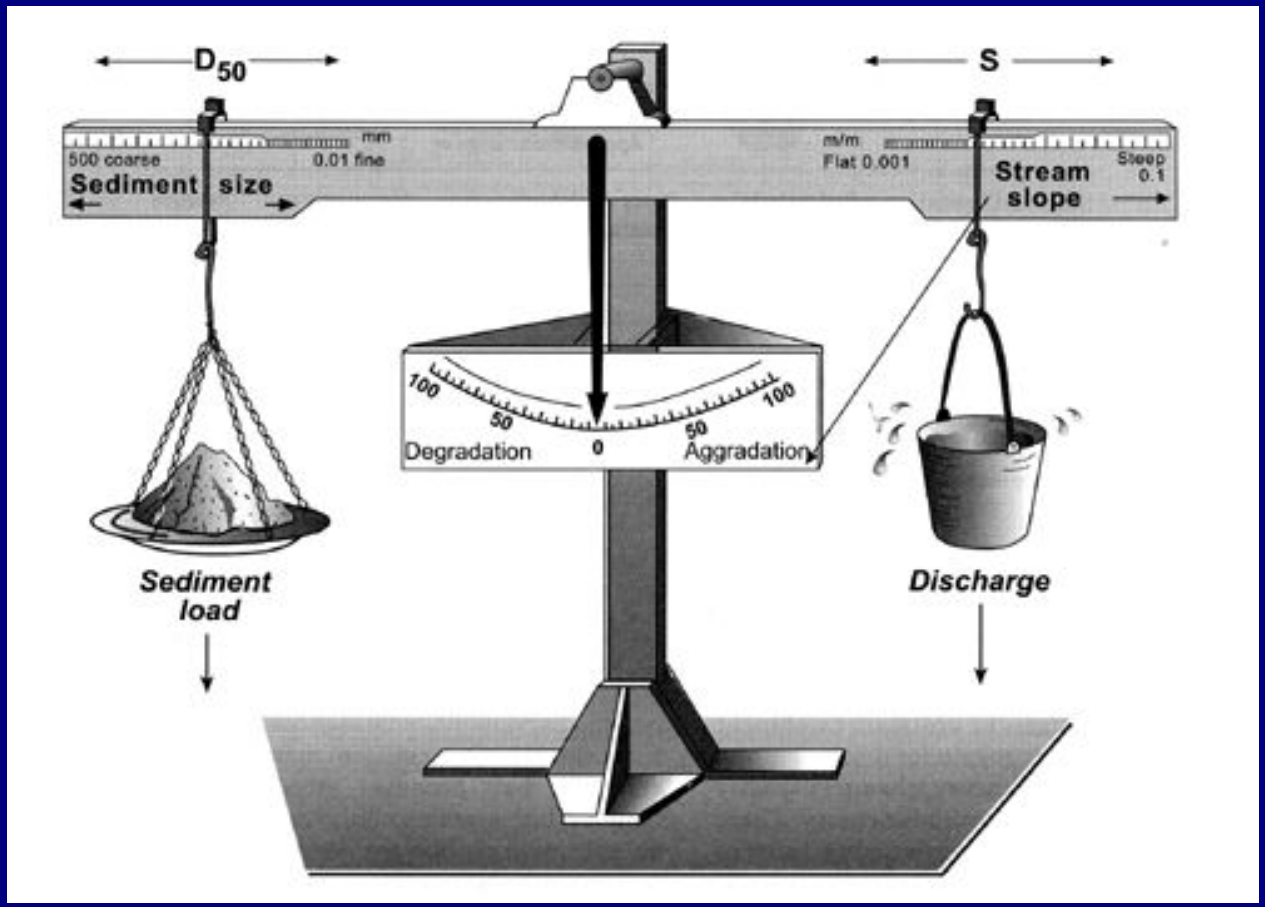
River to Reach



River Morphology

Sediment Balance

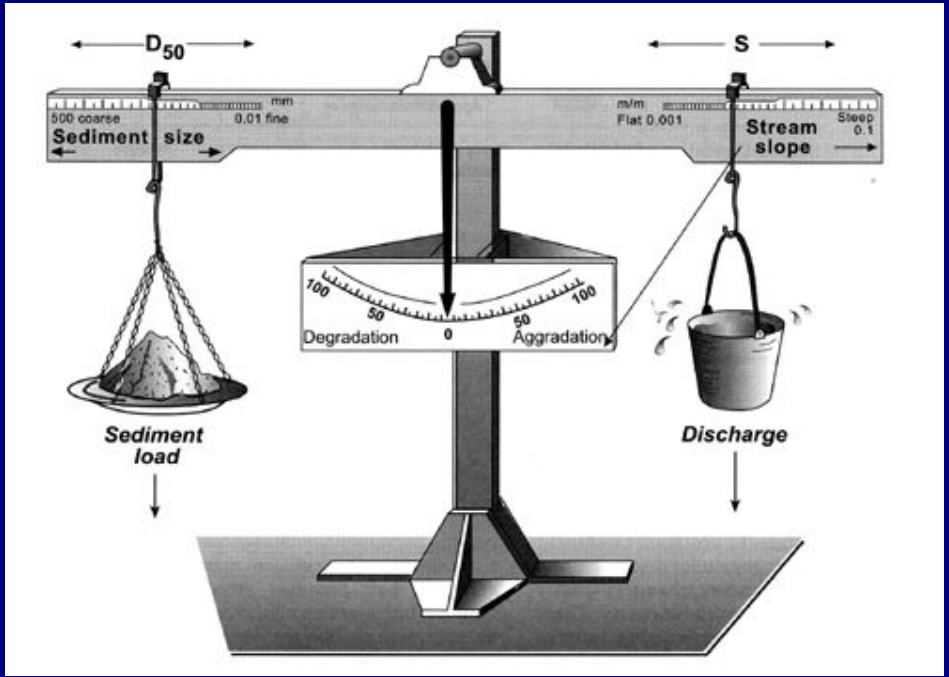
- D_{50} = Median particle size
- Q_s = Sediment Load
- S = Stream Slope
- Q = Stream Discharge
- Channel degradation or aggradation will occur depending on the sediment balance



River Morphology

Sediment Balance

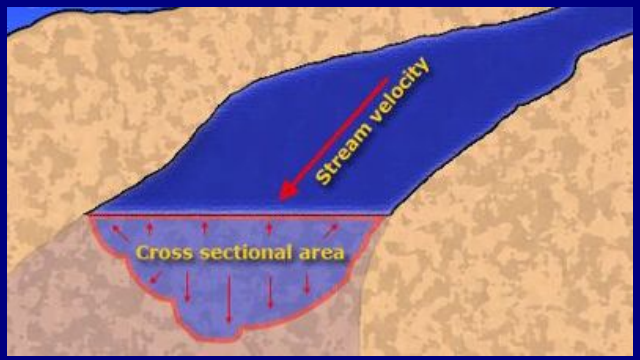
- $Q_s \times D_{50} \propto S \times Q$
  - $Q_s =$ Sediment Load (mg/L)
  - $D_{50} =$ Sediment Size (mm)
  - $S =$ Stream Slope
  - $Q =$ Stream Discharge

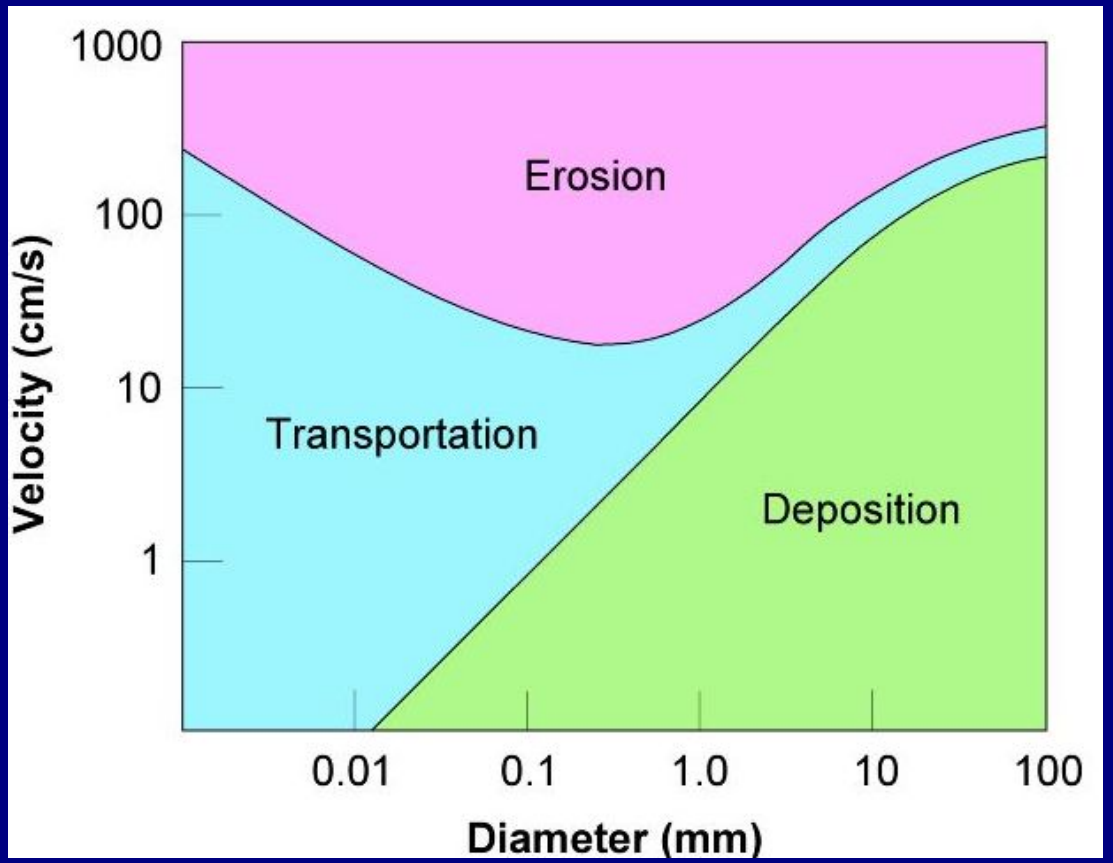


River Morphology

Stream Power

- $Q_s D_{50} \propto QS$
- $QS =$ stream power
- $Q = VA$
  - $V =$ velocity
  - $A =$ cross-section area





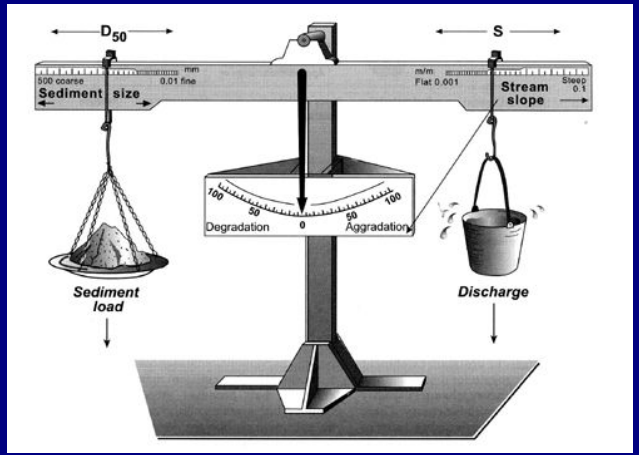
River Morphology

Sediment Balance

$$Q_s D_{50} \propto QS$$

(Sediment Load)(Sediment Size) $\propto$ (Stream Flow)(Stream Slope)

- River adjusts to changes to restore dynamic equilibrium
- $Q_s \propto \frac{QS}{D_{50}}$
  - If $D_{50} \downarrow$, QS unchanged, then $Q_s \uparrow$
    - $\uparrow$ turbidity (TMDL)
  - If $Q \downarrow$, D_{50} and S unchanged, then $Q_s \downarrow$
    - Sediment deposition (aggradation)
    - Slope $\downarrow$ to restore balance



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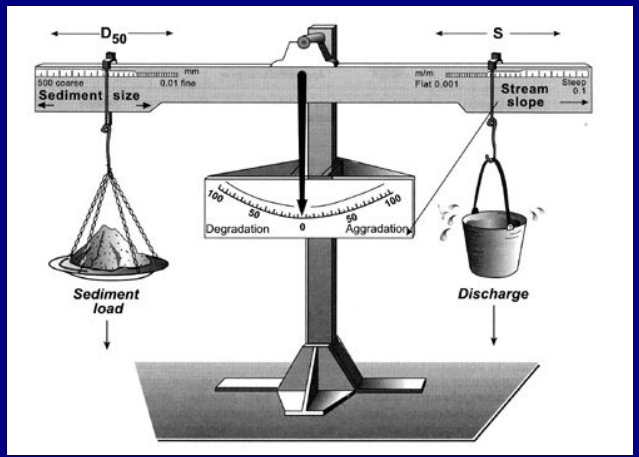

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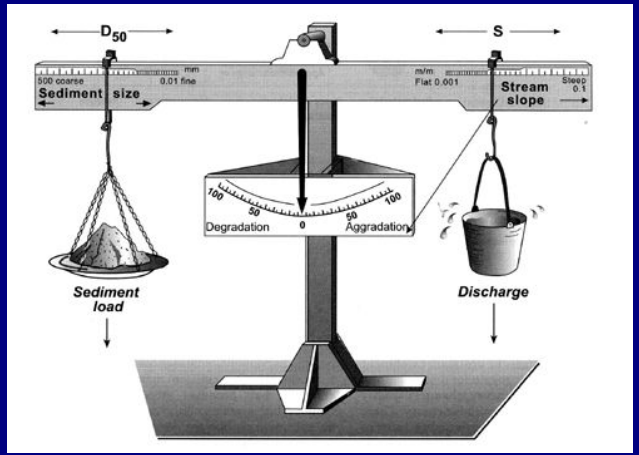

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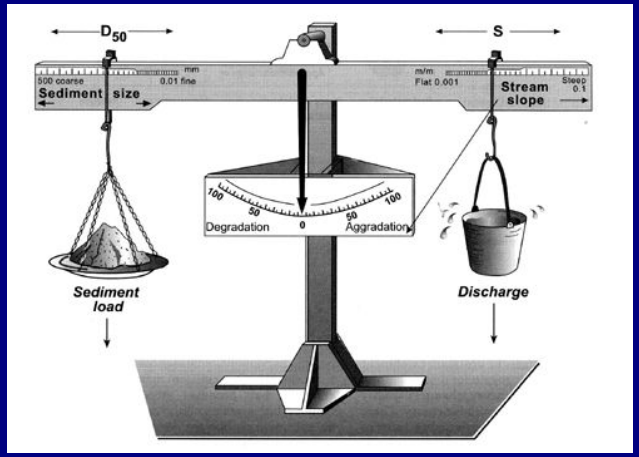

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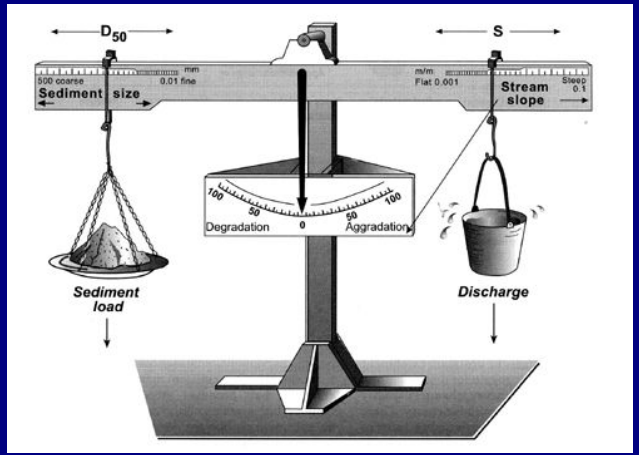
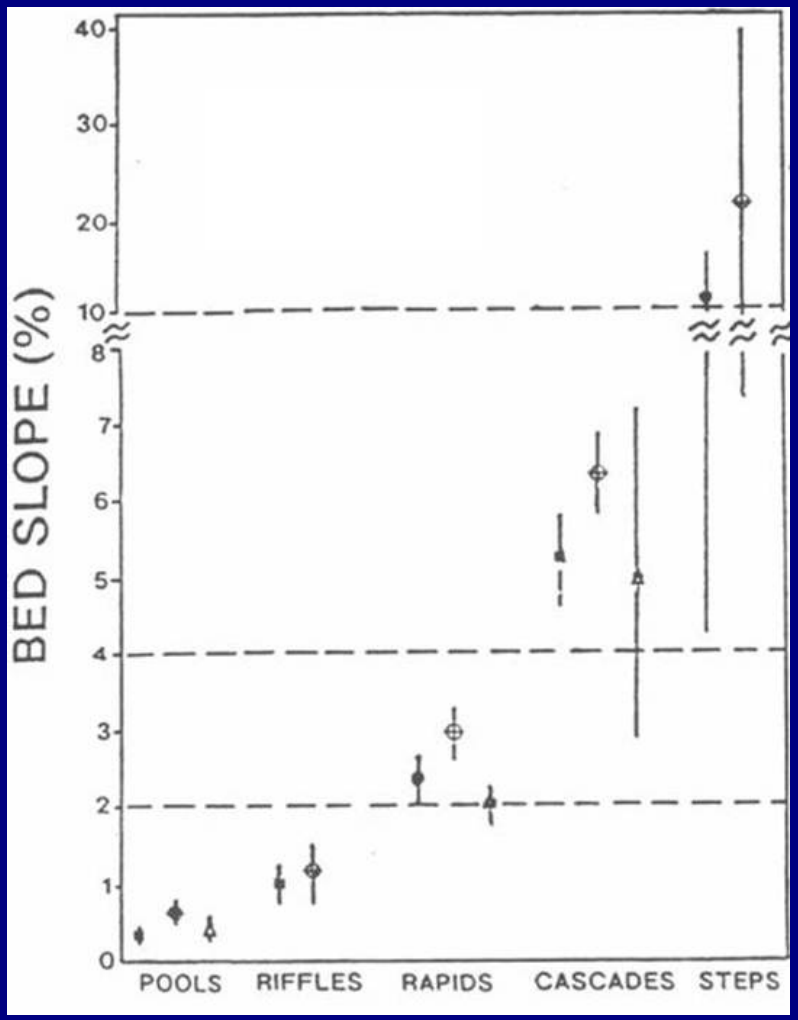
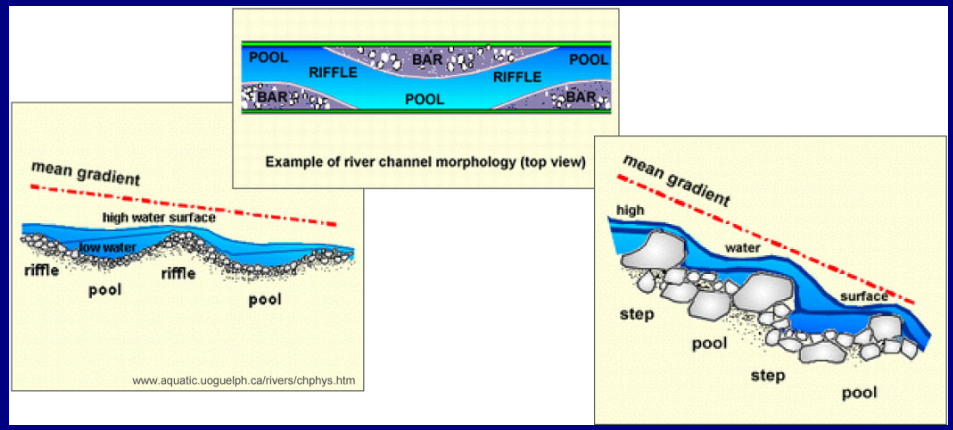


Flow and Instream Habitat Structure

$$S \propto \frac{Q_s D_{50}}{Q}$$

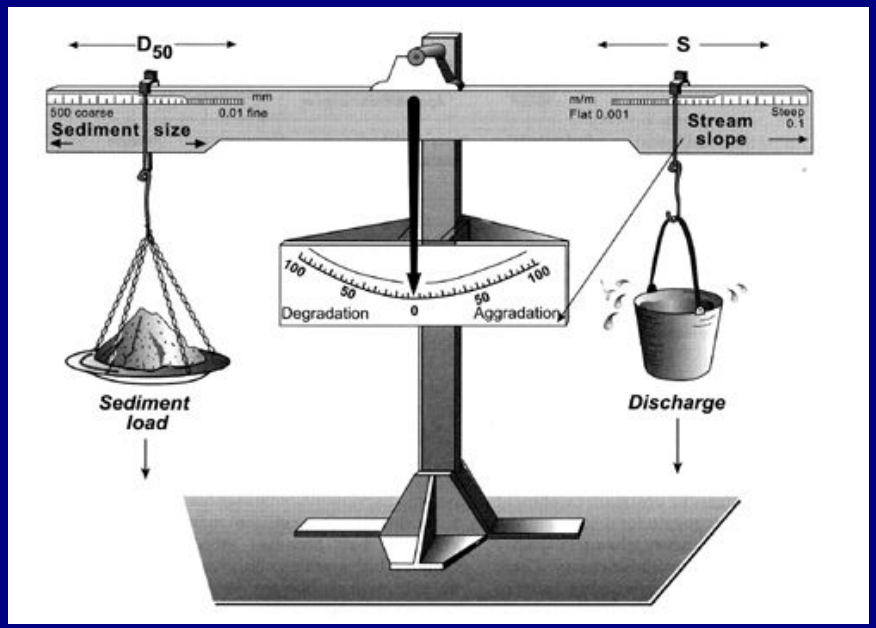


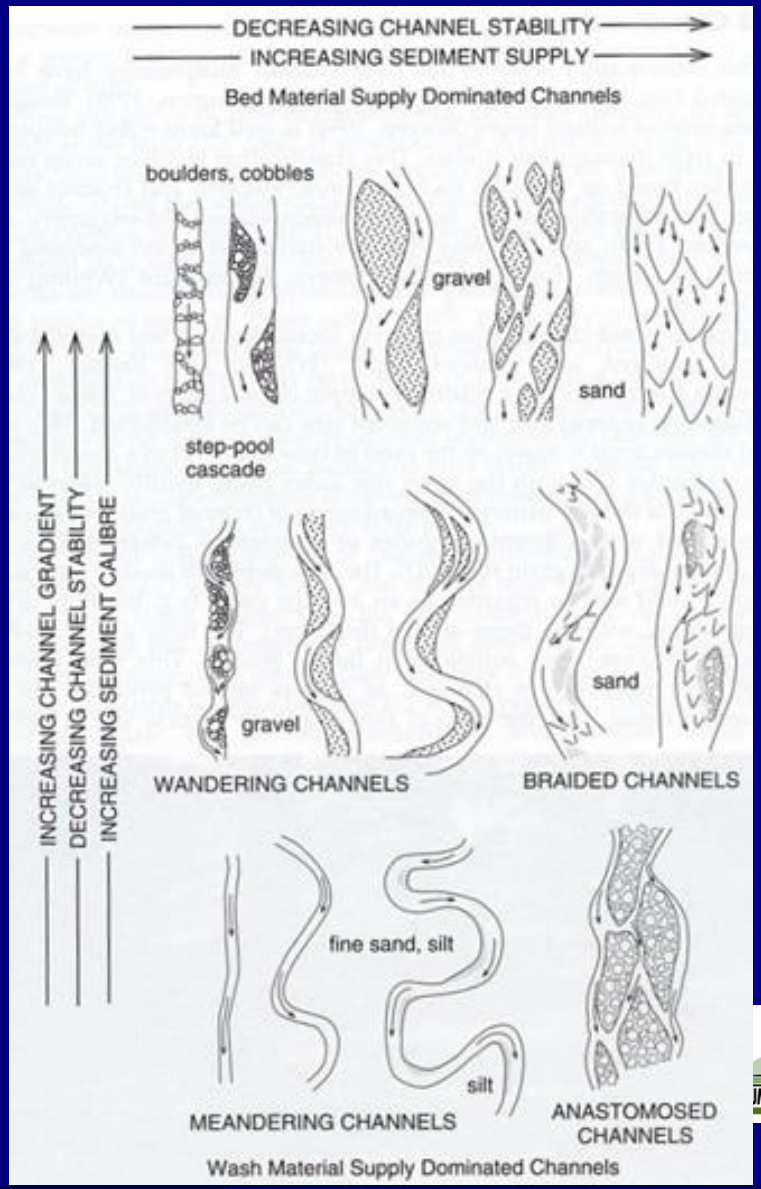


- Potential for local effects from covered activities, for example
  - Culverts
  - Road/bridge crossings

Flow and Instream Habitat Structure: Summary

- $Q_s D_{50} \propto QS$
- (Sediment Load)(Sediment Size) $\propto$ (Stream Flow)(Stream Slope)





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