Refugio Creek Watershed

# CREEKS: HOW THEY WORK

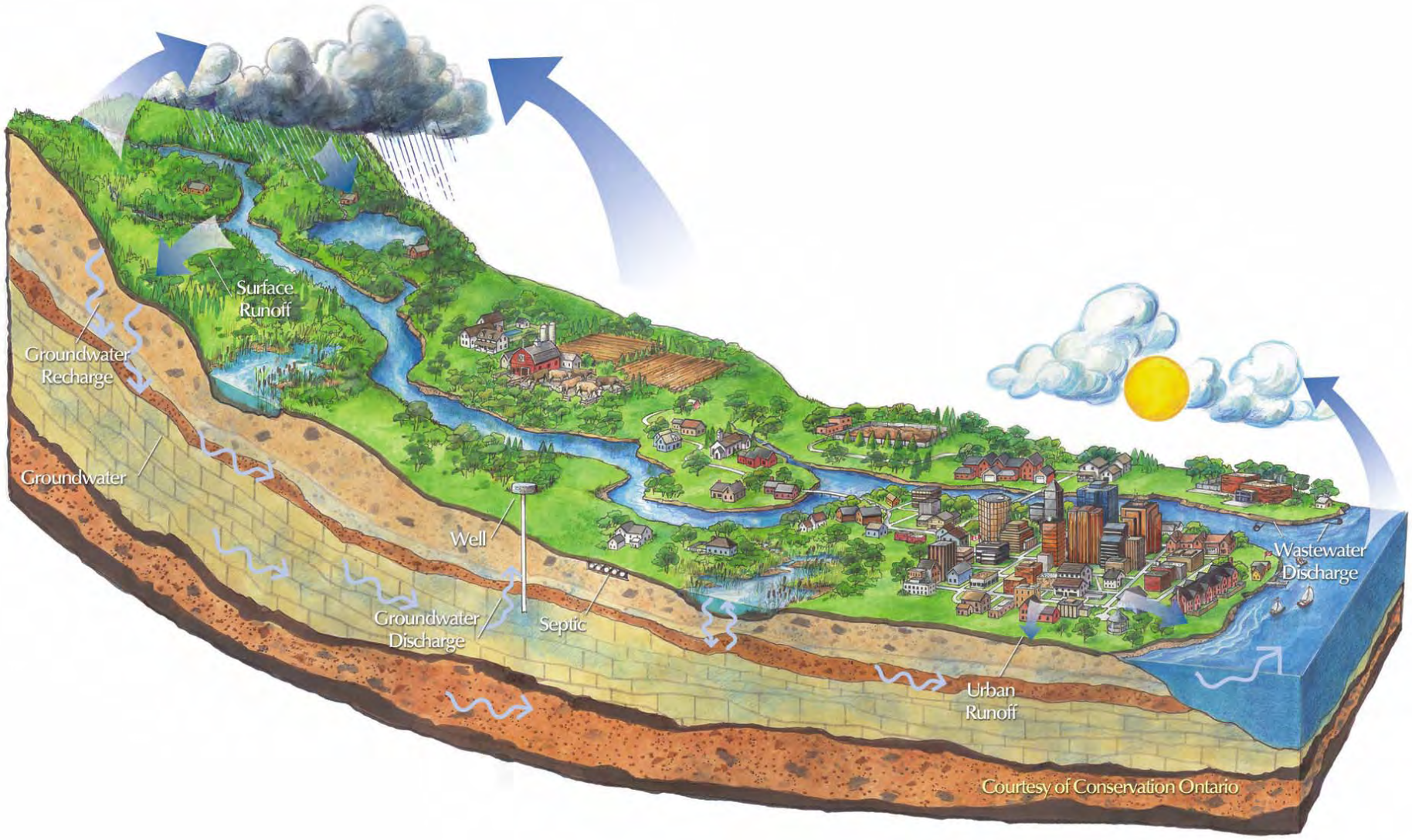
# Overview

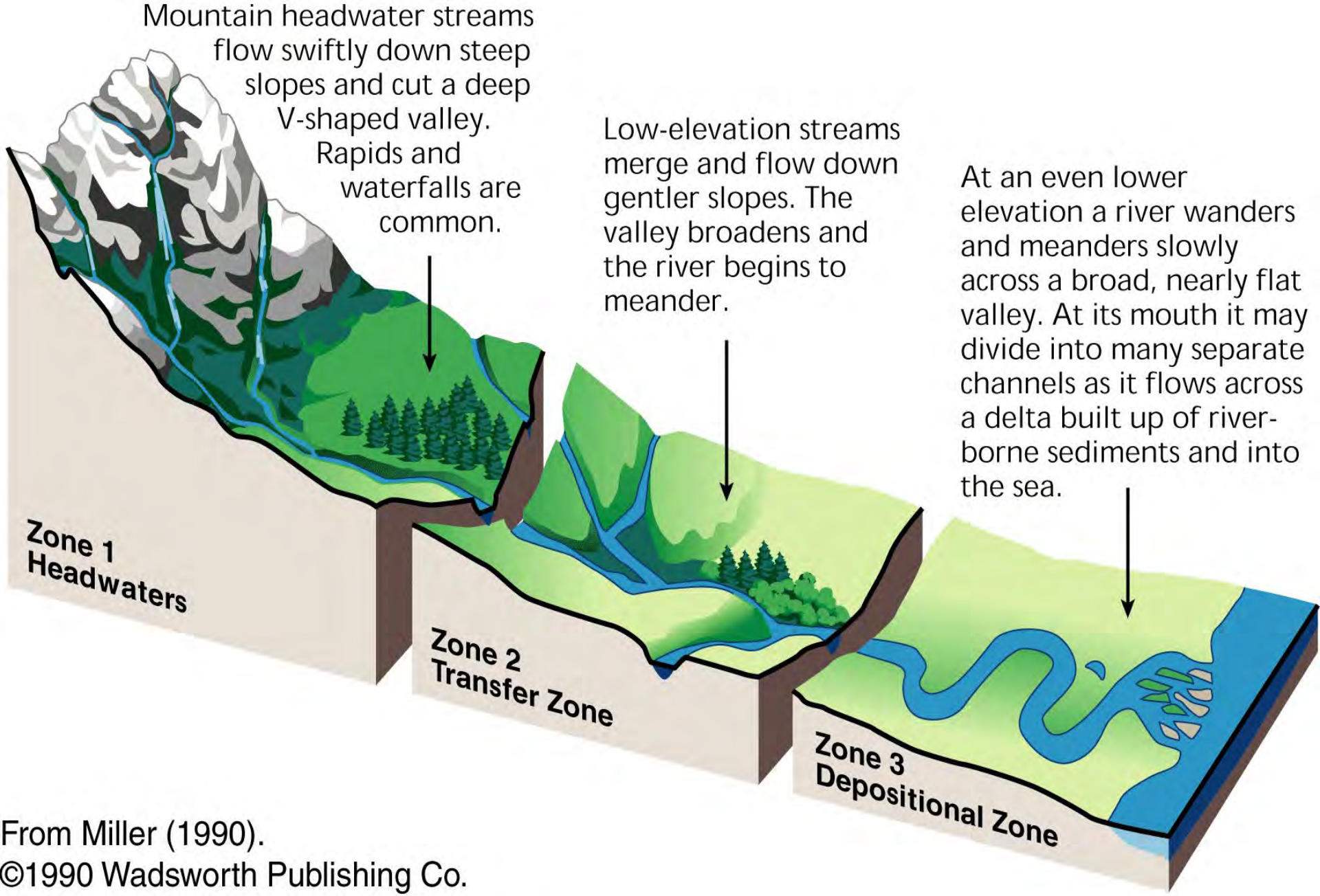
- Hydrology
- Fluvial geomorphology/creeks
- Impacts
- Restoration

# Hydrology

The study of water movement in the natural cycle, answers the question of what happens when it rains.

# Hydrology


Surface Runoff
Groundwater Recharge
Groundwater
Well
Groundwater Discharge
Septic
Urban Runoff
Wastewater Discharge
Courtesy of Conservation Ontario




From Miller (1990).

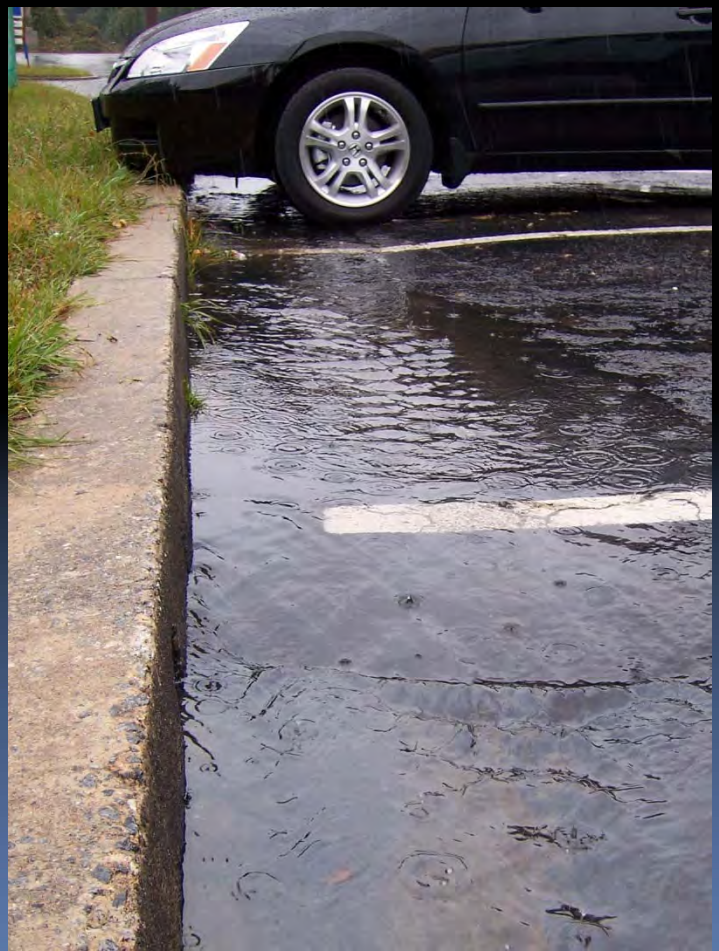


Fig. 1.27 – Three longitudinal profile zones.
In Stream Corridor Restoration: Principles, Processes, and Practices, 10/98.
Interagency Stream Restoration Working Group (15 Federal Agencies of the US).


The Headwaters
where the water drops first hit the ground.

# Hydrology

Rainfall collects into small drainages



# Hydrology

Which collect into bigger drainages

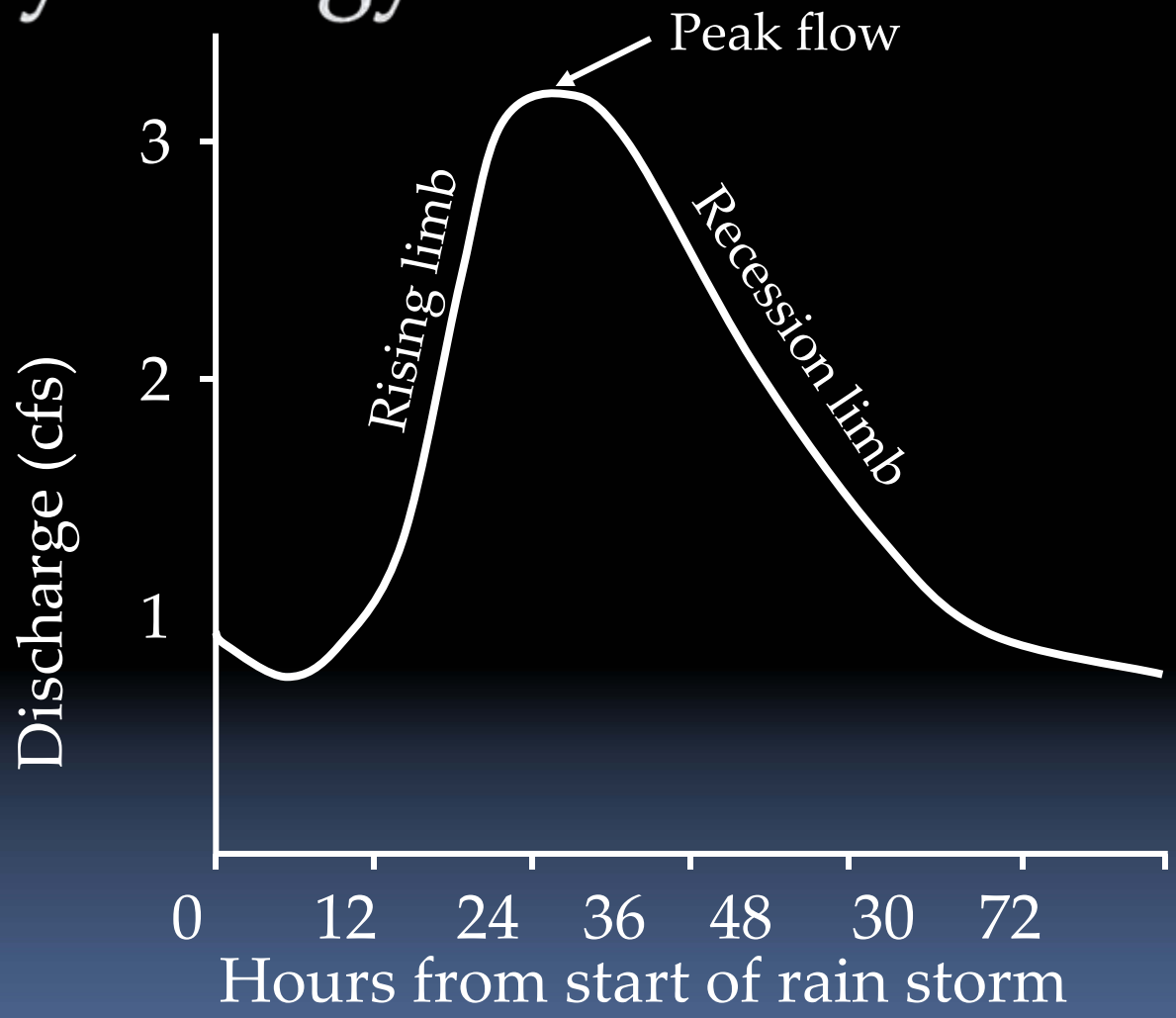

Hydrology
and eventually reach the bay, river or ocean.

# Hydrology

The amount of rainfall, frequency of rainfall and size of the watershed make each creek system unique.

This is reflected in the hydrograph; which graphs the amount of runoff overtime at a single location from a given storm event.

# Hydrology




The Hydrograph

# Geomorphology

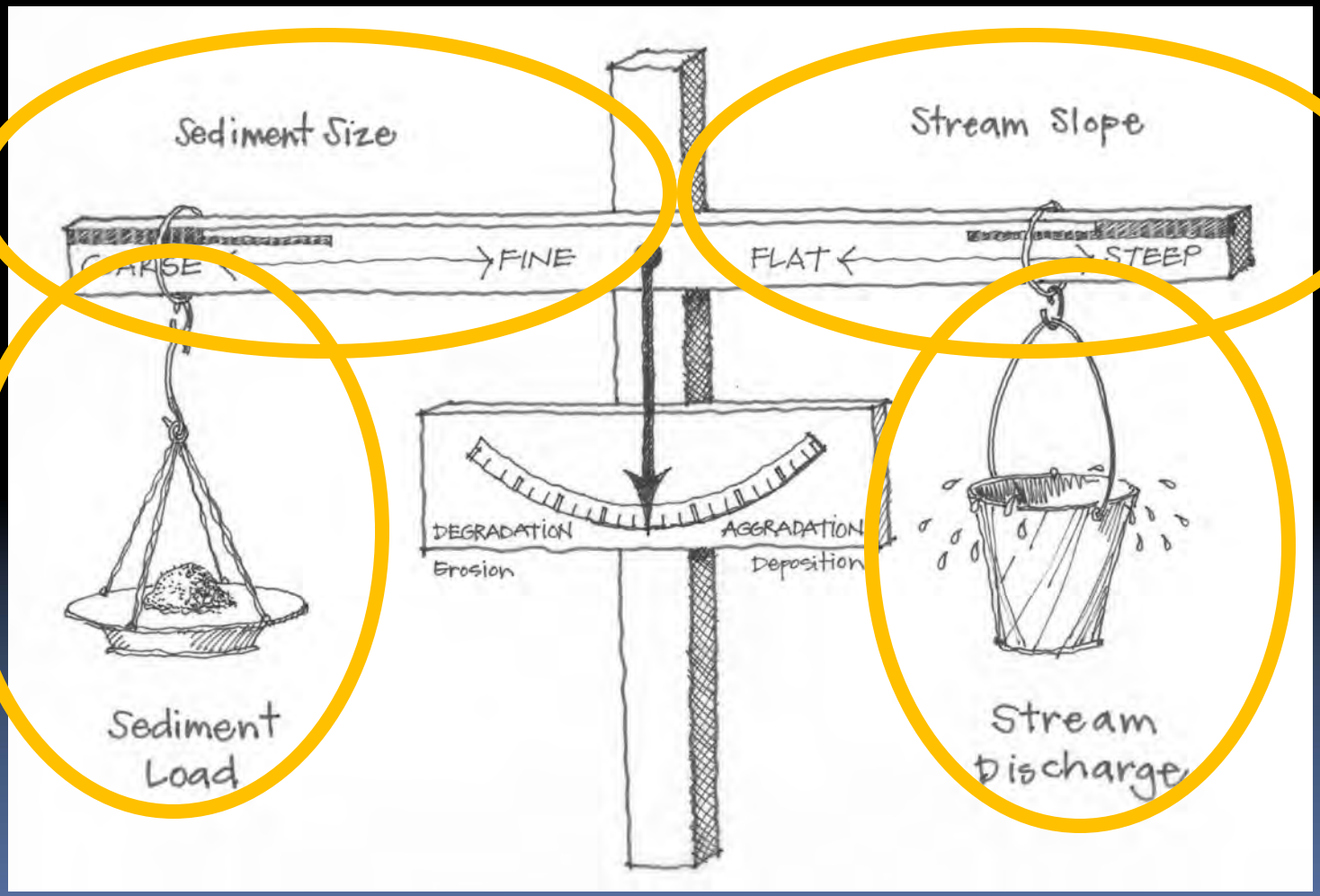
- The study of the evolution of landforms.
- Fluvial geomorphology focuses on the role of water on landforms.
- Pioneered by Luna Leopold (son of Aldo) UCB – learn from the river

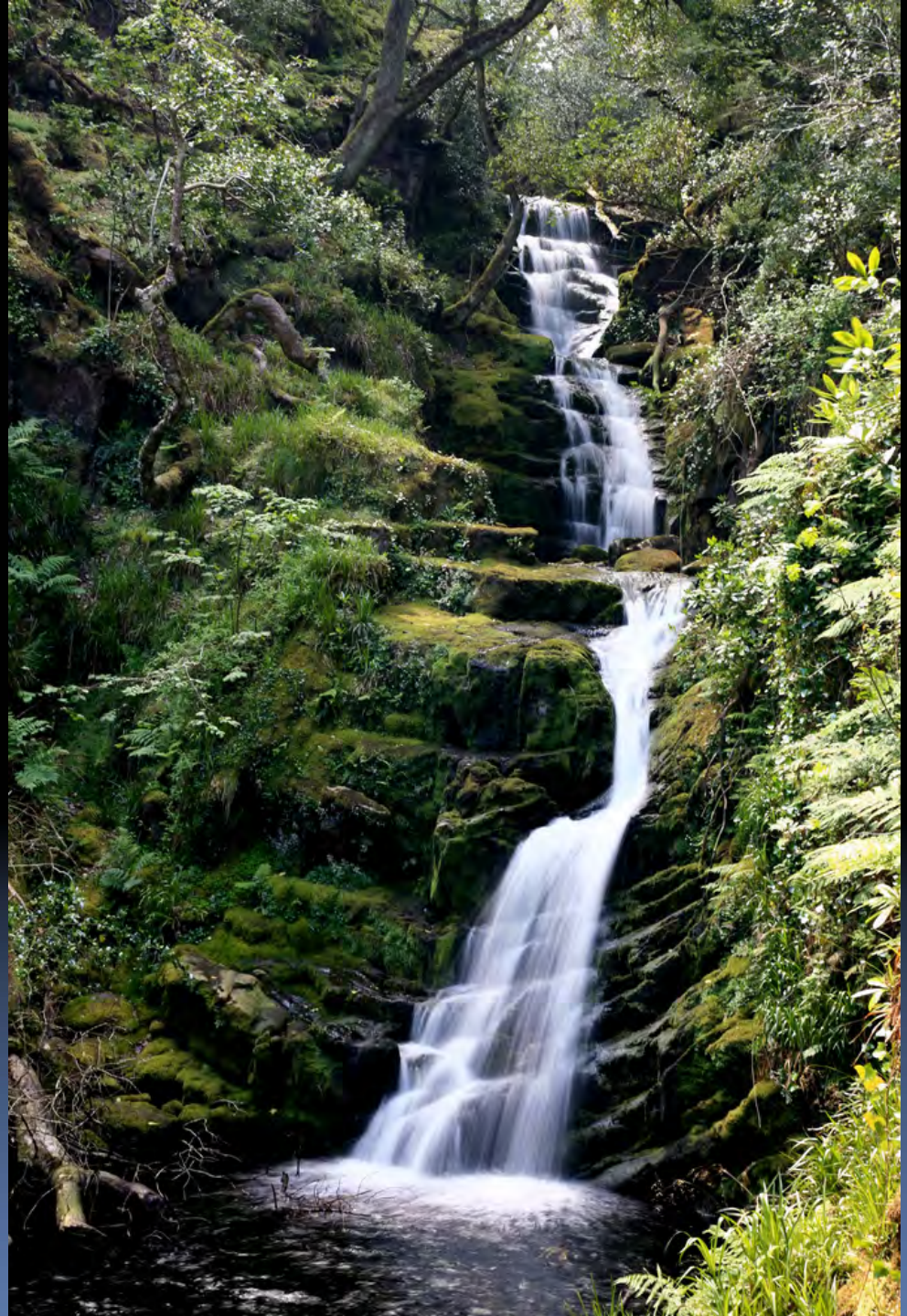
# Geomorphology

Primary Function of Creeks:

- River as Machine. Transport both water and sediment downstream.
- The amount of water, slope, sediment quantity and size all affect the form or "morphology" of a creek.

# Geomorphology



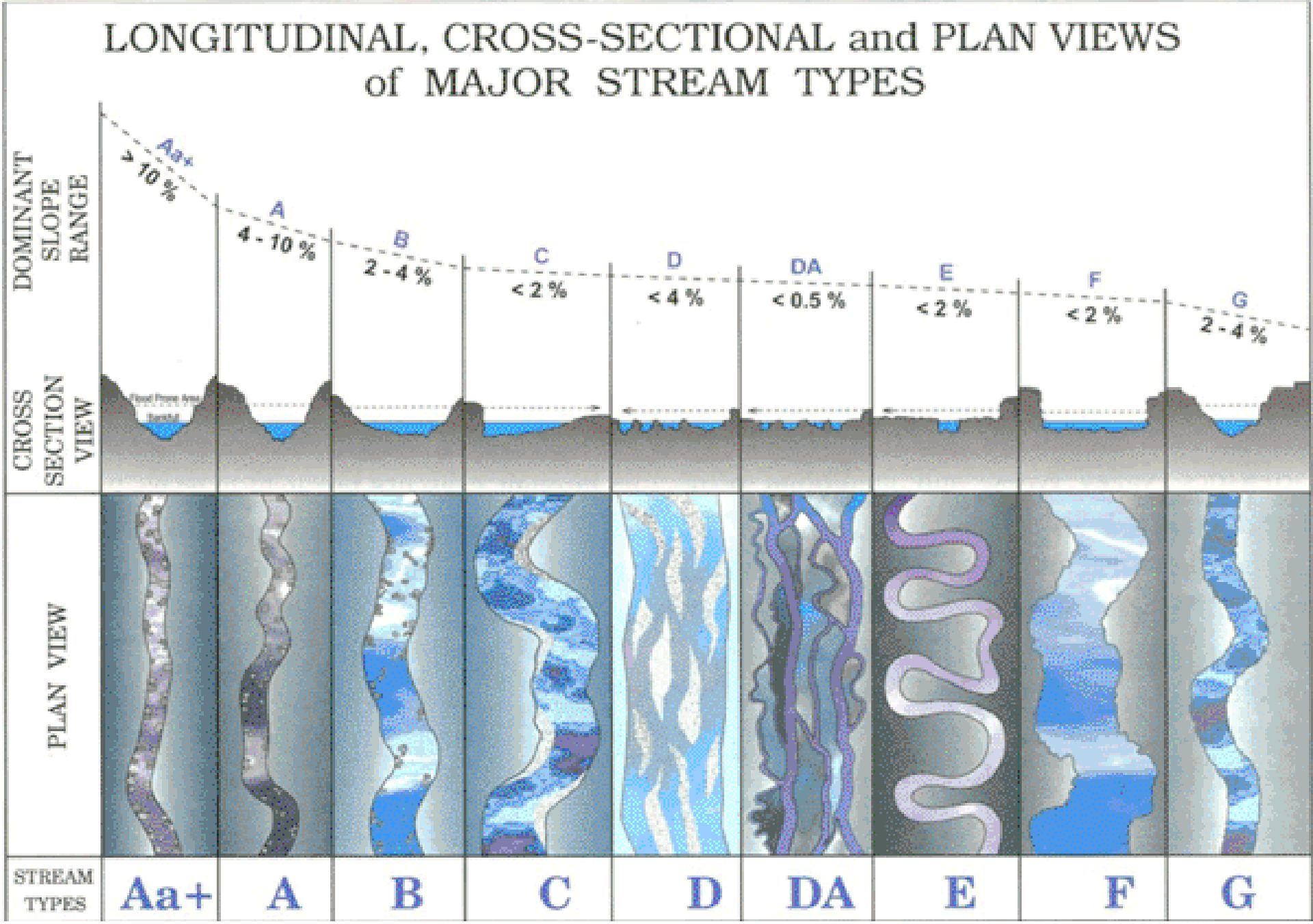


# Geomorphology

Creeks are naturally dynamic, adjusting to changes in flow and sediment supply.

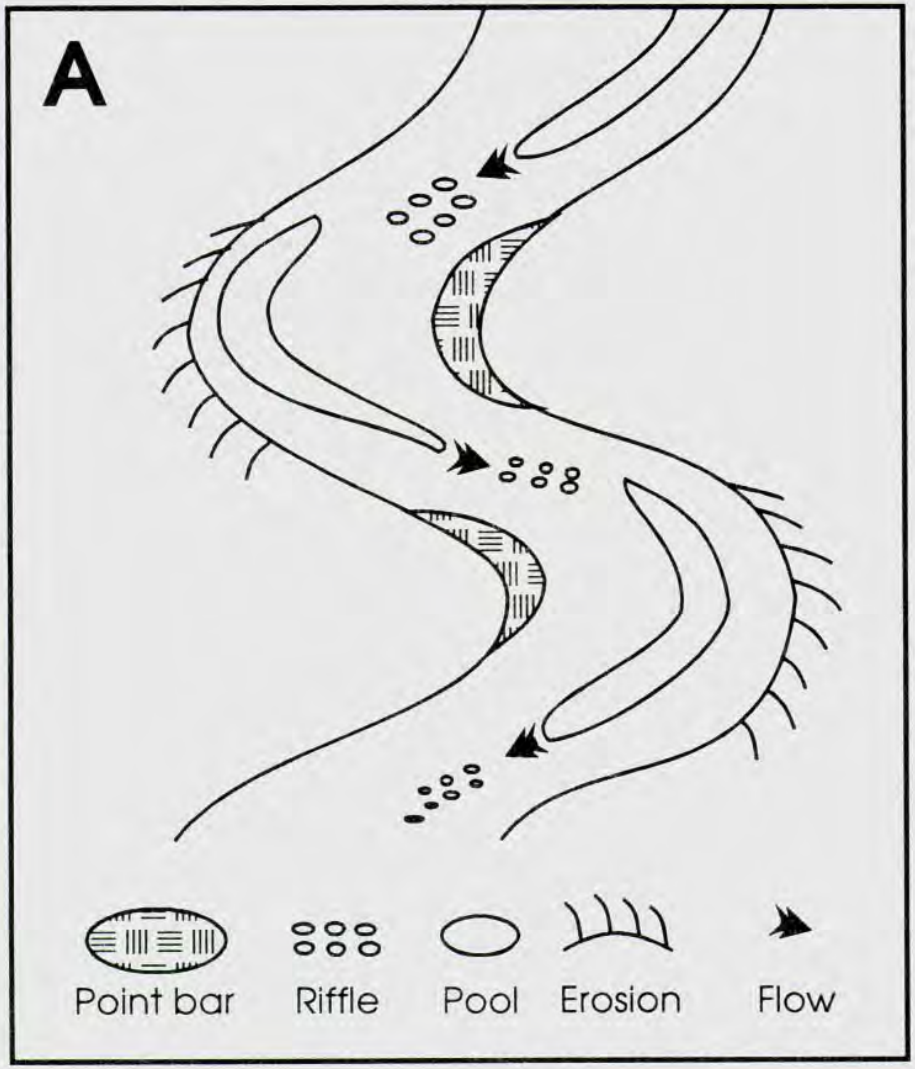
Allowing creeks to change overtime requires ample space so these changes won't affect roads, trails and buildings.

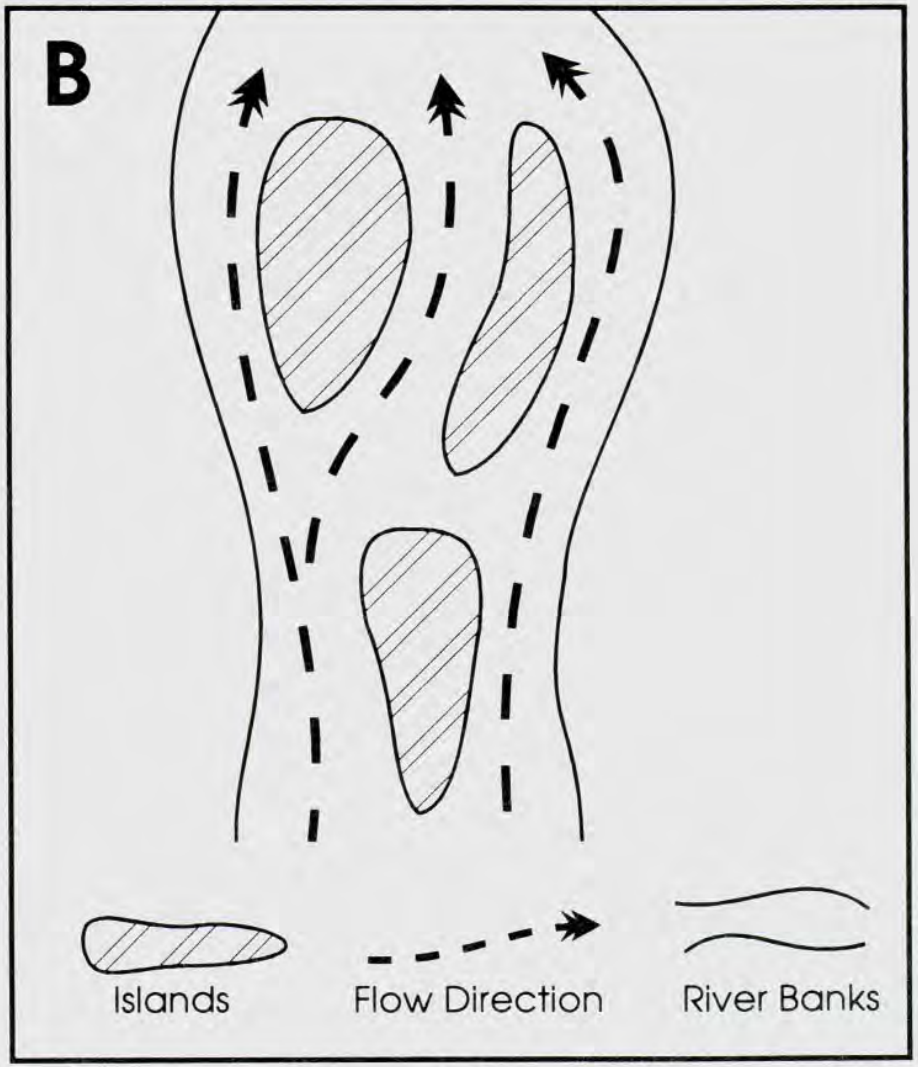
# LONGITUDINAL, CROSS-SECTIONAL and PLAN VIEWS of MAJOR STREAM TYPES




Rosgen, David L. "A classification of natural rivers." Catena 22 (1994): 179. www.wildlandhydrology.com

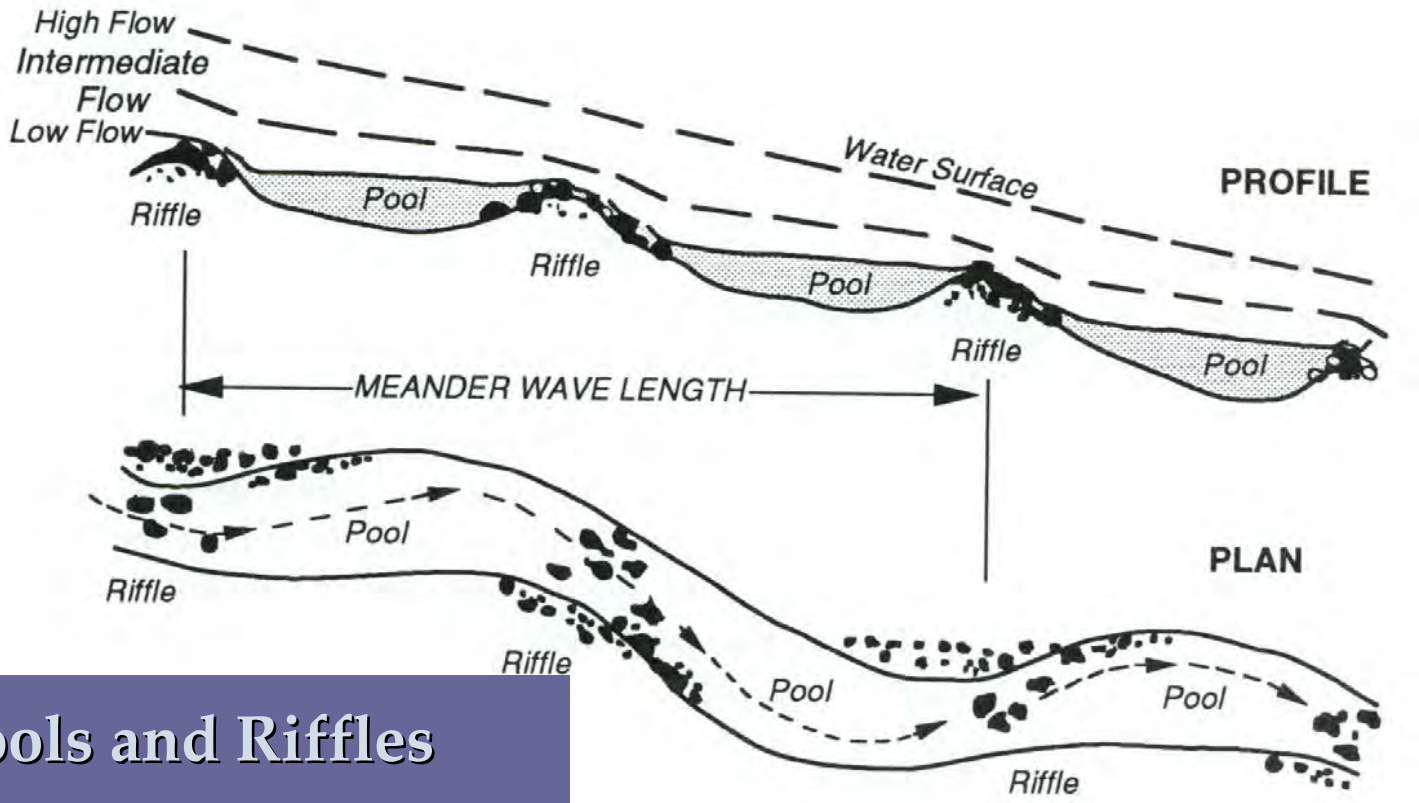
# Features Of A River



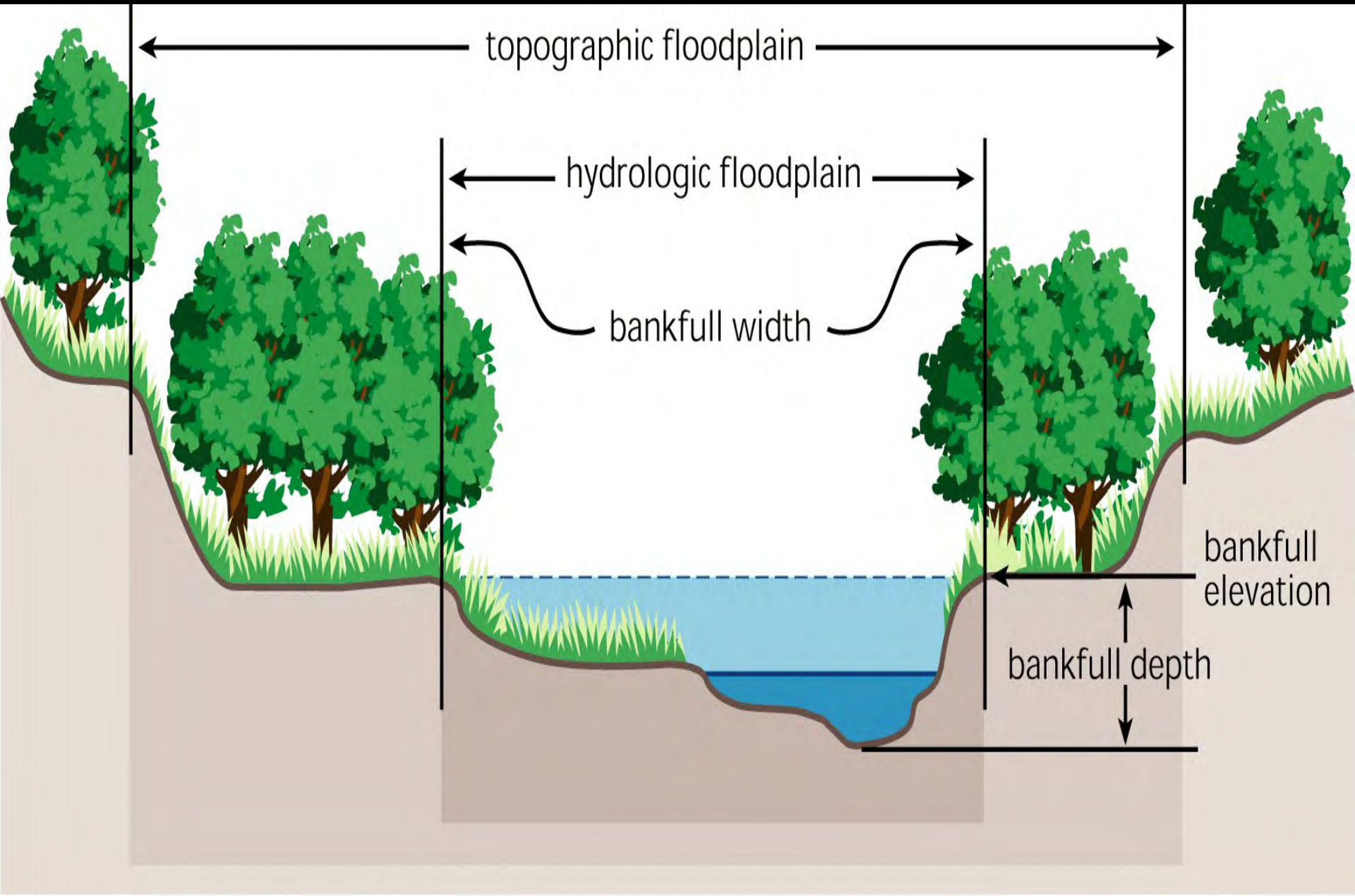



# Conduct a Pebble Count

- Radius of curvature
- Meander length
- Sinuosity



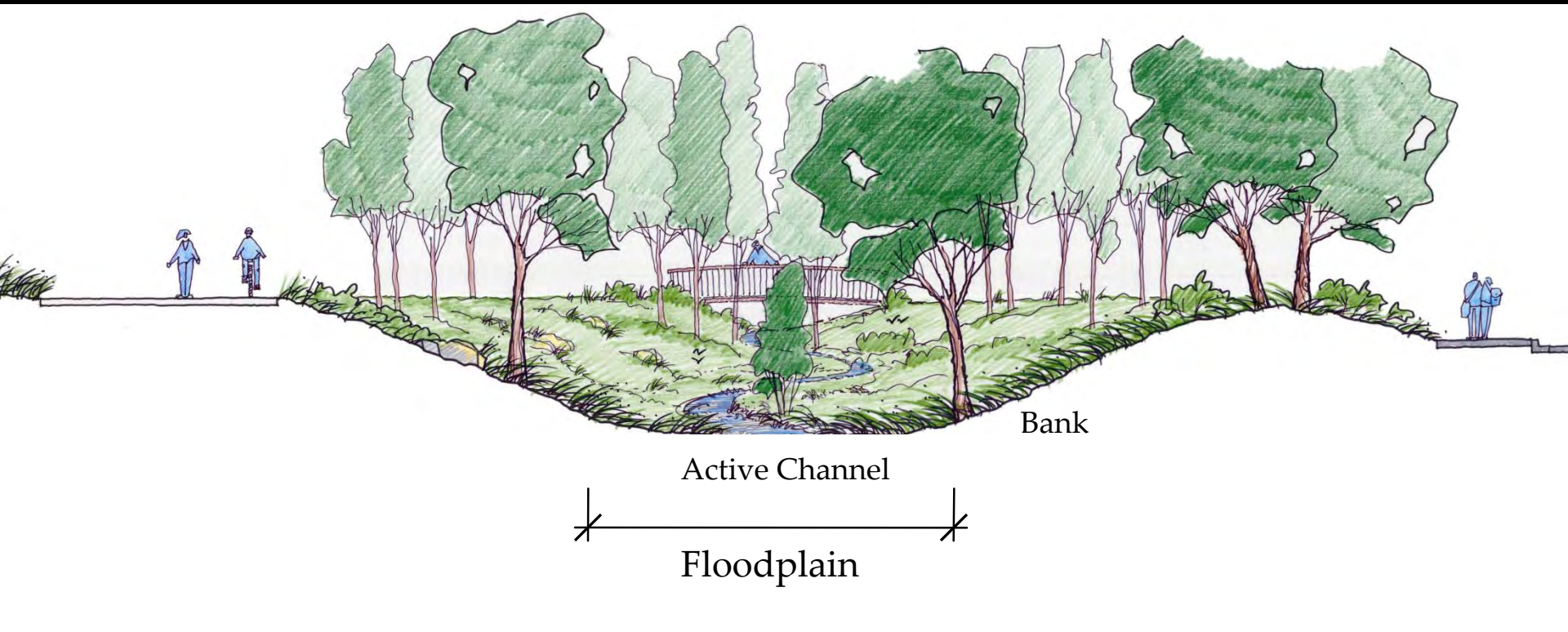

# Pools and Riffles

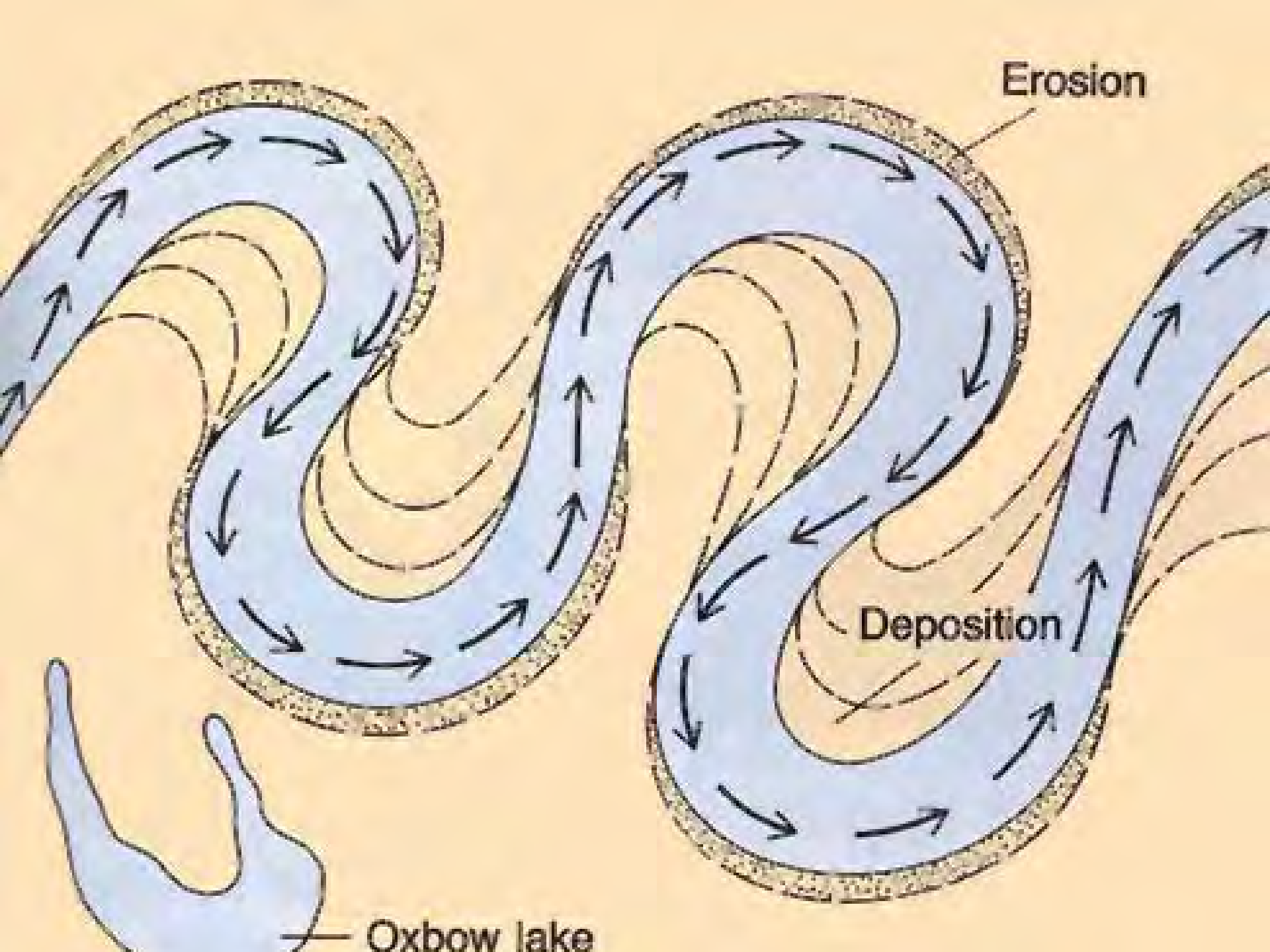

topographic floodplain
hydrologic floodplain
bankfull width
bankfull elevation
bankfull depth

# Geomorphology

The Active Channel is the area that contains the frequent storm events.

The Floodplain is the area outside the active channel that holds, slows, and infiltrates the larger storm events.




Erosion
Deposition
Oxbow lake

# Ecology

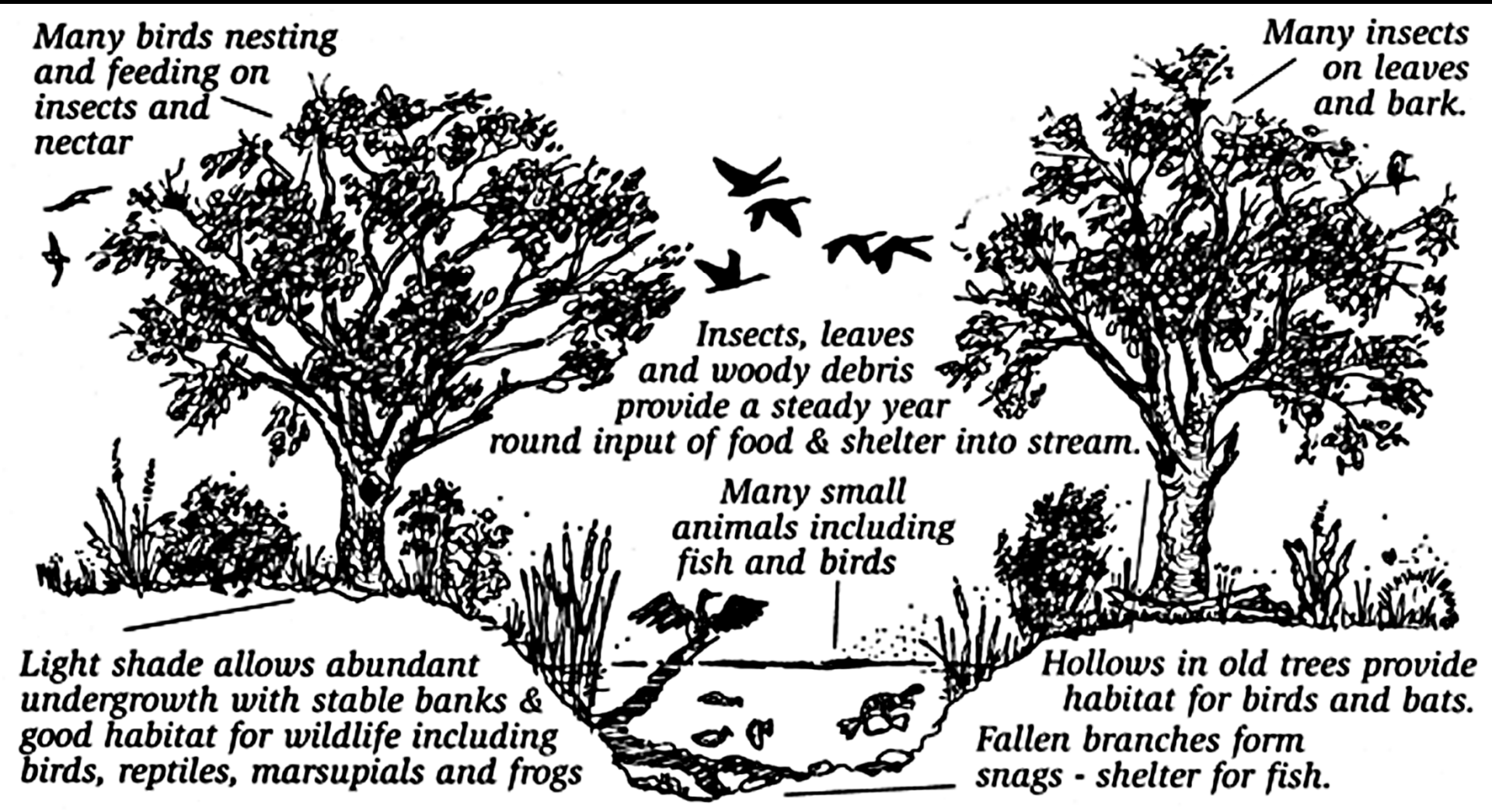
- Healthy Creeks support abundant habitat for aquatic and terrestrial organisms.

# Ecology

Rich habitat results from the variability in structure, such as...

- Channels, pools, riffles, point bars
- Boulders, snags, logs and fallen branches
- Floodplains, fill terraces, oxbows
- Overhanging trees, flowering shrubs, grasses and wildflowers

# Ecology


Many birds nesting and feeding on insects and nectar
Many insects on leaves and bark.
Insects, leaves and woody debris provide a steady year round input of food & shelter into stream.
Many small animals including fish and birds
Light shade allows abundant undergrowth with stable banks & good habitat for wildlife including birds, reptiles, marsupials and frogs
Hollows in old trees provide habitat for birds and bats.
Fallen branches form snags - shelter for fish.

# Ecology

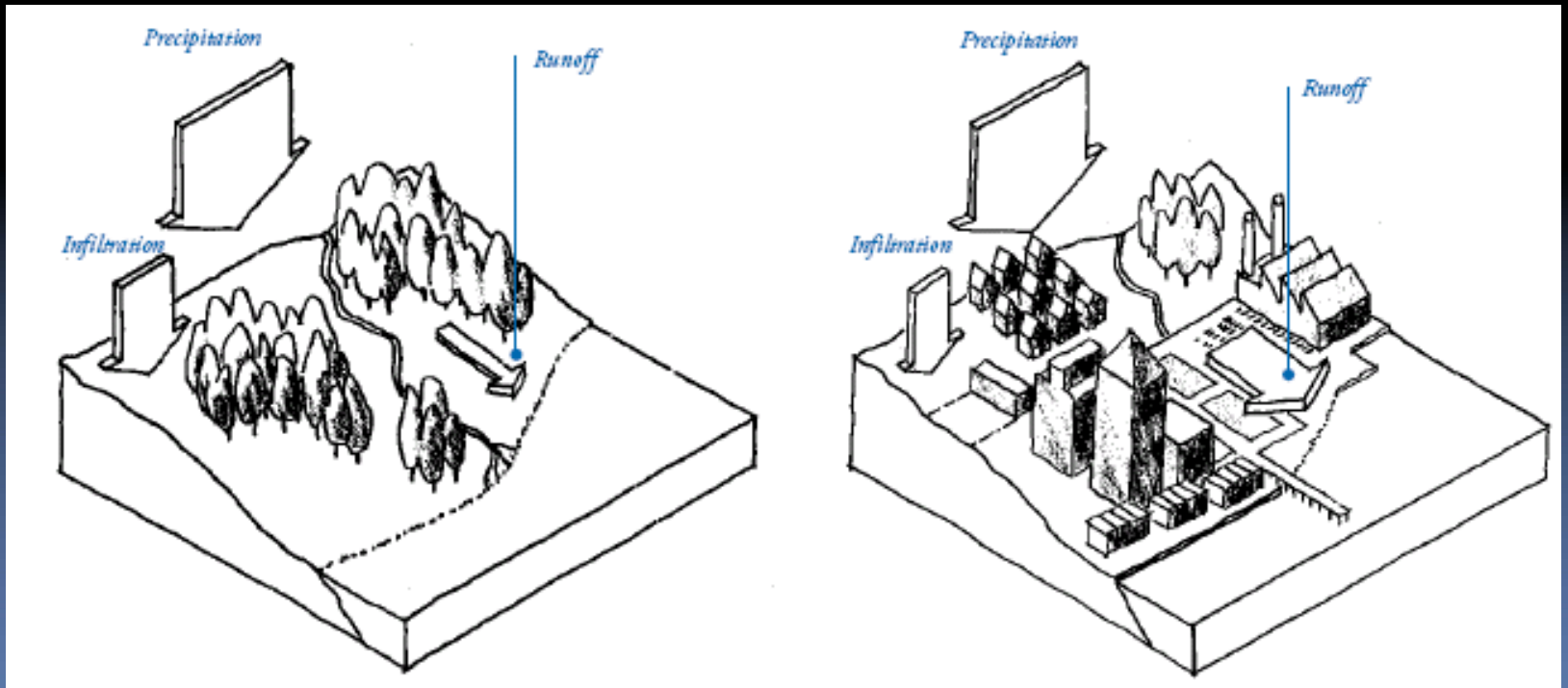
- Greater biological diversity is found in areas of larger connected patches of habitat

- Ecological health of a creek is directly correlated to the amount of space a creek is given.

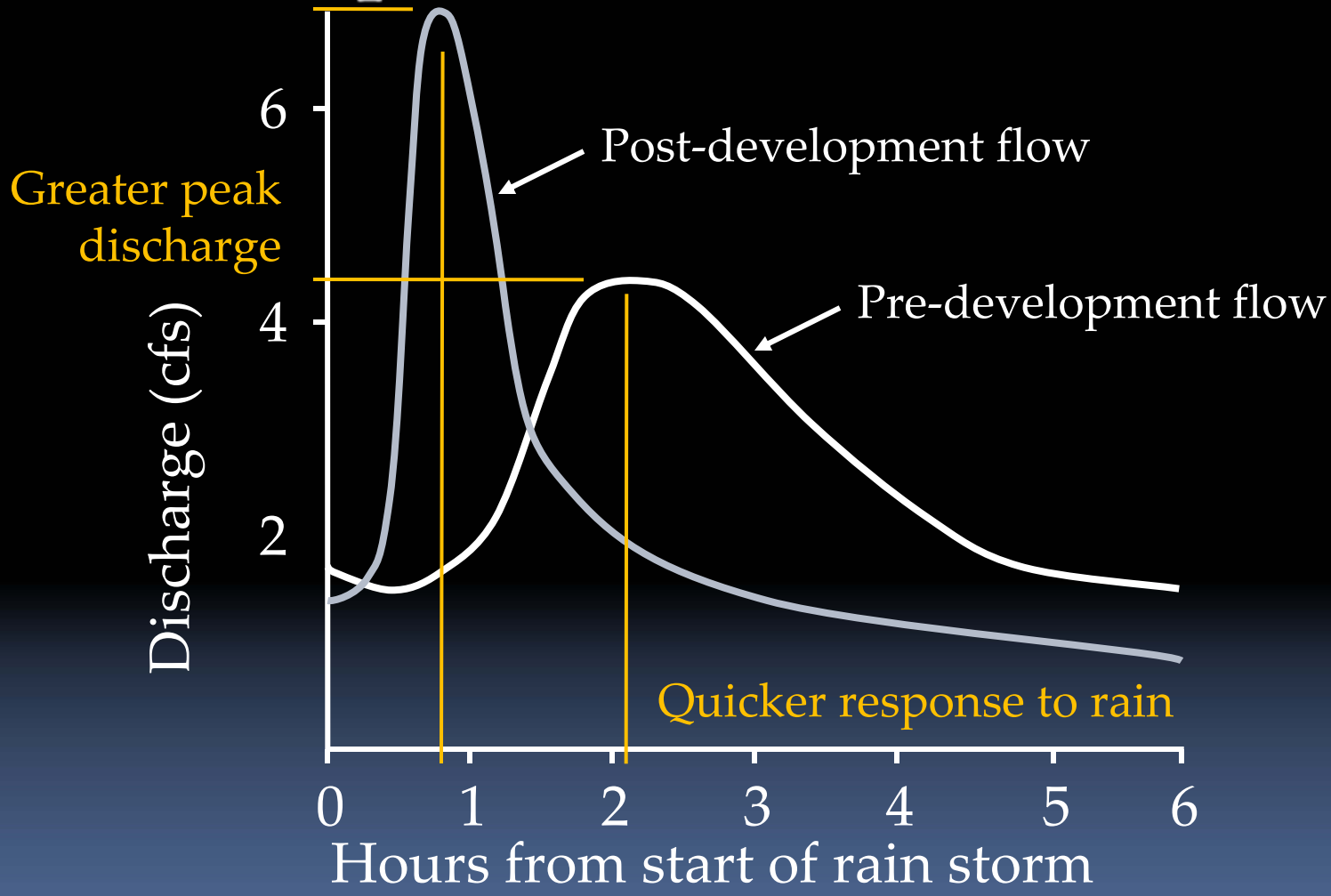
# Development and Land Use

Effects on Hydrology

- Reduced Infiltration
- Increased Runoff



# Development and Land Use

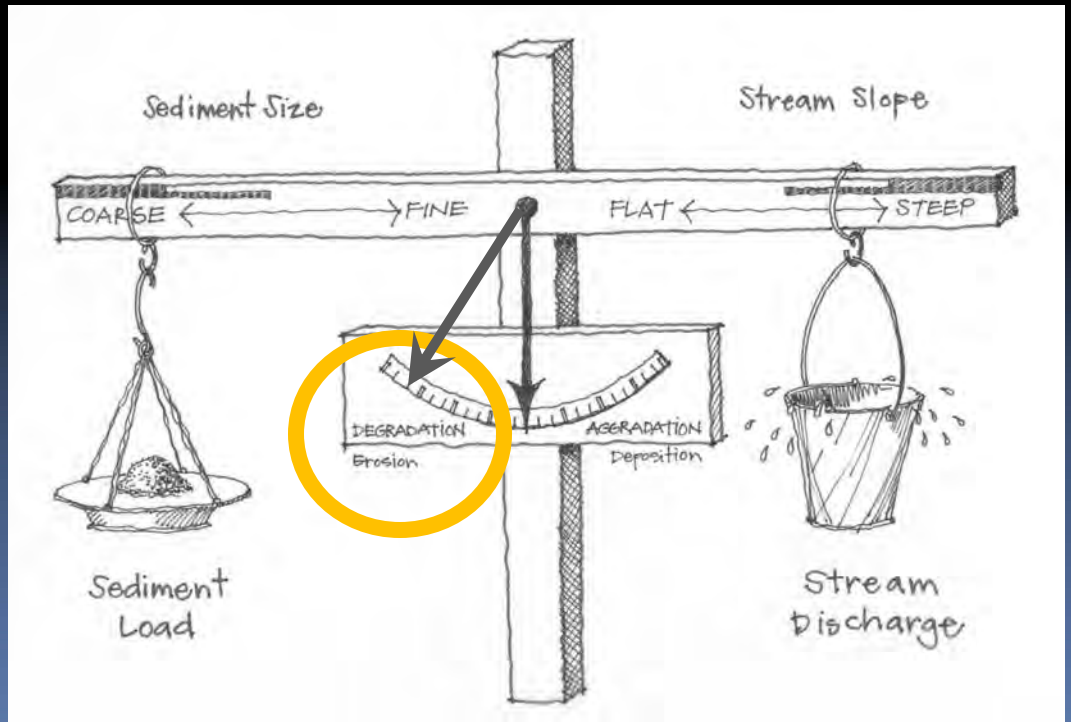



The Urban Hydrograph

# Development and Land Use

Effects on Geomorphology

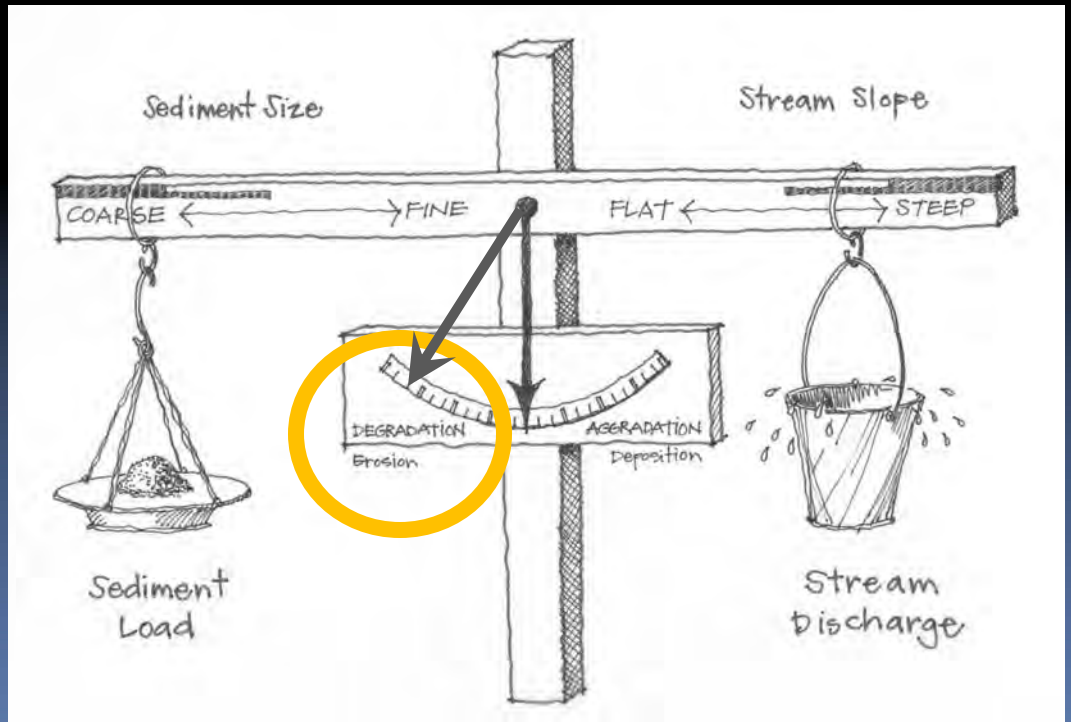
- Increased Runoff
  - Changes pattern and active channel dimensions



# Development and Land Use

Effects on Geomorphology

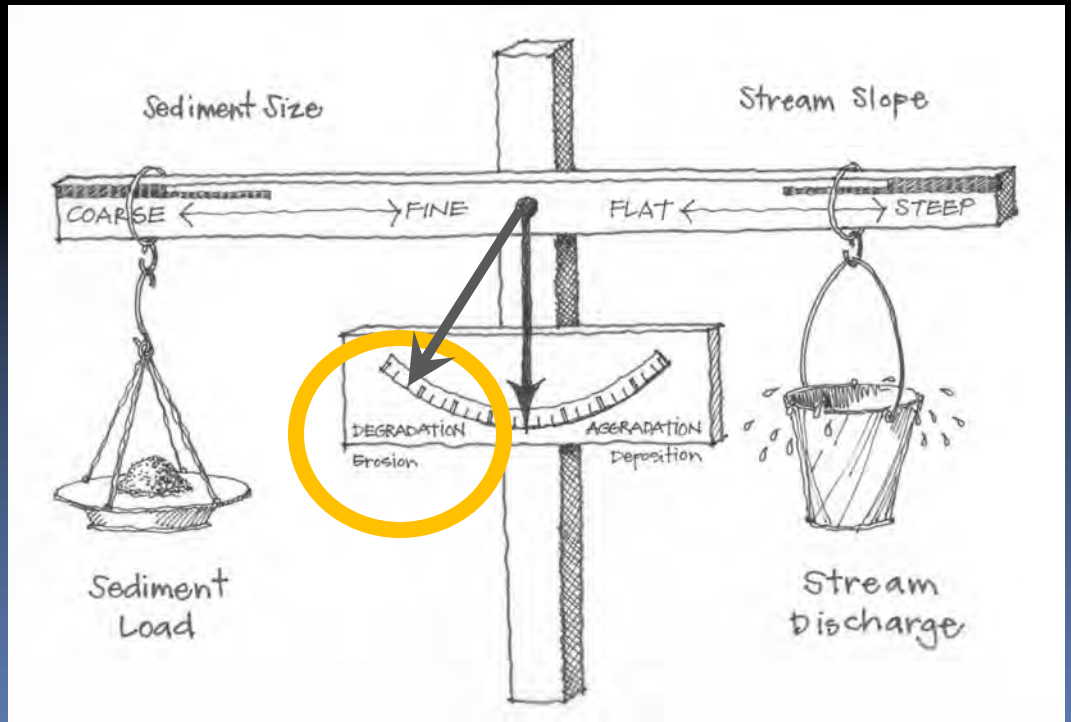
- Armored Banks and paving in watershed
  - Reduces sediment supply



# Development and Land Use

Effects on Geomorphology

- Encroachment
  - Reduces sinuosity and increases channel slope



# Development and Land Use

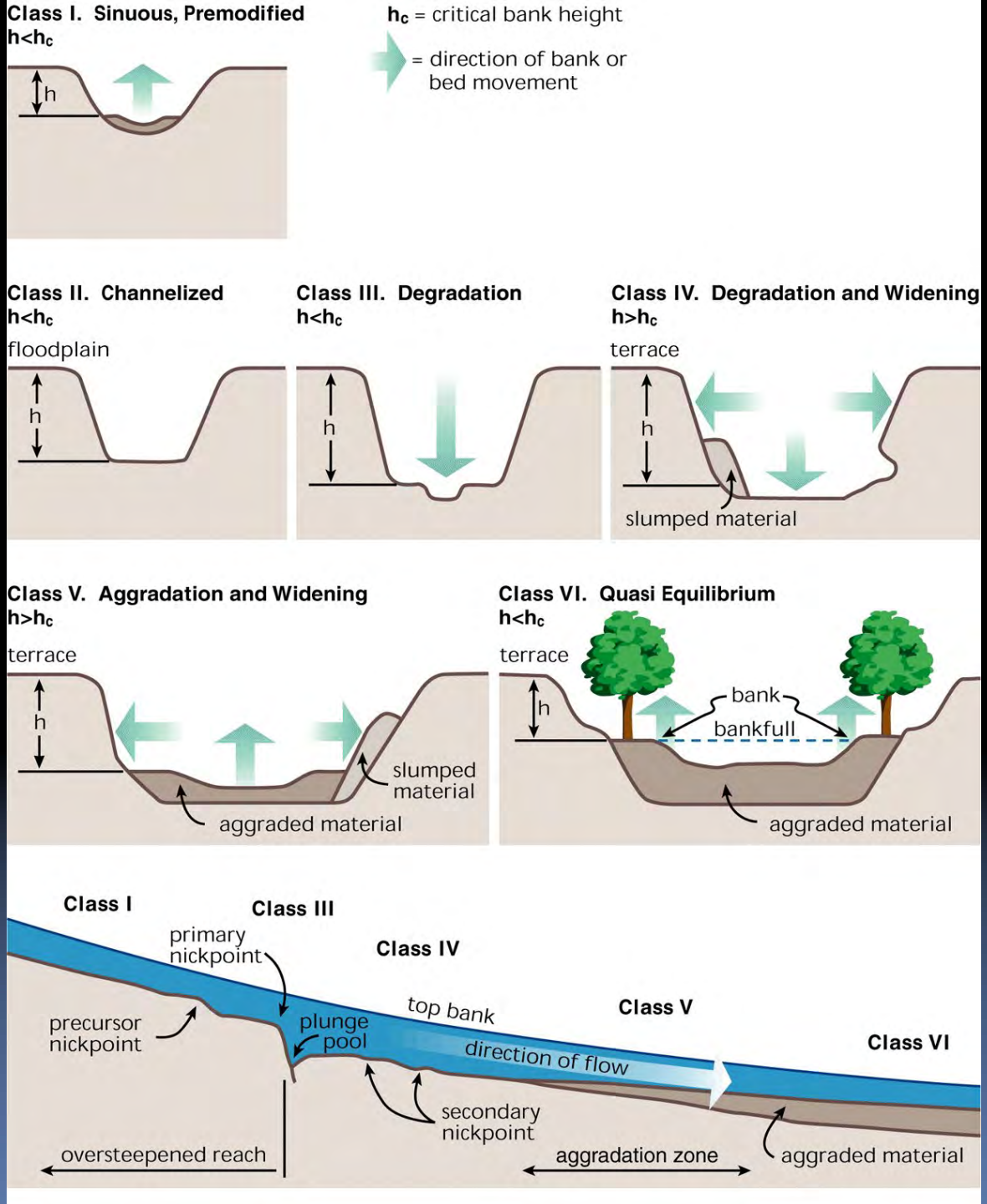
So what does this mean?

# Development and Land Use

- Erosion/sedimentation – WQ, flooding
- Less room for habitat
- Culverts and drainages often replace creeks and floodplains
- Non-native vegetation provides less habitat value

# Development and Land Use

- Creeks in urbanized watersheds often erode their bed and banks. This results in down cutting and over widened channels.


Class I. Sinuous, Premodified
h<hc
h
hc = critical bank height
= direction of bank or bed movement
Class II. Channelized
h<hc
floodplain
h
Class III. Degradation
h<hc
h
Class IV. Degradation and Widening
h>hc
terrace
h
slumped material
Class V. Aggradation and Widening
h>hc
terrace
h
slumped material
aggraded material
Class VI. Quasi Equilibrium
h<hc
terrace
h
bank
bankfull
aggraded material
Class I
Class III
primary nickpoint
Class IV
top bank
Class V
precursor nickpoint
plunge pool
direction of flow
Class VI
secondary nickpoint
oversteepened reach
aggradation zone
aggraded material

# Traditional Responses to Creek "Problems": Channelization

# Erosion Increases and Threatens Property


# Retaining Walls

# Sac-crete

# Rip rap

# Failed Gabion Baskets and Retaining Walls

# Erosion Downstream of Hardscaping

# Failing Culvert

# Impacts of Urbanization

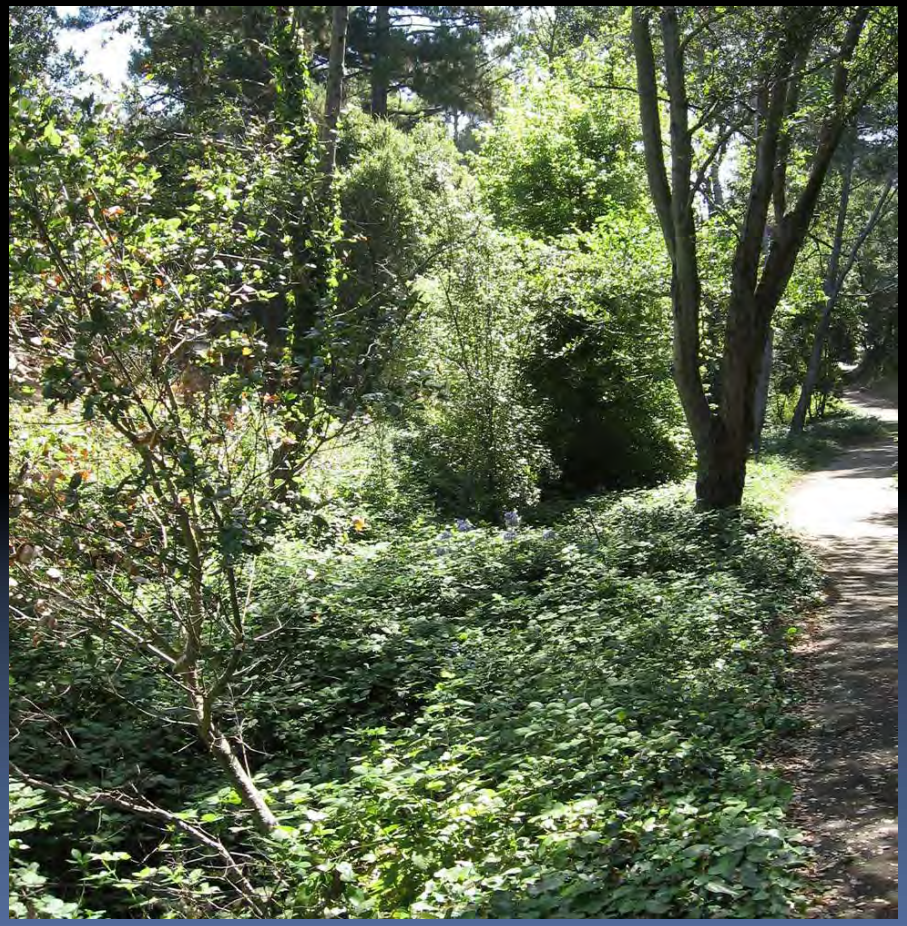
- Higher peak flows mean increased flooding
- Development of floodplains leaves property vulnerable

# Impacts of Urbanization

- Pollution and Trash


# Impacts of Urbanization

- Invasive plants colonize (ivy and blackberry at Canyon Trail Park, El Cerrito)



# Development and Land Use

Overtime an urban creek will stabilize at a with new pattern and active channel dimensions that reflect the new watershed conditions.

Restoration of urban creeks can increase the speed at which this occurs and reduce the risk of damage to property and infrastructure.


ATSU
PC200LC

# Estuaries and Tidal Channels

- Transition areas between Creek and Bay
- Wetlands habitat historically much greater

# Estuaries and Tidal Channels

- Marshes
  - Protect surrounding uplands from floods and waves
  - Capture and store sediment
  - Filters and cleans pollutants from water
  - Provide habitat

# Estuaries and Tidal Channels

- Lagoons
  - Protect surrounding uplands from floods and waves
  - Filters and cleans water
  - Provide habitat