



## Riparian Assessment

*What is a healthy stream?*



## Riparian Assessment vs. Monitoring

- ↔
- Determine stream/riparian health
  - Determine change or trend, especially in response to mgmt



- **Classification** = designation of a specific stream or riparian community with other similar communities and systems.
- **Assessment** – examination of a riparian/stream system to determine its ability to function normally or adequately.
- **Monitoring** = assessment of riparian systems over time to determine change or trend in riparian condition.

## Steps in the right direction...

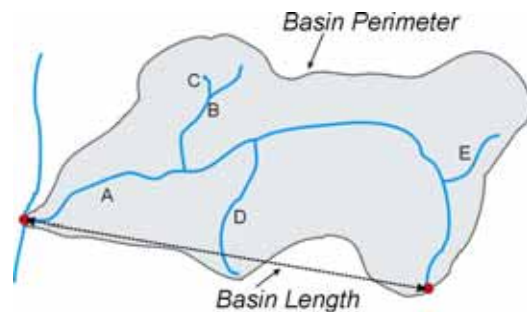
1. **Compile existing information**
  - Maps, aerial photos, stream gauge info, past and present land use & existing data and info from other agencies
  - Define basic watershed & stream characteristics
  - Identify stream reaches of interest
2. **Drainage Basin/ Watershed Characteristic**
  - Use top maps & aerial photos to delineate basin/watershed
  - Basin length = distance from top to bottom of basin
  - Basin relief = difference in elevation from top to bottom of basin
3. **Determine Natural Conditions**
  - Reference reaches of nearby streams
  - Assess natural potential or variability
4. **Determine your objectives**
  - Major concerns, activities, goals
5. **Select an appropriate protocols**
  - Develop a list criteria for stream/riparian health.
  - Search state guidelines or stream classification

## Start by Thinking Big

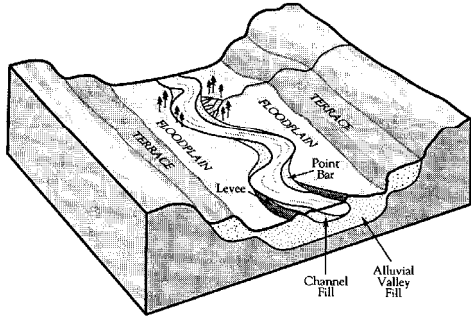
- Landforms & Geologic Material
- Basins & Watersheds
- HUCs (Hydrologic Unit Codes)
- Valley Type



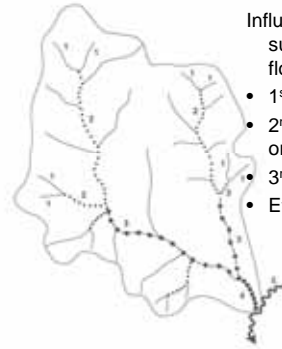
## Drainage Basin/Watershed:



## Stream Valley Morphology



## Stream Order

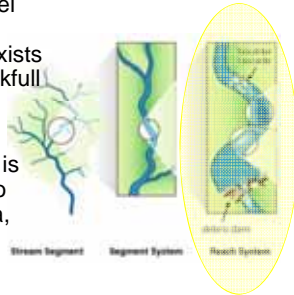


Influences many habitat attributes, such as substrate, algae, floodplains, & large woody debris.

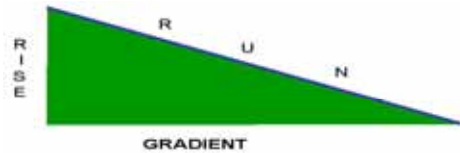
- 1<sup>st</sup> = streams are unbranched
- 2<sup>nd</sup> = stream formed when 2 first order streams run together
- 3<sup>rd</sup> = two 2<sup>nd</sup> order stream join.
- Etc, etc.

## Stream Reach

- A unit length of channel type where the same channel type ideally exists for at least twenty bankfull widths.
- The length of channel is uniform with respect to discharge, depth, area, and slope



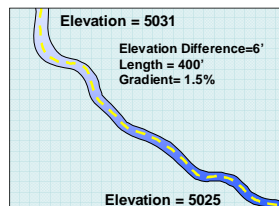
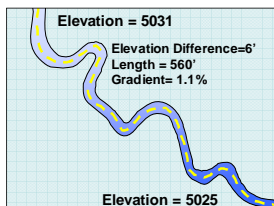
## Stream Gradient



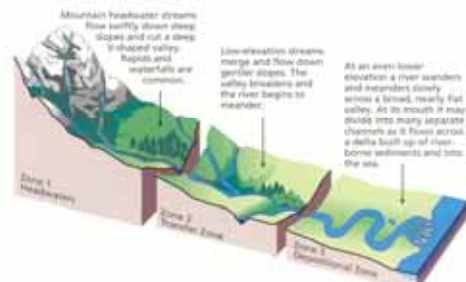
- The general slope, or rate of vertical drop per unit of length of a flowing stream
- "Rise over Run" expressed as a %

## Slope or Gradient

$$\% \text{ Mean Slope} = \frac{\text{Elevation at upper end} - \text{Elevation at lower end}}{\text{Stream channel length}} * 100$$



## Stream Gradient

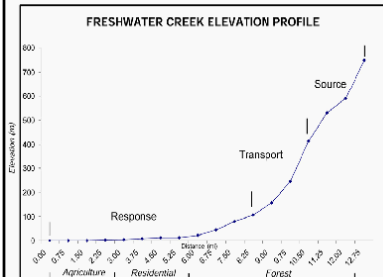


Stream gradient

## Stream Gradient

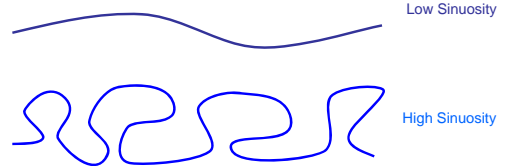
- Gradient breaks:

- < 2% (deposition)
- 2.1 to 4% (deposition & response)
- 4.1 to 8% (response)
- 8.1 to 12% (transport)
- > 12% (source)



## Stream Sinuosity

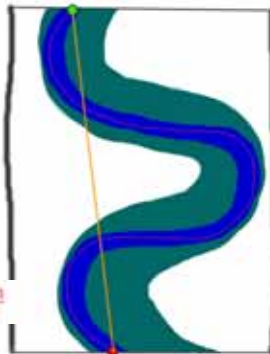
$$\text{Sinuosity} = \frac{\text{Channel Length}}{\text{Valley Length}}$$



## Stream Sinuosity

The degree to which a river or stream bends.

$$\text{Sinuosity} = \frac{\text{Channel Length}}{\text{Valley Length}}$$



## Stream Sinuosity



## Stream Sinuosity



$$\text{Sinuosity} = \frac{\text{Stream Length}}{\text{Valley Length}} = \frac{370'}{195'}$$

## Sinuosity



$$\text{Sinuosity} = \frac{\text{Stream Length}}{\text{Valley Bottom Length}} = \frac{100'}{100'}$$

## Meandering

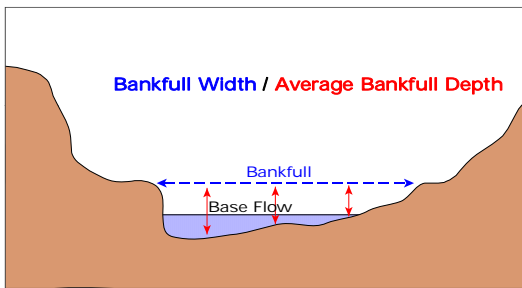


## Width/Depth Ratio

- **Bankfull** = the stage at which the flow that just fills the channel to the top of its banks and at a point where the water begins to overflow onto a floodplain.



## Width/Depth Ratio



## Width/Depth Ratio



## Channel Confinement

- Relationship of the channel to the valley walls

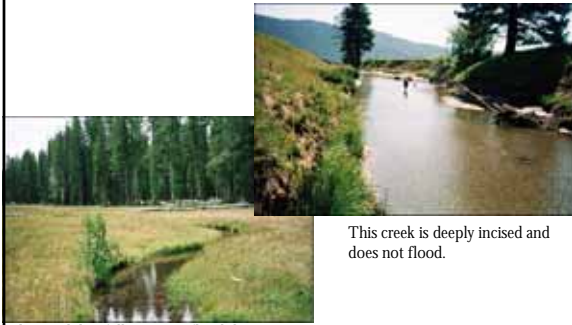


## Channel Entrenchment & Down-Cutting in relation to valley floor

- Aggrading
- Degrading
- Entrenched



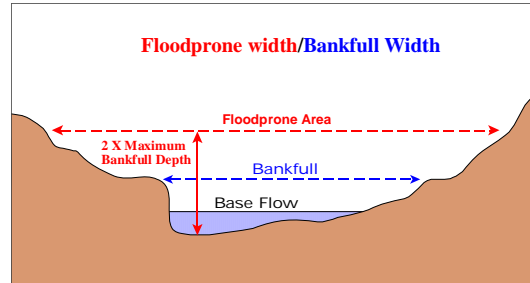
## Access to Floodplain



This creek is deeply incised and does not flood.

This creek has full access to floodplain.

## Entrenchment Ratio



## Channel Lateral Movement

- Not evident
- Avulsion – evident or dramatic movement
- Downcutting or widening
- Progression – progressive lateral movement

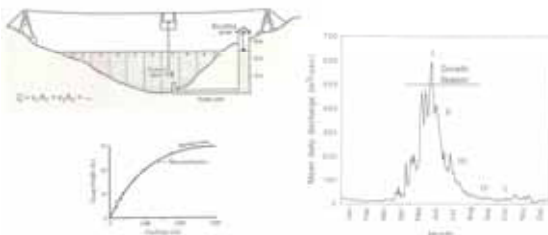


## Stream Duration

- **Ephemeral** – flows in response to precipitation
- **Subterranean** – a subsurface flow follows or intercepts the channel bed
- **Intermittent** – flows seasonally or sporadically (depends on springs, snowmelt, etc.)
- **Perennial** – surface water persists year-long

## Natural Hydrograph

\* Determine Flood Regimes and Average Flows



## Rosgen Stream Classification

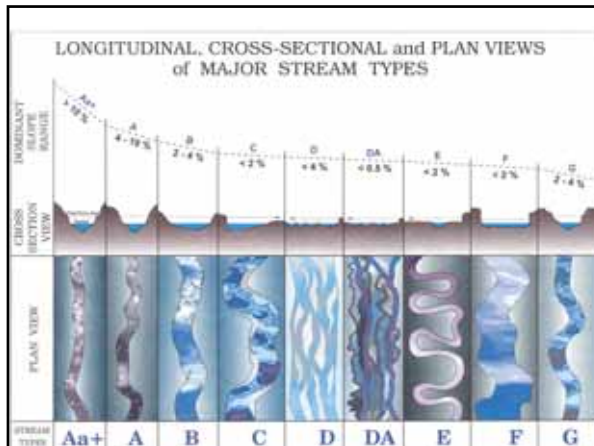
### • Stream Characterization

#### – Channel Pattern

- Single Thread
- Multiple Thread
- Anastomosed (network)
- Channel Slope
- Sinuosity

#### – Channel Characteristics

- Width to Depth Ratio
- Entrenchment Ratio
- Channel Material



## Stream Type Aa+

- Very Steep
- Very Straight
- Deeply Entrenched
- Excessively High Energy & Debris Transport
- Cascading
- Torrent Streams
- Waterfalls and Chutes Prevalent



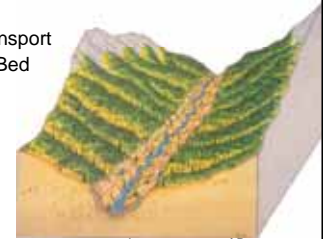
Info from "Fluvial Geomorphology" by SUNY ESF @ <http://www.fgmorph.com/>

## Type Aa+



## Stream Type A

- Steep
- Straight
- Deeply Entrenched
- Cascading
- Step/Pool Sequence
- High Energy/Debris Transport
- Stability Dependent on Bed and Bank



Info from "Fluvial Geomorphology" by SUNY ESF @ <http://www.fgmorph.com/>

## Type A



## Stream Type B

- Moderate Gradient
- Moderate Entrenchment
- Riffles
- Infrequent Pools
- Generally Stable Bed and Banks



Info from "Fluvial Geomorphology" by SUNY ESF @ <http://www.fgmorph.com/>

## Type B



## Stream Type C

- Low Gradient
- Meanders
- Point Bars
- Riffle/Pool Sequence
- Alluvial Channels
- Broad Floodplain



Info from "Fluvial Geomorphology" by  
SUNY ESF @ <http://www.fgmorph.com/>

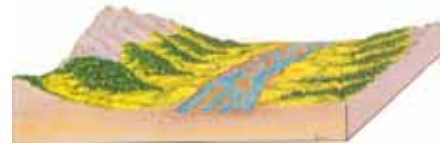
Image courtesy of Rosgen

## Type C



## Stream Type D

- Low Gradient
- Braided Channels
- Longitudinal & Traverse Bars
- Wide Channel
- Eroding Banks



Info from "Fluvial Geomorphology" by  
SUNY ESF @ <http://www.fgmorph.com/>

Image courtesy of Rosgen

## Type D



## Stream Type DA

- Low Gradient and  
Anastomosed
- Braided Narrow and  
Deep Anastomosing  
Channels
- Longitudinal and  
Traverse Bars
- Wide Channel and  
Wetland Floodplain
- Stable Banks



Info from "Fluvial Geomorphology" by  
SUNY ESF @ <http://www.fgmorph.com/>

Image courtesy of Rosgen

## Type DA



## Stream Type E

- Low Gradient
- Low Width/Depth Ratio
- High Meander/Width Ratio
- Riffle/Pool Sequences
- Little Deposition
- Very Stable and Efficient



Info from "Fluvial Geomorphology" by SUNY ESF @ <http://www.fgmorph.com/>

Image courtesy of Rosgen

## Type E



## Stream Type F

- Low Gradient
- High Width/Depth Ratio
- Entrenched Meanders
- Riffle Pool Sequence



Info from "Fluvial Geomorphology" by SUNY ESF @ <http://www.fgmorph.com/>

Image courtesy of Rosgen

## Type F



## Stream Type G

- Moderate Gradient
- Deeply Entrenched
- Gullies
- Step/Pool
- Low Width/Depth Ratio



Info from "Fluvial Geomorphology" by SUNY ESF @ <http://www.fgmorph.com/>

Image courtesy of Rosgen



## Type G



## Rosgen Stream Classification Channel Material (substrate)

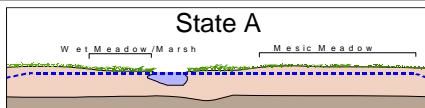
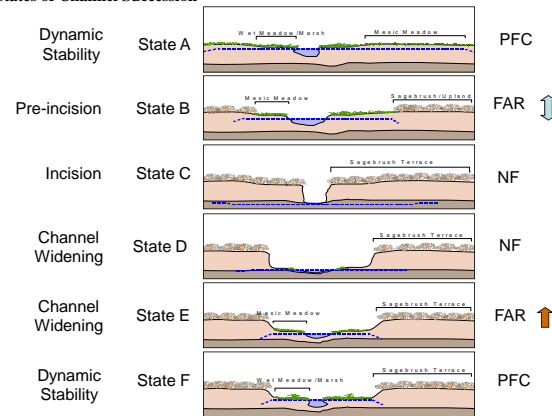
- 1 – Bedrock
- 2 – Boulder (10+ inches)
- 3 – Cobble (2.5 to 10 inches)
- 4 – Gravel (.08 to 2.5 inches)
- 5 – Sand (.062 to 2 millimeters)
- 6 – Silt/Clay (< .062 millimeters)

## Management Interpretations

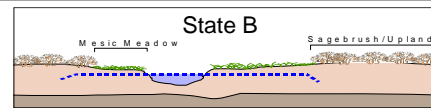
| TYPE | SENSITIVITY TO DISTURBANCE | RECOVERY POTENTIAL | SEDIMENT SUPPLY | STREAMBANK EROSION POTENTIAL | VEGETATION CONTROLLING INFLUENCE |
|------|----------------------------|--------------------|-----------------|------------------------------|----------------------------------|
| A3   | very low                   | excellent          | very low        | very low                     | negligible                       |
| A5   | extreme                    | very poor          | very high       | very high                    | negligible                       |
| B3   | low                        | excellent          | low             | low                          | moderate                         |
| B5   | moderate                   | excellent          | moderate        | moderate                     | moderate                         |
| C3   | moderate                   | good               | moderate        | moderate                     | very high                        |
| C5   | very high                  | fair               | very high       | very high                    | very high                        |
| G3   | very high                  | poor               | very high       | very high                    | high                             |
| G5   | extreme                    | very poor          | very poor       | very high                    | high                             |

Rosgen, 1996

## States of Channel Succession



Sand Creek



Eight Mile Creek



