Channel Morphology Overview

- natural versus constructed (humans, beavers)
- equilibrium versus non-equilibrium
Bartlett Reservoir Main Spillway, 17,000 cfs, Jan 2 2005, Photograph by Bert Duet, USGS
Channel Morphology Influences/Controls

- flows (these have magnitude, duration & frequency)
  - ground water / surface water + exchanges
  - base / low flow
  - flood / storm flows
  - probable maximum flood
- ecosystem
  - flora (micro to mega)
  - fauna (micro to mega)
    - humans (some charismatic)
- substrate
  - rock
  - alluvium / colluvium / soil

photo by CMS
Fossil Creek photo courtesy of APS/N. Berezenko
Other photos by CMS
Channel Morphology Influences/Controls

- sediment budget
  - what is available
  - what enters the system
  - what leaves the system

- geometrics
  - channel gradient
  - constrictions on lateral migration

- lesser factors
  - short-, moderate & long-term geophysical / tectonic events
    - vertical displacement associated with earthquakes
    - uplift
    - subsidence
  - climate, climate change
  - water chemistry
Stream Rehabilitation at Clover Springs
photos by Sean Welch
the morphology of most well-developed channels exhibits a capacity for two sets of lows, low to moderate, and moderate to high...

- low-flow channel – shaped by frequent low- to moderate-magnitude storm flows, e.g., the 2-yr storm, referred to by some as the "bank-full event"
- high-flow channel – shaped by much larger infrequent storm flows that also do a lot more work in terms of sediment erosion, transport and deposition, as well as re-arranging the vegetation and the landscape
Missouri River at Roach Port (Rocheport), MO

from NASA's Scientific Visualization Studio

http://svs.gsfc.nasa.gov/
Stream Classification

• ...a descriptive tool used to systematically organize our observations – usually of stream channel morphology
• ...may or may not be useful as a basis for stream restoration or stream management actions
• ...you will encounter different stream classification schemes depending on where you are working and depending on the orientation and biases of the individuals in charge
Managing Stream Classification Obsession Syndrome

• Here are some references that address some of the pitfalls associated with compulsive-obsessive application of stream morphology classification:


Stream Classification Schemes

• two stream classification schemes in use today:

• both use geomorphic characteristics and physical processes as a basis for classification
Cascade

Step-pool

Plane bed

Pool riffle

Pictures from Montgomery & Buffington, 1997
Step-pool morphology with Travertine steps on Fossil Creek, Photo by Lorrie Yazzie

Figure 3. Schematic longitudinal profiles of alluvial channel morphologies at low flow: (A) cascade; (B) step pool; (C) plane bed; (D) pool riffle; and (E) dune ripple.

from Montgomery & Buffington, 1997
Figure 6. Composite slope distributions for channel reaches surveyed in this and related studies (Buffington, 1995; Montgomery et al., 1995); boxes represent inner and outer quartiles; vertical lines represent inner and outer tenths.

from Montgomery & Buffington, 1997

bedrock (Naco Formation) steps on Fossil Creek, Photo by CMS
Channel Morphology

• ...channel morphology will develop, in part, under the influence of both long-term, frequent, low-magnitude flows, and, high-magnitude, short-term less frequent flows. These high-magnitude flows have the capacity, in the short-term, to undo much of what happens in their absence...

*Cascading flow on the Rio de Flag in historic times. Bottomless Pit, south of Elden Mountain by A.E. Hackett, USGS PP 76, 1913*