Why Classify Streams?
- Communication Tool
- Describe Existing Conditions & Trends
- Describe Restoration Goals
- Research Tool

Stream Classification

Morphologic Stream Classification Systems
- Schumm (1977)
  - Alluvial channels
  - Meandering, straight, braided
  - Type related to channel stability & sediment transport
- Montgomery & Buffington (1993)
  - Alluvial, colluvial, bedrock channels
  - Channel response related to sediment inputs
  - 6 classes of alluvial channels: cascade, step-pool, plane-bed, riffle-pool, regime, and braided
- Rosgen (1994)
  www.wildlandhydrology.com

Rosgen Classification of Natural Rivers
- Based on physical characteristics (empirical)
- Requires field measurements
- Requires bankfull dimensions

What factors affect stream morphology?
- Width
- Depth
- Slope
- Velocity
- Discharge
- Flow resistance
- Sediment size
- Sediment load
Leopold et al (1964)

Level 1 Rosgen Classification

Dimension (cross-section)
Pattern (plan form)
Profile (bed form)
Bed material (substrate)
**Level 2 Rosgen Classification**

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**Riffle Dimensions**

- **W/bkf**: Measure Bankfull Width ($W_{bkf}$) and Bankfull Area ($A_{bkf}$).
- **Mean Depth**: $d_{bkf} = A_{bkf} / W_{bkf}$
- **Width to Depth Ratio**: $W/d = W_{bkf} / d_{bkf}$

**Entrenchment Ratio**

- **ER** = $W_{fpa} / W_{bkf}$
- $W_{fpa}$ = Width of Flood Prone Area measured at the elevation twice bankfull max depth above thalweg
- $W_{bkf}$ = Width of Bankfull Channel

**Bed Material (Substrate)**

- **Silt/Clay**: < 0.062 mm
- **Sand**: 0.062 – 2 mm
- **Gravel**: 2 – 64 mm
- **Cobble**: 64 – 256 mm
- **Boulder**: 256 – 2048 mm
Valley Types: (www.epa.gov/watertrain/stream_class)

Valley Type II
Moderately steep, gentle sloping side slopes often in colluvial valleys

Valley Type VIII
Wide, gentle valley slope with well-developed floodplain adjacent to river terraces

Stream Types in Landscape Positions

A Streams
Incised, Narrow & Deep, Steep Slope Colluvial Valley
A Stream Channel

Single Thread Channel

\[ ER = \frac{W_{fp}}{W_{bkf}} < 1.4 \]

\[ W/d = \frac{W_{bkf}}{d_{max}} < 12 \]

\[ S > 0.04 \text{ ft/ft} \]

A2 Western NC

A2 Montana

Aa+ Streams

Very Steep

(>0.1 ft/ft)

A3 Western NC

A1a+ Western NC
B Streams
Moderately Incised, Wide & Shallow, Moderate Slope, Colluvial Valley

Stream Types in Landscape Positions

B Stream Channel
Single Thread Channel
ER = \( \frac{W_{\text{par}}}{W_{\text{bkf}}} \) = 1.4 – 2.2
\( \frac{W_d}{d_{\text{max}}} = \frac{W_{\text{bkf}}}{d_{\text{max}}} > 12 \)
\( S = 0.02 – 0.04 \) ft/ft
C Streams
Not Incised, Wide & Shallow, Low Slope
Alluvial Valley

C Stream Channel

Single Thread Channel
ER = \( \frac{W_{\text{fp}}}{W_{\text{bkf}}} > 2.2 \)
W/d = \( \frac{W_{\text{bkf}}}{d_{\text{max}}} > 12 \)
S < 0.02 ft/ft

Stream Types in Landscape Positions
E Streams
Not Incised, Narrow & Deep, Low Slope Alluvial Valley

E Stream Channel
Single Thread Channel
ER = \( \frac{W_{upa}}{W_{bak}} > 2.2 \)
\( \frac{W}{d} = \frac{W_{bak}}{d_{bak}} < 12 \)
\( S < 0.02 \text{ ft/ft} \)
G Streams
Incised
Narrow & Deep
Moderate Slope
G Stream Channel

Single Thread Channel

\[ \frac{W_{fpa}}{W_{bkg}} < 1.4 \]

\[ \frac{W_{fpa}}{d_{bkg}} < 12 \]

\[ S = 0.02 - 0.04 \text{ ft/ft} \]

Stream Types in Landscape Positions

G4 Western NC

G4 Eastern NC

G5 Headcut

Georgia
**F Streams**

Incised, Wide & Shallow, Low Slope

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**F Stream Channel**

Single Thread Channel

\[ ER = \frac{W_{ba}}{W_{bdf}} < 1.4 \]

\[ \frac{W}{d} = \frac{W_{bdf}}{d_{bdf}} > 12 \]

\[ S < 0.02 \text{ ft/ft} \]

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**Stream Types in Landscape Positions**

www.wildlandhydrology.com
D & DA Streams
Multiple Channels, Wide & Shallow, Low Slope

D Stream Channel
Multiple Thread Channel
ER = $\frac{W_{fpa}}{W_{bkf}} > 2.2$
W/d = $\frac{W_{bkf}}{d_{bkf}} > 40$

Stream Types in Landscape Positions

D4 Virginia

D4 Georgia

D4 New Zealand
ER=11; W/d=16; S=0.004; D50=1 mm

ER=1.3; W/d=7; S=0.007; D50=1.5 mm

ER=2.2; W/d=14; S=0.024; D50=75 mm

ER=1.5; W/d=10; S=0.009; D50=2 mm