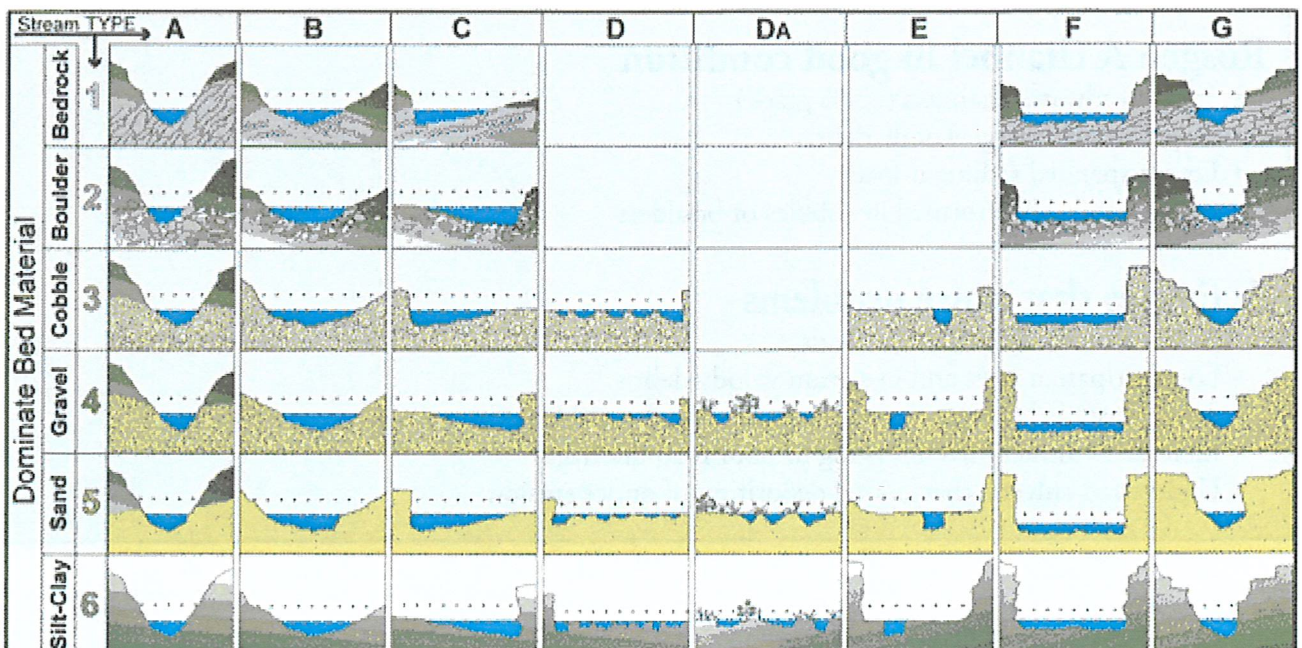
ROSGEN STREAM CLASSIFICATION

Chapter 2 introduced the concepts of stream form and function. Appendix 1 describes the geomorphic characteristics and relative stability of Rosgen stream types. The Rosgen Stream Classification System is widely used and useful for categorizing stream types based on form, which is dicated by physical processes. This system divides channels into seven main types (A to G).

The reason for classifying streams based on form (channel morphology) is to help understand stream condition and potential behavior under the influence of different types of changes. Rosgen stream classification helps to:

- Predict behavior of a river from its appearance
- Develop specific hydraulic and sediment relationships for a given stream type and relative stability
- Provide a system to apply knowledge from one stream reach to stream reaches having similar characteristics
- Provide a consistent frame of reference for communicating stream morphology and condition among a variety of disciplines



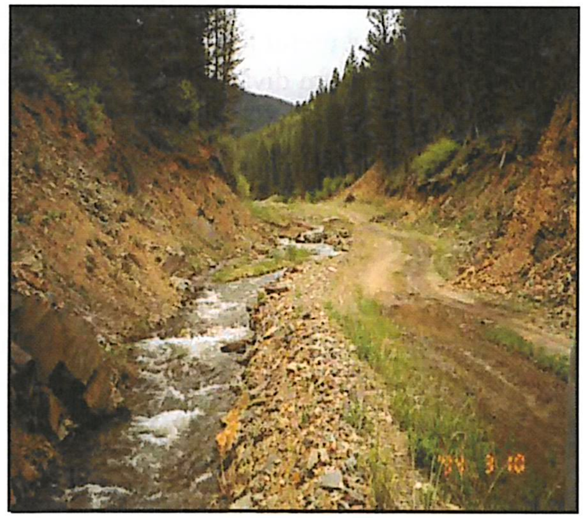
Stream TYPE	A	B	C	D	DA	E	F	G
Entrchmnt.	< 1.4	1.4 - 2.2	> 2.2	n/a	> 4.0	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 40	< 12	> 12	< 12
Sinuosity	1 - 1.2	> 1.2	> 1.2	n/a	variable	> 1.5	> 1.2	> 1.2
Slope	.04-.099	.02-.039	< .02	< .04	< .005	< .02	< .02	.02-.039

Applied River Morphology . Pagosa Springs: Wildland Hydrology Books, 1996. www.wildlandhydrology.com

ROSGEN TYPE A STREAM

Good Condition

Poor Condition



Rosgen A channel in good condition

- Steep headwater channels (> 4% grade)
- Step/pool with large woody debris
- Low suspended sediment load
- Quite stable when formed in cobbles or boulders

Activities that cause problems

- Sidecast road fill from forest roads
- Loss of riparian trees and in-stream woody debris
- Poorly installed culverts (too steep or too long) that block fish passage
- Increased sediment from logging or poor road drainage
- Undersized culverts that caused deposition of outlet erosion

ROSGEN TYPE B STREAM

Good Condition

Fair Condition

Poor Condition

Rosgen B channels

- Fairly steep (greater than 2% grade)
- Can be wide and shallow (width-to-depth ratio greater than 12)
- May be fairly stable, especially when formed in large cobbles
- Frequently have irrigation diversions serving pastures lower in the valley
- Can provide important spawning habitat for fish

Stable B channels can adjust

- B channels can move lots of cobble and gravel at peak flow
- Channels may aggrade or degrade, or erode banks
- Instability is not usually caused by minor land-use changes or channel projects
- Geology plays an important role in structural changes
- Vegetation also plays an important role in channel stability

B channels can be unstable

- Instability can be inherent where bedload transport is high
- Ice jams and debris jams are frequent in these locations
- Irrigation diversions and stream crossings should avoid constricting the channel
- Woody debris can provide important fish habitat, and should be left if possible

ROSGEN TYPE C STREAM

Good Condition: moderate lateral channel movement, stable stream banks and channel form

Fair Condition: signs of channel adjustment including eroding banks, increased width to depth ratio, and sediment deposition in channel

Poor Condition: accelerated bank erosion, high width to depth ratio, migrating channel location, large and irregular sediment deposits

C channels are common

- Typically meandering streams in broad valleys with cottonwood-willow riparian corridors
- Can be wide and shallow
- May be fairly stable when banks and flood-plain are well vegetatedThe floodplain is active (floodprone)
- Provide important fisheries habitat

C channels are sensitive

- Carry large amounts of sediment during peak flow
- Rely on vegetation to maintain a stable width-to-depth ratio
- Lateral bank erosion up and downstream can be accelerated by poorly designed projects
- Soft bioengineering should be considered a substitute for hard methods such as rip-rap

C channels are dynamic systems

- Channel meanders migrate naturally over time
- Restricting meander or bank movement is usually counter-productive to channel stability
- Development of frequent mid-channel bars indicates reduced stability
- Attempts at channelization can lead to severe instability

C Channel Restoration

- Restoration of C channels should endeavor to enhance the plan, profile, and geometry of natural systems, including floodplain function and riparian vegetation
- Photos show the "poor condition" stream was restored to "good condition" using bioengineering; woody vegetation has not yet matured
- In general, hard armoring that restricts meander movement should be avoided

ROSGEN TYPE E STREAM

Good Condition

Fair Condition

Poor Condition

E channels are narrow and deep

- Commonly a strongly meandering stream in agricultural areas
- Low width-to-depth ratio (less than 12)
- Slope is gentle (< 2% grade)
- The floodplain is active (floodprone)
- Fairly stable when banks and floodplain are well vegetated
- Sedges and rushes often provive stability in place of riparian shrubs and trees
- Can provide important fisheries habitat

E channels are sensitive to land use or hydrology

- Channels rely on vegetation to maintain a stable width-to-depth ratio
- Lateral bank erosion up and downstream can be accelerated by poorly-designed projects
- Loss of vegetation or overgrazing can result in conversion to a wider and shallower C channel
- Soft bioengineering should be considered as a substitute for hard methods such as rip-rap
- Photos show the "poor condition" stream was restored to "good condition" using bioengineering

E channels are common in pasture and agricultural areas

- Grazing and confined animal operations can have significant impacts on channel health.
- Road approaches to stream crossings may dike floodplains if fill is elevated.
- Hard bank stabilization can often be avoided by use of vegetative methods.
- Use of barbs/vanes should be avoided.
- Degraded E channels may heal quickly if allowed to revegetate.

ROSGEN TYPES D, F, & G STREAMS

D channel

F channel

G channel

D channels are braided and unstable

- Braided channels have poor lateral bank stability and scour depths can be extreme
- Braided channels carry large amounts of bedload gravel
- Design of stream crossings or channel restoration is difficult
- Stream crossings should avoid braided reaches
- C channels risk becoming D if disturbed by land use or other factors

F channels typically have high unstable banks

- Photo to the left shows E channel becoming established in a former F
- F channels are deeply incised or downcut, and meandering
- May develop in response to severe impacts (channelization, overgrazing, augmented flows), or be natural remnants of climate change
- Challenging to repair, and usually cannot be restored to former floodplain

G channels are typically characterized as gullies

- Found on alluvial fans, downcutting channels, or severely disturbed stream systems
- Can deliver large amounts of sediment to downstream reaches
- Rock weirs may help with grade control.
- Revegetation efforts may meet with limited short-term success

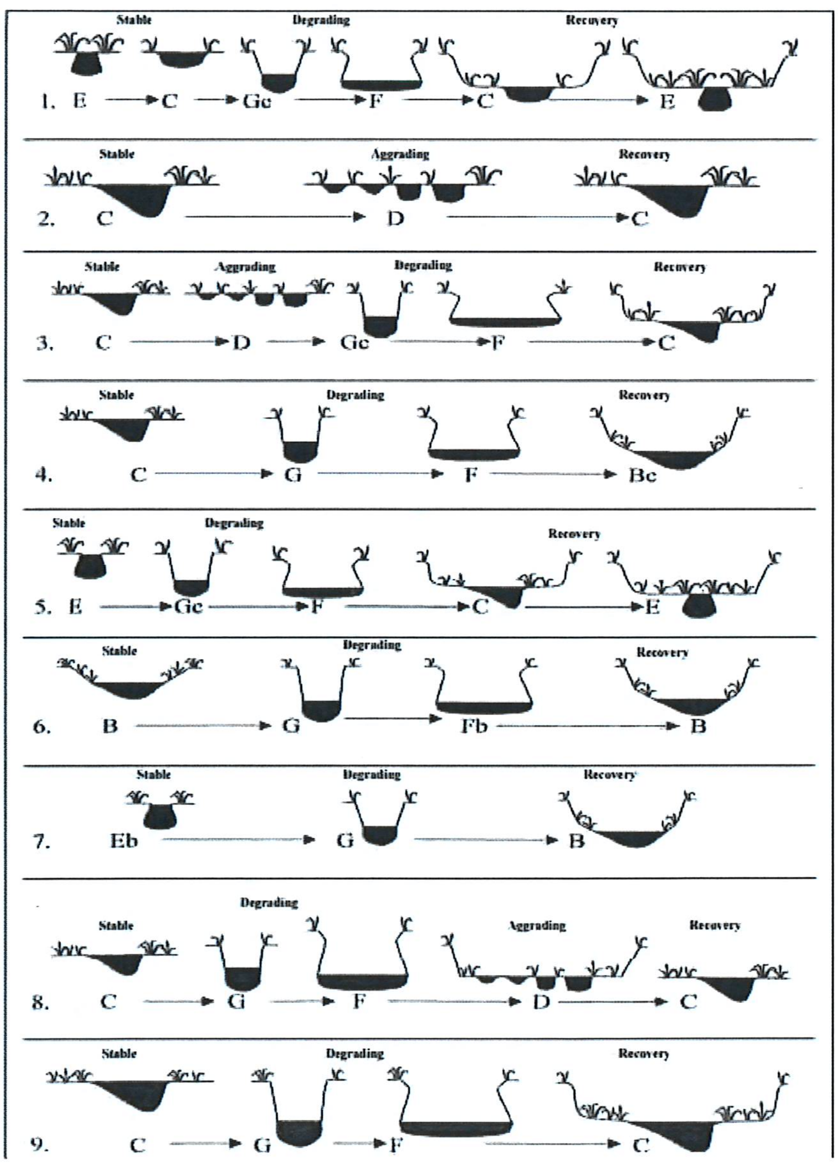
CHANNEL EVOLUTION OF ROSGEN STREAM TYPES

Interpreting Channel Stability Through Channel Evolution

Understanding streambank stability often requires an interpretation of geomorphic process. Stream channels commonly adjust to environmental stresses by changing bed elevation, width-to-depth ratio, channel form, and other morphometric variables. The process can commonly involve conversion from one channel type to another, and sometimes recovery to the original channel type occurs over time. Channels may also convert to a new type. Processes of scour and fill enable to channels to adjust to their environment. Understanding the existing stream condition is important for project design.

The diagram below illustrates several common scenarios for the stream channel adjustments. These adjustments frequently involve widening or deepening of the channel in response to land-use changes. Reestablishment of equilibrium conditions may result when environmental stress is relieved. Active restoration can be beneficial to accelerate this process.

Rosgen Channel Evolution by Stream Type



Common examples of four potential evolutions/progressions in stream type are shown above. These are examples of degradation, aggredation, and equilibrium process.