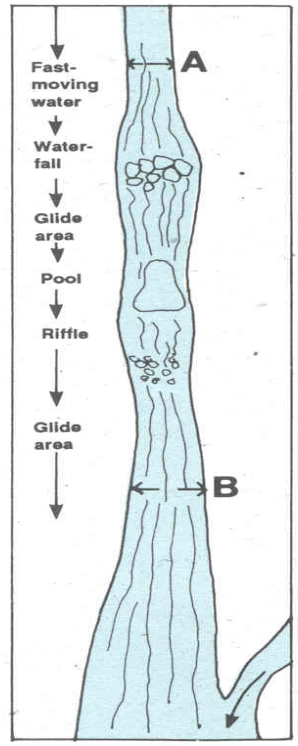
# Stream Dynamics

*"Physical characteristics of the stream influence water quality and the type and variety of habitat that is available to support aquatic life"* (Michaud 1991, p. 28).



*Source: Michaud 1991, p. 28.*

Stream velocity – a measure of the water's speed. A fast-moving stream is usually more turbulent than a slow-moving stream. The speed and extra turbulence give the water the force to scour the stream bottom and banks and pick up sediment and other material. The faster the stream is moving, the larger the materials it can pick up and carry with the current. Algae and other organisms cannot live in a stream that is moving too fast because of this strong scouring force.

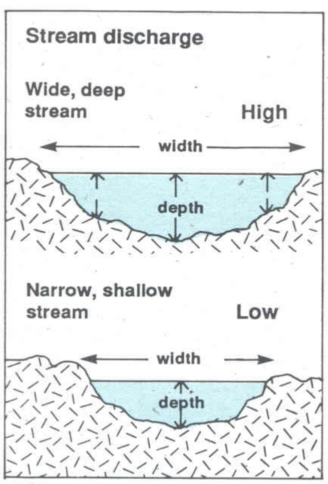
Stream velocity changes within stream segments: in wide or deep channels velocity decreases. The velocity also is much greater on the outside of the curve channel than on the inside. The difference is often so great that while the force on the outside of the curve is strong enough to be cutting away at the bank, the force on the inside is so small that material is deposited along the bank.

Stream depth – determines the formation of pools, riffle, and glide areas.

*A pool* forms in deeper segments while *riffles* form in shallow areas.

*A glide* is the smooth, fast-moving area that often separates pools from riffles.

Depth determines how much sunlight reaches the stream bottom, which in turn determines whether organisms that require light, such as algae, can grow there. Exposure to the air where water can pick up more oxygen is good, but too much exposure to the sun can be harmful if water temperature increases too much.



*Source: Michaud 1991, p. 29.*

Stream width – the narrower the stream, the greater the influence of streamside vegetation. Bankside vegetation keeps temperatures cooler by creating shade, and provides places for fish and other organisms to hide.

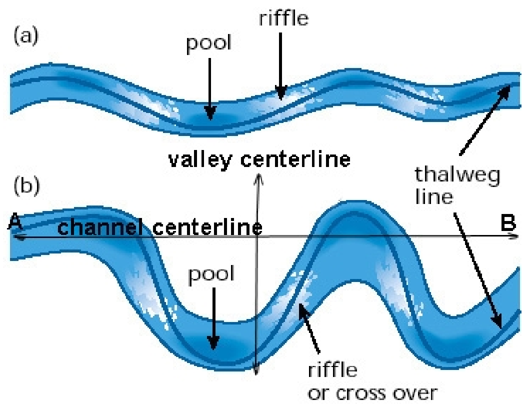
Shoreline shape and character – the shape and character of the shoreline affects how water moves past it, what vegetation grows there, and the type of habitat available.

Stream discharge – total volume of water in the stream. It is a function of the cross-sectional area of the stream (width and depth), and the velocity. A wide, deep stream will have a greater discharge than a shallow, narrow stream, assuming their flow velocity is the same (Michaud 1991, p. 29).

Reference:

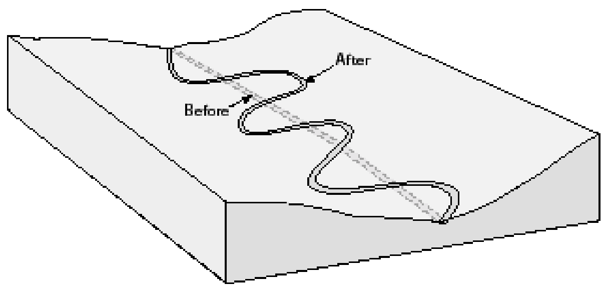
Michaud, Joy P. 1991. A Citizens' Guide to Understanding and Monitoring Lakes and Streams. Washington State Department of Ecology. Publication # 94-149. 66 p.

Natural channels are rarely straight. Sinuosity is a term indicating the amount of curvature in the channel.
The *sinuosity* is computed by dividing the channel centerline length by the length of the valley centerline. In other words, sinuosity is the stream length between two points on a stream divided by the valley length. For example, if a stream is 2,200 feet long from point A to point B, and if a valley length distance is 1,000 feet, then stream has a sinuosity of 2.2. If the channel length/valley length ratio is more than about 1.3, the stream can be considered meandering in form (Stream Corridor Restoration 1998, p. 1-27).
The differences in flow velocity distribution in meandering streams result in both erosion and deposition at the meander bend. Erosion occurs at the outside of bends (cutbanks) from high velocity flows, while the slower velocities at the insides of bends cause deposition on the point bar (which also has been called the slip-off slope).




Sequence of pools and riffles in (a) straight and (b) sinuous streams. Pools typically form on the outside bank of bends and riffles in the straight portion of the channel where the thalweg crosses over from one side to the other.
*Source: Stream Corridor Restoration 1998, p. 1-29.*

The angular momentum of flow through a meander bend increases the height or super elevation at the outside of the bend and sets up a secondary current of flow down the face of the cutbank and across the bottom of the pool toward the inside of the bend. This rotating flow is called helical flow (Stream Corridor Restoration 1998, p. 2-24).
Areas of highest velocities generate the most stream power. As flow moves through a meander, the bottom water and detritus in the pool are rotated to the surface. This rotation is an important mechanism in moving drifting and benthic organisms past predators in pools. Riffle areas are not as deep as pools, so more turbulent flows occur in these shallow zones. The turbulent flow can increase the dissolved oxygen content of the water and may also increase the oxidation and volatilization of some chemical constituents in water (Stream Corridor Restoration 1998, p. 2-25).




Transformation of a straightened stream into a meandering one to reintroduce natural dynamics improve channel stability, habitat quality, aesthetics, and other stream corridor functions or values.
*Source: Stream Corridor Restoration 1998, p. A-19.*

Stream Meander Restoration:

- Creates a more stable stream with more habitat diversity. Stream corridors function as dynamic crossroads in the landscape. Water and other materials, energy, and organisms meet and interact within the corridor. This movement provides critical functions essential for maintaining life such as cycling nutrients, filtering contaminants from runoff, absorbing and gradually releasing floodwaters, maintaining fish and wildlife habitats, recharging ground water, and maintaining stream flows.
- Requires adequate area where adjacent land uses may constrain locations. A meandering stream requires larger valley length than a straight stream.
- Streambank protection might be required on the outside of bends due to erosion and deposition at the meander bend.

Reference:


Stream Corridor Restoration: Principles, Processes, and Practices. 1998 (revised 08/2001). The Federal Interagency Stream Restoration Working Group. http://www.usda.gov/stream_restoration