Straight stream channels are rare and require a narrow set of circumstances to maintain dynamic equilibrium in a natural setting. Like all other open systems, streams adjust their form to minimize the expenditure of energy. This includes pool-riffle patterns and meanders that help maintain an equilibrium condition. Meander formation demonstrates the principle of cause and effect. The cause is the force applied by moving water and sediment and the effect is the shape of stream channel.

To describe the process of meander formation, the distinction between the meander flow or discharge centerline and the channel centerline is important. As illustrated in **Figure 3.1.6**, the channel centerline (effect) lags the discharge flowline (cause). The flow in a stream does not progress in straight lines parallel to the stream channel. Rather the flow is comprised of a primary flow oriented downstream and transverse flows oriented perpendicular to the primary flow. Along the discharge flow path, these inward and outward transverse flows are balanced. However, along the channel flow path, there is considerable asymmetry. Because of the variable turbulence and secondary flow patterns, the flow velocity, sediment transport and boundary shear stress are nonuniform across the channel. These areas of turbulence produce alternating pulses of sediment, scour, and deposition.

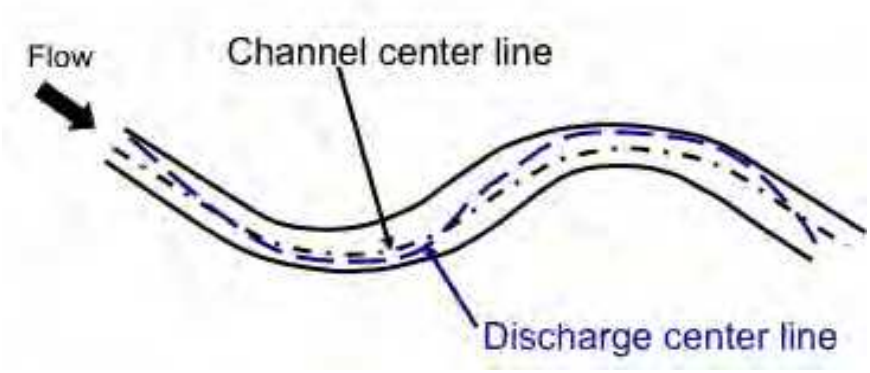

Figure 3.1.6. Mechanics of Meander Creation

Areas of scour and deposition alternate along the axis of discharge flow producing a pool along the outer bend and a corresponding point bar on the inner bend. As the pattern of scour and deposition from one side of the channel to the other, the thalweg (deepest portion of the channel cross section) and maximum flow velocity cross over the center of the channel. These cross-over points become the riffles. The alternating pattern of bar building and bank scour causes straight streams to evolve into meandering ones with a sinuous pattern. Specifically, this is how channelized reaches eventually reacquire a sinuous shape.