In streams containing heterogeneous media and in confined channels, the meander pattern is interrupted by variations in bank structure, infrastructure, confluences, geologic features, and channel manipulation. Streams out of equilibrium also display distortions in meander pattern and growth. Nevertheless, the fundamental relationships describing these patterns remain applicable.

Because the peak stress is just downstream of the apex of each bend, meander waveforms migrate downstream. In stable streams, the meander migration generally occurs at a rate that does not affect infrastructure. However, accelerated migration may pose a substantial risk. A rapid increase in sediment load delivered from an incising or widening reach upstream is the most likely trigger for accelerated migration in Sugar Creek.

### 3.1.5 Profile Analysis

Sugar Creek flows through some reaches with clay beds and others with sand beds. Although the clay bed can and does downcut, the sandbed reaches are more prone to rapid incision. A profile analysis reveals reaches where, by virtue of bed slope and material strength, incision is likely. Abrupt changes in channel profile indicate areas where incision is occurring now or where the degradation is arrested by manmade or natural structures. In Sugar Creek, woody debris jams are the most common natural structures restraining the advance of incision. The advancing front of incision is known as a knick point or where slope changes are slightly less abrupt, knick zone. It is especially important to identify and manage incision because it usually precedes processes that are more destructive.

Some designers consider sediment transport competency for major projects by establishing a sediment budget to analyze sediment movement through the designed intervention. More sophisticated techniques include computer based analyses. For small projects, it is usually difficult to justify a sophisticated model. The designer, however, can achieve a basic understanding of sediment transport competency and erosion hazard from data and analyses used to determine water surface elevations. The designer estimates area of erosion and deposition from the continuity of the stream power or boundary shear stress. Routines in the hydraulic models calculate stream power and boundary shear stress. The values of either stream power or boundary shear stress are plotted against the longitudinal profile. The designer compares the zones of highest and lowest values to his field observations of size and distribution of bed material and the location of scour and erosion. The designer then establishes threshold values from these observations. Improved sediment transport competency results from using these threshold values in design. Boundary shear stress is the product of density, depth and slope. The designer predicts areas of scour and erosion by comparing the boundary shear stress to the shear resistance of the bed or bank toe materials. The shear resistance for granular materials is calculated using empirical relationships. The shear resistance for cohesive materials is usually compared to measured or tabulated values.