Whether intended to stabilize a failing bank, arrest incision or dispose of waste, the dumped material in the stream in general is not effective in improving stream stability and in some cases aggravates the instability. It may also degrade water quality and cause culvert/bridge bloackage.

The natural response to incision in this region is the development of woody debris jams. As trees and shrubs fall into the creek, the woody debris is distributed throughout the system forming a pool and riffle system. The debris jams generate the profile form that manages energy. The jams reinforce the bed and increase the hydraulic roughness dissipating erosive energy. The backwater effect of the jams lowers the hydraulic gradient for low flows. The critical shear resistance for woody debris is estimated at 3 psf. While debris jams may contribute to local flooding, they also reinforce local stability. Removal of debris jams without reinforcing the bed usually leads to incision, widening, or meandering.

Vegetation

The riparian corridor of Sugar Creek is in variable condition with some areas densely forested and others denuded. While there are many stands of mature trees remaining, the stream has incised below the root zone for most of the watershed. In stable, natural streams trees populate the banks near the water line. The vigor and integrity of riparian vegetation plays an important role in the physical, chemical and biological health of stream systems. Diverse stands of healthy native vegetation process and sequester pollutants, attenuate the volume and timing of surface runoff, moderate soil moisture, and increase the shear strength of streambanks. By adjusting the rate of evapotranspiration as plant-available moisture varies, trees and shrubs moderate the extremes of soil moisture and help maintain optimum moisture for soil strength. Because Sugar Creek has incised roughly 8 to 10 feet in its mid and lower reaches, the stream is cut off from the riparian corridor and the connection between surface water and the adjacent uplands (**Figure 3.3.20**) are damaged reaches where the vegetation has been removed are far more prone to gully formation.

3.4 Hydraulics

The hydraulic model estimates flows, velocities, and water surface elevations for a series of flow events. Although it was not specifically developed to determine geomorphic processes, analysis of the results can be used to interpret observations and to index calculated applied tractive shears. The average applied shear was calculated for each segment modeled. A segment is the reach between two cross-sections. The locations of cross-sections were chosen for hydraulic modeling prior to field observations of geomorphic process. The average depth and slope between the cross-sections were used to calculate the reach average shear. Actual applied shear will vary over the segment as a function of depth, hydraulic slope and density of the water which is influenced by suspended particles and temperature.