Framework for quantifying flow and sediment yield to diagnose and solve the aggradation problem of an ungauged catchment

Sagar Tamang (2), Wenjun Song (1), Xing Fang (1), and Jose Vasconcelos (1)

(1) Auburn University, Department of Civil Engineering, United States (xing.fang@auburn.edu), (2) St. Anthony Falls Laboratory, Department of Civil, Environmental and Geo-Engineering, University of Minnesota, Minneapolis, Minnesota USA 55414

Estimating sediment deposition in a stream, a standard procedure for dealing with aggradation problem, is complicated in an ungauged catchment due to the absence of necessary flow data. A serious aggradation problem within an ungagged catchment in Alabama, USA, blocked the conveyance of a bridge, reducing the clearance under the bridge from several feet to a couple of inches. A study of historical aerial imageries showed deforestation in the catchment by a significant amount over a period consistent with the first identification of the problem. To further diagnose the aggradation problem, due to the lack of any gauging stations, local rainfall, flow, and sediment measurements were attempted. However, due to the difficulty of installing an area-velocity sensor in an actively aggrading stream, the parameter transfer process for a hydrologic model was adopted to understand/estimate flow. Simulated discharge combined with erosion parameters of MUSLE (modified universal soil loss equation) helped in the estimation of sediment yield of the catchment. Sediment yield for the catchment showed a significant increase in recent years. A two-dimensional hydraulic model was developed at the bridge site to examine potential engineering strategies to wash sediments off and mitigate further aggradation. This study is to quantify the increase of sediment yield in an ungauged catchment due to land cover changes and other contributing factors and develop strategies and recommendations for preventing future aggradation in the vicinity of the bridge.