

Computational Methods for Determining Effective Discharge in the Yazoo River Basin, Mississippi

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Abstract. The Demonstration Erosion Control (DEC) project was established to develop, test, and monitor methods and structures used to control flooding, sediment transport, and bank failure in the Yazoo River Basin, located in central Mississippi. Primary methods utilized by the DEC project include grade control structures and flow control reservoirs. Hydrologic data are extremely important in stable channel design, as well as the design of grade control structures.

Prior to the 1960's, it was widely believed that infrequent flow events were responsible for channel formation. In 1960, Wolman and Miller presented evidence against the concept of infrequent events and presented the idea of an effective force. This concept was later termed effective discharge by Andrews in 1980. The definition and determination of effective discharge is often disputed. Bankfull discharge and the two-year discharge have also been associated with the effective discharge. As a result, the determination of effective discharge includes frequency analysis, bankfull analysis, and flood frequency analysis. Determination of effective discharge for the DEC sites would be an important aspect in the design of these methods and structures.

Data obtained from thirteen gauged sites in the Yazoo River Basin were instrumental in the determination of effective discharge. Based on these limited hydrologic records, several methods were developed to determine the effective discharge at twenty-three study sites within the Yazoo River Basin. Procedures and data were developed to analyze and create flow-duration relationships. Sediment transport relationships were developed for total sediment load and total bed material load for thirteen USGS gauging stations within the DEC watersheds. Effective discharge calculations were made using the following data: 15-minute discharge data, total suspended load, and bed material load.

Calculated effective discharges transported a range of 47% to 67% of the total sediment yield and were within the published error range of $\pm 44\%$ of the two-year discharge. The Q_{eff}/Q_2 ratio ranged from 0.4 to 1.2 ($\mu=0.8$, $\sigma=0.4$). From the results of this study a general set of guidelines for determining a design discharge for the Yazoo River Basin, Mississippi was developed.

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