

Effects of bendway weir characteristics on resulting eddy and channel flow conditions

Kristoph-Dietrich Kinzli

Civil Engineering Department, Colorado State University, Fort Collins, Colorado 80523

Abstract. Natural processes associated with rivers lead to meandering, degradation of the channel, erosion of banks and the migration of river bends. Traditionally, armor protection and longitudinal structures have been used to prevent river migration. In the last twenty years bendway weirs, a type of transverse structure, have been used to prevent river migration and concurrently create aquatic habitat.

River rehabilitation along the Middle Rio Grande has become necessary due to changes in morphology resulting from the installation of the Cochiti Dam. Cochiti Dam has trapped nearly all river sediment causing a 29-mile reach downstream to shift from a traditionally braided system to a meandering system. The agency responsible for the rehabilitation of the 29-mile reach is the United State Bureau of Reclamation. Plans for rehabilitation include the use of bendway weirs. Past projects utilizing bendway weirs have relied on field experiences and engineering judgment rather than specific design guidelines.

Based on the need of bendway weir design equations, the United States Bureau of Reclamation commissioned a model study at the Hydraulics Laboratory of the Colorado State University Engineering Research Center. To study resulting flow conditions from the placement of bendway weirs an undistorted 1:12 Froude scale, hard boundary model was constructed. The model contained two bends representative of bends found in the Middle Rio Grande study reach. Three dimensional velocities were recorded for a series of tests in which weir length, weir angle and weir spacing were varied.

Using data obtained from the test series two equations were developed to predict eddy velocities and two equations were developed to predict velocities at the toe of installed bendway weirs. Equations relate the velocity found after bendway weir installation to bendway weir design characteristics and pre-weir channel conditions. Utilizing the developed equations a designer is able to predict velocities in eddies and velocities at the toe of bendway weirs using only weir design variables and pre-weir channel conditions.