# Alphabet Weir Physical Modeling

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**Abstract.** In-stream weir structures can provide energy dissipation, increase aquatic habitat, allow fish passage, and relieve pressure on failing banks. The scope of the study includes A-, U-, and W- weirs. The Pacific Northwest region designs and constructs numerous structures every year for fish passage and habitat restoration as part of the Salmon Recovery Project (FCRPS). The Middle Rio Grande, River Maintenance Project is exploring alternate means to stabilize banks by reducing flow velocity along eroding banks. Information on the design and performance of these structures is largely anecdotal based on empirical professional experience without the engineering rigor required for duplicability. Site specific design requires a substantial design effort that in some cases can consume more resources than construction. There is little systematic information on how well these structures meet project goals. A research proposal by the Technical Service Center seeks to streamline the design process, increase understanding of the performance of the structures, and improve the chances for successfully meeting management objectives. Previous testing identified development of a downstream scour pool as the dominant failure mechanism. Testing is currently being conducted at the Colorado State University Engineering Research Center on three different types of weirs (U, A, and W), with three different bed materials (5-mm, 9.8-mm, and 15-mm), and three different discharges (1/3, 2/3, and bankfull discharge). The end product of the scour quantification process will relate the formation of the scour hole to parameters identifiable through 1D hydraulic modeling. Data obtained from the physical model will assist in three ways: 1) Dimensions of the scour hole cannot be identified through current computer technology and scientific observation. Physical modeling will directly measure the scour hole under controlled conditions. 2) Water surface profiles will be used to develop and validate techniques for modeling the structures in HEC-RAS under 1D flow conditions. Current 1D equations apply to other types of structures and assume a position fully perpendicular to the flow. Structure specific empirical coefficients and relationships account for energy losses. 3) 3D velocity measurements will provide calibration points to validate structures simulated using numerical models. Numerical models allow Reclamation to explore additional configurations for less cost than a physical model.

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