PREDICTING FISH PASSAGE DESIGN FLOWS AT UNGAGED STREAMS IN EASTERN WASHINGTON

Abstract

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An estimated 2,400 to 4,000 hydraulic structures are barriers to fish passage in Washington State. Many are culverts inadequately sized for fish passage. Recently, the Washington Department of Fish and Wildlife established statewide guidelines to incorporate fish migration into culvert design by providing two approaches: stream simulation and hydraulic design.

Stream simulation involves designing culverts to be wider than the natural channel under bank-full conditions. The hydraulic design option requires culverts to satisfy minimum depth and maximum hydraulic drop constraints ranging from 0.8 to 1.0 ft and permissible velocities from 2.0 to 6.0 ft/sec depending on salmonid species and culvert length. The permissible velocity criterion is to be met during the fish passage design flow.

A new model is presented for estimating fish passage design flows at ungaged streams in Eastern Washington. The model is founded on two key concepts: a unique definition of fish passage design flow and an area based approach for estimating this flow at ungaged streams.

The fish passage design flow was developed by combining the concepts of allowable fish delay, established to be 3 days, with a consecutive day analysis. This design flow ensures that fish are not delayed for more than 3 consecutive days during a water year.

A fish passage design flow per unit area is assigned to previously delineated subwatersheds in Eastern Washington. Similarity relationships, derived from basin characteristics, relate USGS gaging stations to subwatersheds in Eastern Washington. These relationships form the basis for assigning a value of fish passage design flow per unit area to each subwatershed in Eastern Washington.

The percent standard error for this model was calculated as 36%. This is a significant improvement from the 75% standard error calculated for the model that previously addressed fish passage design flows in Eastern Washington.