CASE STUDY: EVALUATION OF CHANNEL FORMING DISCHARGE IN THE JOCKO RIVER WITH CALIBRATED SEDIMENT TRANSPORT FUNCTIONS.

Mitch Price, Water Resource Engineer, P.E., River Design Group, Inc. 5098 Highway 93 South Whitefish, MT 59937 (406) 862-4927. mprice@riverdesigngroup.net

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Abstract:

Channel forming discharge is an important design parameter in river restoration projects. Use of field-based and analytical methods for estimating channel forming discharge can provide a range of values that reduces design uncertainty. This case study presents an evaluation of effective, or channel forming discharge for the Jocko River near Missoula Montana using sediment transport functions calibrated with measured bedload and suspended sediment data.

A tributary to the Flathead River in Northwest Montana, the Jocko River is a snowmelt-hydrology dominated gravel-bed alluvial system draining a catchment area of nearly 380 square miles with a bankfull discharge up to 1,000 cfs and is the highest priority restoration effort by the Confederated Salish and Kootenai Tribes in Montana. The Jocko watershed is also a core area for the threatened bull trout and supports a relatively healthy population of westslope cutthroat trout, a Tribal Species of Special Consideration. Restoration measures to date have primarily targeted the lower reaches of the Jocko River ecosystem which have been substantially disturbed by agriculture, irrigation, livestock grazing, transportation infrastructure, and residential and commercial development. These and other water quality impacts have destabilized much of the river and impaired bull trout and westslope cutthroat trout habitat, particularly downstream of the town of Arlee, MT.

In support of restoration design and implementation efforts within the Jocko River corridor, bedload and suspended load measurements were collected at multiple sites over a period of three years. More specifically, sediment data were used to 1) monitor sediment supply reduction achieved by restoration efforts; 2) increase confidence in field-calibrated bankfull discharge estimates by computing effective discharge; and 3) verify analytically-derived estimates of incipient motion with measured data. This case study focuses on the evaluation of effective, or channel forming discharge. To estimate the channel forming effective discharge within the study reach, grain size specific bed material transport functions based on a reference shields stress were stochastically calibrated to measured sediment data and combined with bed shear frequency/duration synthesized using a one-dimensional gradually varied hydraulic model. Results were compared with other methods for computing channel forming discharge including regional equations, analysis of gage data, and field-calibrated geomorphic indicators. In support of ongoing restoration efforts, continued sediment sampling is being used to refine transport equations for use in a one-dimensional sediment transport/routing model to evaluate reach scale trends in transport continuity and channel aggradation/degradation.