

Channel-forming discharge on the Dolores River and Yampa River, Colorado

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Abstract. Channel-forming discharge can be defined as a range of discharges that determines the shape and form of an alluvial channel, and therefore also determines the available habitat for fish. In this study we estimated channel-forming discharge for two study sites on the Yampa River and one site on the Dolores River in Colorado via four different methods and compared the results with results from previous studies. The Dolores River is regulated by a major dam, and the Yampa River is impacted by grazing and diversions.

The first method estimated the bankfull discharge utilizing GPS survey data, GIS mapping and HEC-RAS modeling to determine the flow that begins to inundate the floodplains or reaches the top of banks. The second method (applied only on the Yampa River) determined the effective discharge using discharge and sediment data at USGS gaging stations to determine the flow that transports to most sediment over a long period of time. The third method involved development of flood-frequency curves from annual peak flow data and determination of the two-year frequency flow. The final method estimated the flows necessary for marginal transport and for significant motion of the bed material using the Shields equation and the average boundary shear stress. On the Dolores River, the flow that inundates most of the floodplain areas, and the flow that begins to mobilize the bed material are in the range of 2,600 to 3,400 cfs corresponding to 1.8 to 2.5-year frequencies in the post-dam flow regime. On the Yampa River, the flow that inundates most of the floodplain areas and the flow that begins to mobilize the bed material range 11,000 to 13,000 cfs (2.5 - 5.4-year frequency), however the effective discharge on the Yampa River was estimated to be 8,100 cfs (1.4-year frequency). The discrepancy between bankfull and effective discharge on the Yampa differs from previous studies that suggested that bankfull and effective discharges are equivalent.