

Morphodynamics of riffle-pool sequences in the middle Elwha River, Washington

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Abstract. Quasi-regular sequences of vertical bed undulations known as riffles and pools are common to many gravel-bed rivers and are often forced by width variations. They are ecologically important features for a number of aquatic biota. The natural genesis and maintenance of riffle-pool sequences remains poorly understood. There is also much uncertainty in how these morphological units respond to certain disturbances such as large fluctuations in sediment supply. The Elwha River restoration project and associated removal of Glines Canyon Dam provides a natural setting for an experiment to explore how large increases in sediment supply affect downstream riffles and pools. Here we present results from bathymetric/topographic surveys conducted in September 2014 and June 2015 on a reach of the middle Elwha 1 km in length and located approximately 5 km downstream from the former Glines Canyon Dam site. The surveys were combined with airborne lidar flown in October 2012 and February 2015 to create two continuous surface models. Differencing of the two surveys reveals an increase in meandering and bed aggradation. The elevation models were used as input for two-dimensional hydrodynamic modeling to aid in the delineation of riffle and pool units. During winter 2014-2015 pool area decreased while riffle area increased. Hydrodynamic modeling also indicates that a shear stress reversal between low and high flows may be responsible for the maintenance of riffle and pool units in this reach.