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Using bathymetric LiDAR and 2-D hydraulic modeling to map riverine aquatic habitat

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Advances in the ability to map river bathymetry using airborne LiDAR have made it feasible to numerically represent river hydraulics over long reaches (> 15 km) using two-dimensional (2-D) hydraulic modeling. Applications of 2-D river hydraulics include sediment transport, flood routing, evaluation of various in-stream structures, and habitat evaluation. In September 2004 and April 2005 airborne LiDAR bathymetry (ALB) was acquired on the Yakima River (Washington, USA) at 2 x 2 meter spot spacing. Prior to using ALB data for hydraulic modeling an analysis of data quality was performed. This analysis showed that mean error and standard deviation were within manufacturer's specifications and, following a data adjustment for systematic error, was sufficient for numerical modeling of aquatic habitat. The initial modeling effort evaluated pool, glide, and riffle habitat with the Froude number and side channel habitat availability under a range of discharges. The overarching goal of this analysis was to evaluate how discharge affected the availability of these habitat types. Further analysis included numerical modeling of spawning habitat. It was found that the model could determine appropriate hydraulic conditions for spawning using the Froude number. Although numerical representation of spawning habitat is promising, the results are preliminary. This type of analysis can be greatly enhanced with knowledge of spatial variations in bed material composition and locations possessing a vertical head gradient (upwelling/downwelling). Future habitat evaluation using ALB and 2-D hydraulic modeling is currently in the planning phase. This effort will more rigorously apply model results by constructing habitat polygons with a 1 x 1 meter resolution using a combination of depth, velocity and distance to the edge of water to quan-

tify habitat availability at various discharges. Results of the modeling effort will be verified with water surface elevations and velocity measurements using an acoustic Doppler current profiler. Additional model verification will use field-surveyed habitat polygons at randomly chosen locations using depth and velocity measurements and measurements to the edge of water. Information from these analyses can be applied toward determination of minimum in-stream discharges or flow prescriptions for regulated rivers or provide valuable habitat information related to a variety of in-stream structures or habitat diversity for planned rehabilitation efforts.