River Morphology/Stability Analysis and Fish Habitat/Population Significance[AFS]

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Stability of rivers is key to understanding their physical and biological function and their "potential" state. Corresponding relations of habitat quality and fish population dynamics are directly related not only to stream type, but to stability as well. River stability (equilibrium) is defined as the ability of a stream, over time, in the present climate, to transport the flows and sediment produced by its watershed in such a manner to maintain its dimension, pattern and profile without either aggrading nor degrading. To predict and verify river stability involves a quantitative effort of assessment involving numerous measurements and prediction methods. The prediction level (III) and validation level (IV) are presented that allows the assessor to determine the nature, magnitude, cause and consequence of instability. The methodology involves prediction and validation to document the nature and rates of; bank erosion, aggradation, degradation, enlargement, lateral accretion, successional scenarios and associated stages, down-valley meander migration, changes in sediment competence and capacity, changes in river hydraulics, and riparian vegetation/channel interactions. Fish habitat assessments and population data will be presented demonstrating the importance of understanding river types and their state or condition. As biologists are often expected to improve the fisheries resource, it is imperative to integrate river morphology and stability with the biological assessments in order to make management recommendations and/or conduct restoration/enhancement. Detailed procedures for measurement and analysis are presented involving existing characteristics of channel properties including their dimension, pattern, profile, materials, sediment and hydraulic relations. This is done on both impacted and reference reaches. Reference reach data is assessed to document stability indices of the

stable form in order to complete a departure analysis of disturbed river systems. Reference reach data is also used to establish a range of morphological variables amongst stable rivers of a particular type and to establish dimensionless ratios for application in natural channel design. Example departure and potential condition analyses completed on disturbed stream reaches in the Prospect and Grave Creek drainages in western Montana are presented. Both study reaches have deviated significantly from their potential state, resulting in accelerated lateral erosion, channel widening, down valley meander migration, and subsequent meander abandonment. The predicted channel succession sequence has resulted in impaired channel form and function in both systems, reducing the availability of complex fish habitat for resident and migratory fish species. Example design plans and stream restoration applications are presented for the Grave Creek study reach. Pre- and post-construction effectiveness monitoring data are presented demonstrating the benefit of stream restoration applications to migratory adult bull trout habitat.