Characterization and Quantification of Historic Gunnison River Streamflows and Potential Applications in Regulated River System Management

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Abstract. Combined effects of water resource development in the Colorado River Basin have contributed to the decline in native fish populations, prompting the U.S. Fish and Wildlife Service to list four native fish species as endangered. A recovery program is endeavoring to formulate integrated flow recommendations for the Colorado River system to enhance conditions for and lead to recovery of endangered fishes. Managing regulated river systems for natural resource and societal needs requires streamflow variation with attributes and at timescales that are both ecologically and operationally relevant for the naturalized river system. The challenge is to determine what types of and ranges in streamflow variation are necessary and tolerable, as well as at what timescales, and to restore those characteristics to the river system to benefit endangered fishes, and allow flexibility in dam operations to meet all statutory purposes (e.g., water supply, hydropower, and flood control.

Characterizing streamflows typically involves application of established hydrologic methods to entire flow records to derive basic statistics, such as mean and standard deviation, which describe general characteristics and behavior of the aggregated streamflow record, allowing relative comparisons of flows for the period of record. The approach is well suited for engineering applications, such in design of dams or flood frequency studies, since the goal is often to assess general characteristics of the aggregated data, and determine flow levels of interest for the project purpose. However, the same approach and methods alone do not sufficiently characterize streamflow variability needed for integrated flow recommendations that constitute streamflow features reflective of natural river system dynamics, and yet are appropriate for the naturalized system. A more applicable approach was needed to exact further streamflow features and variability attributes.

Framing a more applicable analytical approach for flow recommendations began with accounting for: (1) the context and content of a river system relative to the purpose of the study, (2) streamflow data characteristics and limitations, (3) available methods and applications, and (4) information needs. A framework approach was then set up to address the following:

(a) Would data at smaller time increments better describe short-term flow variability;
(b) Are periodic data methods more appropriate for characterizing flow sequences;
(c) Do streamflows of similar hydrologic year types behave similarly;
(d) How do unregulated vs unregulated conditions compare; and
(e) What applications may the results have on regulated river system management?

This paper summarizes results for unregulated and unregulated streamflows, and discusses potential applications for Gunnison River management and operations of the Aspinall Unit.