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Climate Variability and Water Management Decision-Making on the Colorado River

The Colorado River Basin experienced the worst 5-year drought in the past 100 years from 2000 through 2004. The unregulated inflow into Lake Powell over this period was just about one-half of average, with 2002 being the worst year on record at just 25% of average. Fortunately, the reservoir system was nearly full at the onset of the drought and the U.S. Bureau of Reclamation (Reclamation) was able to meet all of its delivery requirements in the Lower Basin during that period. In 2005, inflow to Powell was 105% of average, certainly an improvement over the preceding years. This, coupled with unprecedented inflow in the Lower Basin in 2005, resulted in a gain in system storage of about 5 million acre-feet, which offset the decrease in storage seen in 2004. Although the forecasted 2006 April through July runoff to Lake Powell was near average through March of this year, it is clear that the actual runoff will be below 70% of average, indicating that this drought is not over. Furthermore, demands on the system continue to increase. These increasing demands, coupled with the variability in climate that we have seen in the past century and the potential for even higher degrees of variability in the future, indicate that we are indeed entering in an “era of limits” on the Colorado River and prudent water management will be key to meeting demands in the future.

When assessing the impact of current and future decisions, hydrologic modeling is used to assess the potential impacts of each decision to various resources. The major uncertainty is this modeling exercise lies in the assumption of future inflows into the system. In past long-range planning efforts, Reclamation has relied on the Index Sequential Method (a method that uses the historical natural flow record as a surrogate for the future) to quantify this uncertainty. Research is being conducted to investigate other techniques for postulating future inflow sequences, including parametric and non-parametric stochastic methods. In particular, recent research indicates that the additional knowledge of historical variability can be used by employing a “k nearest neighbor” technique to resample natural flow data consistent with paleo-state information deduced from tree-ring studies. A similar technique might also use future state information deduced from climate models.