Water Management on the Colorado River: From Surplus to Shortage in Five Years

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On Jan. 16, 2001, then-Secretary of Interior Bruce Babbitt approved a set of rules to manage surplus water supplies in the Colorado River Basin. These Interim Surplus Guidelines (ISG) were motivated by the other basin states' desire to curb water use by California, which had exceeded its allocation of river water for many years. The new rules provided a way of gradually enforcing the state's water allocation before water shortages emerged as a more urgent threat under future water use scenarios.

Few imagined the transition from surplus to shortage planning would occur so soon, as basin-wide storage dropped from 94 to 50 percent of capacity from 1999 to 2004 due to the combination of increased demand and five consecutive years of below-average inflow into Lake Powell. Despite the river's notorious over-allocation, this rapid reservoir decline threatened to diminish hydropower production and led to the first-ever water shortage in the basin.

In 2000, the U.S. Bureau of Reclamation utilized its long-range planning river operations model, the Colorado River Simulation System, to project future reservoir levels under different surplus alternatives. Because the five-year dry period from 1999 to 2004 has no precedent in the instrumental streamflow record, the model projections did not simulate any water supply scenarios that resembled the actual reservoir declines that occurred from January 2001 to April 2005, when Lake Powell hit its 37-year low.

Striving for Consensus on Shortage

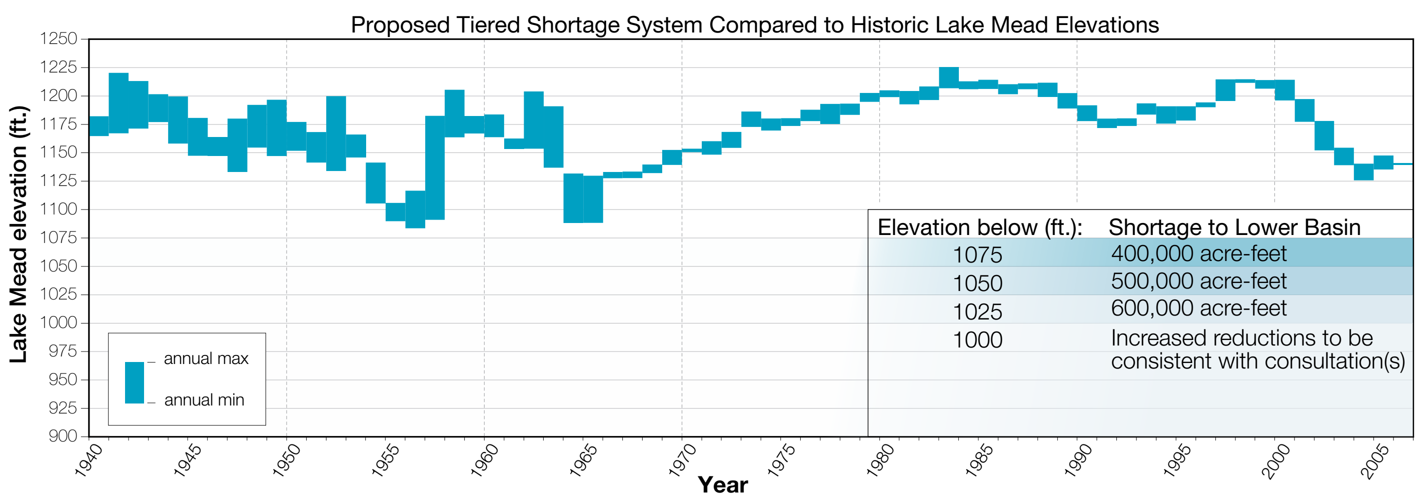
By spring 2004, declining reservoir storage prompted then-Secretary of Interior Gale Norton to urge the seven Colorado River Basin states to begin informal discussions about shortage to avert crisis-driven decisions. The ensuing negotiations have forced Colorado Basin water managers and users to reconsider elements of the ISG and several other long-standing legal, operational, and water-use issues. In June 2005, Norton initiated a public process in conformance with the National Environmental Policy Act (NEPA) to develop both shortage guidelines and management criteria for coordinating operations of lakes Powell and Mead during low-reservoir conditions. As part of the planning process, Reclamation is preparing an Environmental Impact Statement (EIS) for a range of alternative operating scenarios (see timeline at right).

Costly Litigation Temporarily Averted

The NEPA process has advanced toward a shortage plan that could avert costly litigation among the states. On Feb. 3, 2006, all seven basin states approved a preliminary shortage management proposal. This was the product of two years of public and closed-door technical meetings where operations and policy alternatives were examined using the Colorado River Simulation System.

The preliminary proposal attempts to juggle competing demands for the river water and avert a rupture of the complex legal and operational rules that are collectively referred to as the Law of the River. If approved, the shortage proposal would remain in effect through 2025 and would:

- Coordinate reservoir management in lakes Powell and Mead to protect Upper Basin reservoir capacity and hydropower production in Lake Powell during early years of low reservoir conditions, while providing some relief to the Lower Basin's reservoir capacity in Lake Mead during later phases of shortages.
- Administer a tiered system of escalating Lower Basin annual shortage volumes according to Lake Mead elevations (see table below).
- Discontinue use of the "partial domestic surplus" designation under the 2001 ISG guidelines, thereby preventing surplus water deliveries from Lake Mead when reservoir levels fall below 1,145 feet in elevation.



Proposed tiered shortage system for the Lower Basin, showing the annual quantity of shortage proposed in the basin at various reservoir elevations, compared to historic elevations. The distribution of such shortages among Lower Basin states and Mexico is being discussed as part of ongoing negotiations. Source: Seven Basin States' Preliminary Proposal Regarding Colorado River Interim Shortage Operations, Feb. 3, 2006.

- Delay discussions on "catastrophic" Lower Basin shortages (greater than 600,000 acre-feet per year). Such shortages would trigger a set of emergency consultations.
- Temporarily augment supplies for water-strapped Nevada to delay controversial Virgin River diversions.

This preliminary agreement bodes well for a consensus among the seven states, and it has already triggered changes to the scope of analysis for the NEPA process. Reclamation released an EIS scoping document on March 31, 2006, that expands the scope to consider a credit system that would provide Lower Basin states with a mechanism to store "intentionally created surpluses" in Lake Mead during relatively wet years for use during shortage conditions.

In Arizona, discussions regarding intrastate shortage issues continue because the junior priority of Central Arizona Project water during shortages makes the state relatively more vulnerable than the other basin states. Shortages in Arizona will require interpretations of water contracts to address competing priorities among Central Arizona Project water users and water users along the river. The next major step is for Reclamation to release its draft EIS in late summer 2006 in anticipation of a record of decision in December 2007.

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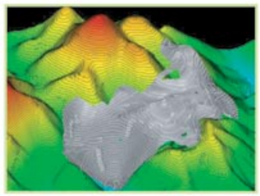
Arizona's Shortage Planning History

Jan. 2001	Former Secretary of Interior Bruce Babbitt signs Record of Decision for Interim Surplus Guidelines
May 2004	Arizona Department of Water Resources (ADWR) initiates Shortage Sharing Stakeholder Workgroup
Dec. 2004	Secretary Norton establishes April 2005 deadline for consensus plan from seven states
Apr. 2005	Deadline passes without consensus shortage plan; on April 8, 2005, Lake Powell reaches 37-year low before rebounding slightly in summer 2005
May 2005	Secretary Norton conducts first-ever midyear review of the Lower Colorado River Annual Operating Plan and determines no changes are needed from "normal" operating plans
June 2005	*Federal Register* notice announces start of public process to develop management protocol during "low reservoir conditions"
July 2005	ADWR initiates series of five meetings in five weeks for Shortage Sharing Stakeholder Workgroup to review modeling scenarios and develop intrastate shortage sharing agreement
Sept. 2005	*Federal Register* publishes notice of intent to prepare Environmental Impact Statement for shortage guidelines
Feb. 2006	Seven states meet deadline for consensus preliminary proposal
Sept. 2006*	U.S. Bureau of Reclamation aims to release Draft Environmental Impact Statement on shortage guidelines
Dec. 2007*	Secretary of Interior intends to sign Record of Decision for shortage guidelines

* Anticipated Dates



ON THE GROUND (continued)

Lessons Learned from Restoration Practitioners

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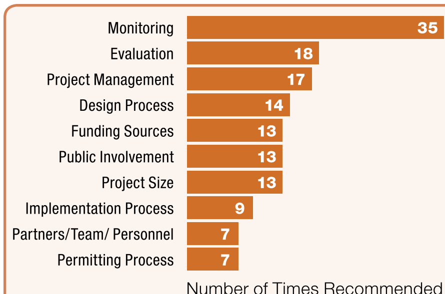
This is the final article of a 3-part series.

In the last issue of *Southwest Hydrology*, we reported that the roughly $1 billion spent on restoration in the Southwest has supported more expensive projects with more monitoring activity relative to the rest of the country. Here we share the lessons restoration practitioners have learned, as we discovered through standardized telephone interviews with 48 individuals associated with projects across Arizona, Colorado, New Mexico, and Utah.

Most interviewees would have made some changes to the way restoration projects were conducted, although the vast majority of interviewees considered their projects successful. Most of the desired changes related to project monitoring (see chart and table). Interviewees would have measured more variables, increased the duration of monitoring, or conducted pre-project monitoring if constraints such as limited funding and staff had not existed.



The distribution of improvements to the restoration process, by category, as suggested by 48 restoration practitioners in telephone interviews.

Improved collaboration and communication between project partners were cited by interviewees as a means to improve project management. Interviewees also noted that projects ran smoothly if a single, well-organized individual served as manager throughout the project duration and established clear roles for participants. Adaptability was cited as a key characteristic of effective project implementation, especially in the face of changes in project design or environmental conditions.

Almost one-third of interviewees would have preferred greater citizen participation during the restoration process, although citizens were involved to some degree in 82 percent of projects. A third of interviewees would have improved project evaluation by developing criteria for success prior to project implementation, more rigorously analyzing monitoring data, or establishing a formal evaluation program that included independent review.

Palmer and others (2005) recently published five standards for judging the ecological success of restoration. Projects must demonstrate:

- the establishment of a guiding image for restoration to the least degraded and most ecologically dynamic state possible;
- measurable improvement of ecological condition based on success criteria established prior to project implementation;
- system resilience and self-sustainability so that little or no project maintenance is required;
- avoidance of lasting harm inflicted upon the ecosystem during project construction; and
- pre- and post-project assessment, with data made publicly available.

A comparison of survey responses to these standards produced mixed results. Most interviewees stated that project goals and restoration sites were most often selected to stem ecological degradation as opposed to other motivations, but only a few described a post-restoration system that would support a mosaic of stream habitats and varied ecological and physical processes. The majority of interviewees reported that success criteria had been established before projects were carried out, but less than 10 percent based project success on the fulfillment of these criteria. Many interviewees observed improvements—usually in abundance —to fish, plants, and wildlife, and more than half used monitoring data during the project evaluation process. Almost three-quarters of interviewees noted that ongoing project maintenance was needed, indicating that restoration efforts should focus more on the promotion of resilient, self-sustaining systems. Determining whether lasting harm has been inflicted downstream of restoration sites is difficult because the cumulative effects of multiple restoration projects within a single watershed are rarely quantified. However, interviewees reported that the impact of construction was often mitigated by installing silt fences, avoiding the use of heavy equipment when possible, and preserving intact vegetation. Although pre- and post-project monitoring was conducted for the majority of projects surveyed, it rarely included reference sites. Multiple parameters were measured for most projects, often for two or more years. Yet, just one-quarter of interviewees of projects with monitoring data sent reports of monitoring results to funding or regulatory agencies.

Our evaluation of survey results with respect to the suggested standards reveals that restoration practitioners can improve the likelihood of ecological success by:

- articulating success criteria in quantifiable terms prior to project implementation and describing a range of desired conditions;
- reducing the maintenance needed to sustain projects by prioritizing projects located in areas where supportive ecosystem processes are intact or by using innovative design and materials;
- promoting ongoing coordination of regional restoration activities;
- collecting pre-project baseline or reference-site data that mirrors post-project monitoring;
- evaluating projects by reviewing pre- and post-project monitoring data in relation to the established success criteria; and
- reporting monitoring data to funding and regulatory agencies that compile restoration information in publicly available databases.

Category	Lessons
Project management	"Many practitioners think problems are mainly technical … [It also is important to] develop backgrounds in law, politics, negotiation, and business management."
Partners	"A broad team of advisors should be involved in all phases of a [restoration] project."
Public involvement	"Get as many stakeholders involved at the outset of the project and make sure all stakeholders are viewed as equals."
Costs	"The difference in project cost is not great when comparing costs associated with designing a project for best ecological gain versus just getting by, so why not shoot for best ecological gain?"
Design process	"Experimental treatments for project implementation would have created more opportunities to learn from the project."
Implementation process	"Restoration takes a long time to be effective, so it is important to watch natural processes and work with them."
Monitoring	"It is important to set up a monitoring program prior to project implementation."
Evaluation	"Do baseline inventories so project outcomes can be quantified."
Needs	"There is a great need for monitoring data to be accessible online in order to better facilitate the design process for future projects."

Examples of lessons learned, as stated by restoration practitioners.

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Reference

Palmer, M.A., E.S. Bernhardt, J.D. Allan, P.S. Lake, G. Alexander, S. Brooks, J. Carr, S. Clayton, C.N. Dahm, J.J. Follstad Shah, D.L. Galat, S. Gloss, P. Goodwin, D.D. Hart, B. Hassett, R. Jenkinson, G.M. Kondolf, R. Lave, J.L. Meyer, T.K. O'Donnell, L. Pagano, and E. Sudduth, 2005. Standards for ecologically successful river restoration. Journal of Applied Ecology, 42(2): 208-217.