

Land Letter



2. COLORADO RIVER: USGS analysis offers key findings from high-flow tests (02/10/2011)

April Reese, E&E reporter

As federal water managers begin to plan for more high-flow releases from Glen Canyon Dam to help ameliorate its impacts on Grand Canyon resources downstream, the U.S. Geological Survey has released an [analysis](#) of previous test flows designed to improve the effectiveness of future releases.

The three previous high flow releases, conducted in 1996, 2004 and 2008, have delivered mixed results, concluded the USGS report, issued on Tuesday. But each test provided important lessons that together should help managers fine-tune future releases to avoid some of the problems of past experiments, scientists involved in the analysis said.

"Research and long-term monitoring of the effects of three high-flow experiments have allowed scientists to unravel some of the many uncertainties about how these Glen Canyon Dam releases affect downstream river resources," said Ted Melis, deputy chief of USGS's Grand Canyon Monitoring and Research Center. "We believe that the scientific findings presented in the report will allow managers to better plan future flow operations to meet desired resource goals."



A new U.S. Geological Survey analysis of three high-flow experiments on the Colorado River found that the tests provided important insights into river management but also created new challenges going forward. Photo courtesy of BuRec.

The stretch of the Colorado River that flows through the Grand Canyon once raged through the channel in the spring, when snowmelt from the Rocky Mountains drained into the river. A smaller pulse would often occur later in the year, during the Southwest's monsoon season. But since the dam sealed off the river just below the Utah-Arizona border in 1966, forming Lake Powell, the river's flow has been carefully regulated for optimal production of hydropower from Glen Canyon Dam.

The dam provides power for irrigators and residents throughout the Colorado River Basin, and the reservoir is a key part of the Southwest's water storage system. But those benefits have come at a price: the transformation of the Colorado into a smaller, clearer and cooler river that rarely roars through the Grand Canyon as it once did.

Among other things, lower flows have left less water for native fish and other species, and the sand, silt and clay that was once redistributed throughout the river channel now becomes trapped behind the dam, accumulating in Lake Powell instead of flowing downstream to build sandbars and beaches. Those slips of terra firma along the river's edge provide crucial habitat for fish and wildlife, protect archaeological sites and shore up campsites for river rafters and hikers, USGS noted in its report.

The high-flow tests were designed to mimic historic flows for short periods to at least partially reverse some of the ecological consequences of the dam. Under the Grand Canyon Protection Act of 1992, the Interior Department must "protect, mitigate adverse impacts to, and improve" the Grand Canyon's natural, recreational and cultural resources.

According to the USGS report, the two primary lessons from the three experiments done so far are that high flow releases should be timed after storm events to take advantage of the influx of water and sediment from tributaries below the dam, and the high flows should not continue for very long.

In the first and longest test, which ran for 90 hours in 1996, managers succeeded in transporting sediment into the canyon, but the torrent lasted too long, scouring away the sandbars and beaches it had initially built.

The second experiment, eight years later, was shortened to keep more sediment in the canyon and prevent erosion ([Land Letter](#), Dec. 2, 2004). In the most recent high-flow test, managers took greater advantage of storm flows from the Paria River, a primary tributary downstream from the dam, to capitalize on the added input of sediment ([Land Letter](#), April 10, 2008).

While the results of the experiments are encouraging, significant questions remain about the effects of the manipulated high flows, the analysis concluded.

For instance, the 2008 test resulted in an eight-fold increase in rainbow trout at Lee's Ferry, a recreational fishery below the dam. While popular with anglers, the non-native trout prey on humpback chub and compete with them for resources. Fish biologists have tried removing the trout from humpback chub habitat using an electro-shocking technique, but that strategy has been controversial.

And managers are still learning the nuances of how to keep newly built sandbars and beaches intact after flows return to normal.

Rick Johnson of the nonprofit Grand Canyon Trust said scientists have done "a great job" figuring out how to build sandbars with the high-flow releases and improve conditions for native fish downstream from the dam.

"Although we only have really good data on the response of the aquatic community following the 2008 high-flow event, the data is so compelling that it seems likely that future events will have a similar response," he said.

More high flows planned

The USGS review comes just as the Bureau of Reclamation is deciding when and how to conduct future high-flow releases. Last month, the agency issued a [draft protocol](#) for how to plan multiple short-term, high-volume high flows between 2011 and 2020.

The objective, according to Reclamation, is to "determine how multiple events can be used to better conserve sand over a long period."

The protocol takes advantage of lessons learned from the previous three high-flow tests. It calls for timing all new releases to coincide with the influx of water and sediment from tributaries during rainstorms and suggests conducting back-to-back high flows to help prevent the erosion of newly built sandbars and beaches.

Consecutive high flow releases "may better balance the sand budget," according to the protocol. The effects of conducting more than two back-to-back pulses are uncertain, the authors add.

Under the draft protocol, managers would first come up with a possible timeframe for the high flows and evaluate how much water could be released from the dam and how much sand and mud would be transported into the Colorado River from the Paria River and other tributaries. If scientists and federal managers determine conditions are suitable, they would then submit a recommendation to the Interior secretary.

The experiments are expected to benefit humpback chub over the long run by improving habitat, but possible increases in the rainbow trout population remain a concern with future experiments, the protocol acknowledges.

The volume of the releases would be between 31,000 and 45,000 cubic feet per second, and the releases would be conducted in the spring or fall.

The rest of the year, the river would remain regulated in accordance with the "modified low fluctuating flow" regime set by the 1996 Glen Canyon Dam operating plan. Environmental groups have long argued that this flow regime needs to be changed to fully benefit canyon resources ([Land Letter](#), May 7, 2009).

Reclamation does plan to conduct "steady flows" at certain times of the year, which the Fish and Wildlife Service has said could help endangered fish.

But Johnson said what is really needed to sustain the sandbar-building benefits of high-flow releases is a change in the day-to-day operations of the dam.

"There is a simple approach to maintaining sediment that could be implemented immediately," he said. "The export of sediment out of Grand Canyon could be dramatically reduced by stabilizing monthly and daily dam releases."

That strategy, however, would affect hydropower production, and power producers have been slow to embrace the idea of stabilizing daily flows in addition to the high-flow experiments.

The high-flow tests over the next decade are expected to cost hydropower producers between \$6 million and \$12.5 million in lost revenues and replacement power purchases, according to the document.

Controlling non-native fish

To better protect the humpback chub from non-native fish, Reclamation also recently crafted a new non-native fish control plan.

The [draft plan](#), issued late last month, calls for removing rainbow and brown trout from two locations: at the confluence of the Little Colorado River and at a site just downstream from the dam. The controls, which would be conducted over a 10-year period starting this year, should begin "as soon as possible," the document says.

"Competition and predation by rainbow trout and brown trout are reducing survival and recruitment of young humpback chub and threatening the potential recovery of the species," the draft plan warns.

The plan is in response to analyses released by FWS in 2008 and 2009, which called for continued efforts to remove non-native fish to help the chub.

"Protecting endangered native species is a key component of Reclamation's efforts to balance the complex and competing interests in the Colorado River downstream of Glen Canyon Dam," said Anne Castle, Interior's assistant secretary for water and science, in a statement. "The science we are bringing together through this study will help us wisely manage Colorado River flows and meet our water delivery and environmental responsibilities, while protecting the cultural values of native American communities."

The new plan is designed to address the concerns of Zuni Pueblo and other area tribes that consider the confluence of the Little Colorado River and the mainstem river to be a sacred site, and oppose the taking of life there.

In a statement to Castle last summer, Zuni religious leaders said continued mechanical removal "will create a counterproductive energy" to tribal ceremonies and requested that Interior seek alternative control measures "that do not entail the massive destruction of life that has characterized the past mechanical removal efforts."

To comply with the tribes' request, Reclamation has proposed conducting most of the removals farther upstream.

Up to six removal trips would still be conducted at the confluence of the Little Colorado River and the mainstem Colorado, but the fish would be euthanized and frozen on site to be used later as food for people or for raptors and other wildlife, according to the draft plan.

[Click here](#) to read the USGS report.

[Click here](#) to read Reclamation's draft high-flow protocol.

[Click here](#) to read Reclamation's draft plan for non-native fish control.

Reese writes from Santa Fe, N.M.

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