GLEN CANYON DAM
ADAPTIVE MANAGEMENT PROGRAM
Using science to manage river resources in Grand Canyon

High Flow Releases at Glen Canyon Dam

Construction and operation of dams results in numerous physical and ecological changes to river systems. Among them is the sediment carrying capacity of the river downstream of the dam. With the construction of Glen Canyon Dam, seasonal flooding that once moved sand from the riverbed to the shoreline, no longer occurs. Because more than 90 percent of the sediment that historically moved through the Grand Canyon is trapped behind the dam, the primary sources of new sand to the river system are two downstream tributaries: the Paria and Little Colorado rivers.

The Operation of Glen Canyon Dam Final Environmental Impact Statement, completed in March 1995, hypothesized that controlled high-volume releases of water could be important for restoring ecological integrity downstream from the dam. Testing that hypothesis would help determine whether experimental high flows could be used to benefit important physical and biological resources in Grand Canyon National Park and Glen Canyon National Recreation Area. Such flows would also be consistent with the objectives of the 1992 Grand Canyon Protection Act (Public Law 102-575).

Water being released through river outlet tubes

Because controlled experimental high-flow releases to some extent mimic natural flooding, conducting such releases would provide the opportunity to evaluate the potential benefit to sediment-dependent resources including sandbars and camping beaches, marsh and riverside vegetation, and backwaters, which are near-shore areas of low-velocity flow which may be used as rearing habitat by native fish.

The framework and flexibility to adapt the dam's operations to facilitate scientific experimentation and research including conducting controlled experimental high-flow releases, was provided through the Glen Canyon Dam Adaptive Management Program established by the 1996 Record of Decision on the EIS for operation of the dam.

Starting in 1996, Reclamation and its collaborators within the Glen Canyon Dam Adaptive Management Program have conducted several controlled experimental high-flow releases from Glen Canyon Dam. The first experimental release took place March 26, - April 2, 1996, and was described as a beach/habitat-building flow that released 45,000 cubic feet per second of water for seven days to rebuild high elevation sandbars, deposit nutrients, restore backwater channels, and provide some of the dynamics of a natural system. Releasing that volume of water was achieved through a combination of the eight hydroelectric powerplant generators and the four river outlet tubes which bypass the powerplant and do not generate hydroelectric power.

The total combined capacity of the eight hydroelectric powerplant generators is 32,000 cfs. The ability to release this volume of water depends on the reservoir level and the full operability of each unit. The total combined capacity of the four river outlet tubes is 15,000 cfs. Because water released through the river outlet tubes bypasses the powerplant, it does not generate hydropower.

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Scientists and managers used the information gained from the 1996 release to refine the timing of subsequent controlled experimental high-flow releases to better take advantage of episodic tributary floods, particularly the Paria River, that supply new sand to the Colorado River downstream from the dam.

Prior to the next controlled high-flow experiment in 2004, three habitat maintenance flows took place. HMFs are short-term high releases in the spring within powerplant capacity, intended to transport and deposit sand for maintaining beaches and fish and wildlife habitat. The duration of each of these flow events was 72 hours.

The 2004 controlled high-flow experiment was a 60-hour release that took place November 21 – 23, at 41,000 cfs. This HFE was conducted shortly after a large amount of sediment was delivered by the Paria River and it helped test the hypothesis that maximum sediment conservation would occur with a high-flow shortly after the sediment was deposited in the mainstem of the Colorado River.

Downstream view of 2008 controlled high flow experiment at night – photo by: T. Ross Reeve

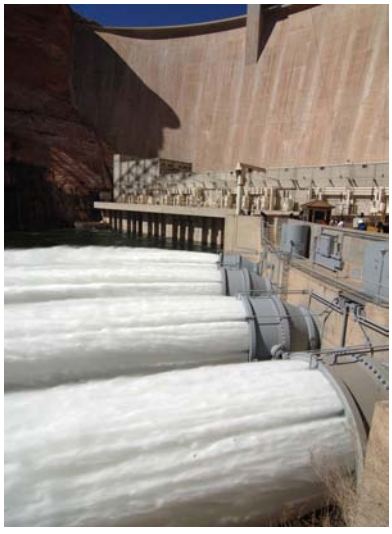
Lessons learned from both the 1996 and 2004 HFEs were incorporated into the third HFE which occurred in 2008. This 60-hour, 41,500 cfs release which took place March 5 – 7, was timed to take advantage of the highest sediment inputs in a decade which allowed for a better assessment of HFE's effectiveness for rebuilding sandbars and beaches that create backwaters which may provide habitat for endangered fish as well as campsites for river runners in the Grand Canyon.

On-going research and long-term monitoring since the first controlled high flow release in 1996 have allowed scientists to unravel many, but not all, of the uncertainties that exist about how HFEs might affect downstream resources. The current state of knowledge is summarized in the report released in February 2011, by the U.S. Geological Survey's Grand Canyon Monitoring and Research Center on the effects of the 1996, 2004, and 2008 high-flow experiments on the Colorado River ecosystem downstream from the dam.

In December 2009, the Department of the Interior, acting through the Bureau of Reclamation, proposed the development and implementation of a protocol for controlled high-flow experimental releases from Glen Canyon Dam to gain a better understanding of whether and how sand conservation can be improved in the downstream Colorado River corridor.

Building on the results of prior high flows, the 10-year protocol for HFEs (between 2011 – 2020) takes a multi-year, multi-experimental approach to using short-duration, controlled high-volume releases from the dam during sediment-enriched conditions in the downstream channel.

Understanding the complexities of the interrelated ecosystem downstream of Glen Canyon Dam is a long-term challenge. The adaptive management model which emphasizes an on-going cycle of learning through experimentation, refinement, and improvement over time, provides the appropriate framework to achieve this understanding. Through the Glen Canyon Dam Adaptive Management Program, continued implementation of HFEs as a key operational strategy will yield invaluable knowledge about the response of, and benefit to downstream resources.



Water being released through river outlet tubes – 2008