

TWG 1/11/99
Attachment 2

**THE STATE OF NATURAL AND CULTURAL RESOURCES
IN THE COLORADO RIVER ECOSYSTEM:
1998 DRAFT REPORT**

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EXECUTIVE SUMMARY

The status of physical, natural and cultural resources of the Colorado River affected by Glen Canyon Dam are summarized here to provide relevant information to stakeholders, the Adaptive Management Work Group and the public. In addition, this 1998 State of the Colorado River Ecosystem report summarizes long-trends in resource conditions, and focuses on scientific insights gained through analyses of previous and on-going scientific studies.

Physical resources reported here include climate, flow, changes in sediment transport, sandbar morphology, and campsite availability. Discharge remained high, often exceeding 20,000 cfs in the summer of 1998, as Lake Powell reservoir reached near full-pool stage. Flood-triggering flow criteria were not met in 1998. Several large Paria River flows in late summer increased sediment supplies in the Marble Canyon reach to the highest levels since 1980. Sediment inflow from the Little Colorado River was also substantial in 1998. If other flow and resource triggering criteria are met in 1999, the availability of abundant sediment means that planned flooding may be very successful for rejuvenation of sand bars in 1999.

Water quality data reported here includes the limnology of Lake Powell, and downstream water temperature, water clarity and water chemistry. Data on water quality are contributed by the GCMRC Lake Powell Program, which has synthesized and analyzed changing water quality since 1965 in Lake Powell, and since 1990 in the Colorado River downstream from Glen Canyon Dam.

Aquatic biological resources include the aquatic foodbase and fisheries. High flows from 1996-1998 resulted in extensive colonization of the 8,000 cfs to 20,000+ cfs zone by benthic macrophytes and invertebrates, which comprise the aquatic foodbase. The Labor Day 1997 8,000 cfs constant flow may have desiccated macrophyte beds, and the November 1997 31,000 cfs habitat maintenance flow (HMF) may have scoured some benthos, but those flows resulted in no detectable impact on the trout or native fisheries. Continued high discharges in 1998 have increased benthic colonization up to the 20,000 cfs stage. The general conclusion from 8 years of benthic analyses in this ecosystem is that high, steady flows enhance the aquatic foodbase, while lower, fluctuating flows reduce the benthos to the lowest stage achieved on about a monthly basis. Analysis of the relationship of the aquatic foodbase to higher aquatic trophic levels is underway.

Endangered humpback chub (HBC) exist in 9 mainstream populations in Grand Canyon but are restricted in breeding to the lower Little Colorado River (LCR). The status and health of the population have been difficult to determine with the given data; however, concern exists regarding condition factor and population size. Cool spring weather in 1998 retarded the HBC spawn, but this year appears to have been fair for reproduction in the mainstream. Another new finding from 1998 is the presence of more subadult HBC in the mainstream than has previously been reported. Reasons for this finding are related to gear type: the subadult size class (200-400 mm) is better sampled using mini-hoop nets, and is undersampled using electroshocking equipment. Other native fish populations appear to be in near-normal condition; however, time series monitoring data on condition or population trends have yet to be developed.

Asian tapeworm infestation in HBC is widespread, and remains a concern. Health of HBC is being monitored.

The Glen Canyon reach supports a blue-ribbon rainbow trout fishery, of which 70% may be naturally produced. The condition of this fisheries in 1998 appeared to be near-normal.

Some other non-native fish populations (e.g., red shiner) appear to be increasing, while time series analyses of the other non-native fish populations have yet to be developed.

Terrestrial biological resources include wetland and riparian soils, vegetation and fauna, including several species of concern. Slight gradients established under constant flows may direct groundwater flow and nutrient distribution. The extent of scour of marsh vegetation during the 1996 experimental flood varied, with some, including two at southwestern willow flycatcher foraging sites, sustaining considerable scour. In addition, recovery of marsh patches has remained slow, possibly because of increased soil texture. The timing of the 1996 BHBF (March) and the 1997 HMF (November) limited saltcedar seedling establishment during those two planned floods, but constant high flows from 1995-1998 have allowed increased some additional establishment downslope from the 30,000 cfs stage.

Terrestrial species of concern are being monitored to determine long-term population trends and responses to dam operations. The Kanab ambersnail (KAS) exists at Vaseys Paradise in native and non-native herbaceous vegetation. Habitat and population recovery from the 1996 planned flood continued in 1998, approaching levels near the pre-1996 BHBF levels in the stage zone below the 45,000 cfs stage. The impacts of the 1997 HMF were nominal, resulting in a "take" of no more than 50 KAS. In 1998, one or more tributary floods scoured some higher elevation habitat. The September (pre-dormancy) population survey indicated that 68.8 m² (10.5%) of the KAS habitat existed below the 45,000 cfs stage, supporting an estimated 3170 KAS (7.3% of the total estimated population). Analysis of an extrapolated stage-to-discharge relationship at Vaseys Paradise suggests that 162.3 m² (24.8%) of the KAS habitat and 9405 (21.6%) of the KAS population exist downslope from the 60,000 cfs stage.

Endangered southwestern willow flycatcher wetland feeding habitat had been reduced by the 1996 BHBF, and 2 of 4 marshes associated with nest site stands have recovered little from the 1996 test flood. The single pair at Mile 50.5L has not bred successfully in 1997 and 1998, having been subject to brown-headed cowbird brood parasitism and inclement weather conditions (high winds).

The -9L Spring populations of northern leopard frog and *Niobara ambersnail* survived the 1996 BHBF and appeared to be little affected by the November 1997 31,000 cfs HMF. Although frogs continue to be abundant at that site, flows in excess of 20,000 cfs through the summer of 1998 eliminated most of the habitat of the *Niobrara ambersnail*, and it was not evident in late summer. No flow-related impacts on peregrine falcons, bald eagles, osprey or belted kingfishers were reported in 1997 or 1998, and 1998 populations appear reasonably robust.

Overall, the short-term and long-term impacts of the Preferred Alternative flow regime, coupled with planned flooding, affect some (particularly terrestrial) species of concern and

their habitats, so that the most conspicuous tradeoffs occur between aquatic and terrestrial resource components.

Cultural resources include: archaeological sites and traditional cultural resources such as springs, landforms, sediment and mineral deposits, and traditional plant locations and animals. All of these resources have the potential to be affected by the operations of Glen Canyon Dam. The ultimate goal of the cultural resource efforts related to Glen Canyon Dam operations is *in-situ* preservation, with minimal impact to the integrity of the resources and when preservation is not possible data recovery efforts, as appropriate.

Hydroelectric power production data were compiled from the Bureau of Reclamation SCADA data. These data are tightly correlated with flow releases, and show a comparable variability over the past two years, with a peak during the November 1997 habitat maintenance flow test.

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INTRODUCTION

Administrative Overview

The Colorado River ecosystem affected by Glen Canyon Dam is the subject of federally authorized monitoring and research to improve ecosystem management in Lake Powell, lower Glen Canyon and throughout Grand Canyon. These scientific studies are coordinated by the Department of the Interior's Grand Canyon Monitoring and Research Center (GCMRC) office in Flagstaff, Arizona, under direction from the Adaptive Management Work Group (AMWG). The AMWG is a Federal Advisory Committee consisting of a diverse group of stakeholders, including: Department of Interior agencies (Bureau of Indian Affairs, Bureau of Reclamation, Fish and Wildlife Service, National Park Service), Western Area Power Administration, Colorado River basin states, Native American tribes, economic development groups, and environmental organizations. The AMWG meets semiannually to discuss dam management, review the progress of the GCMRC's scientific activities, develop plans for future activities, and provide recommendations to the Secretary of the Interior on Glen Canyon Dam operations. The AMWG is advised by its representatives on the Technical Work Group (TWG).

The wide array of physical, biological and cultural resources and processes of the Colorado River ecosystem are highly dynamic, and some resources respond dramatically to different flow regimes. Effectively managed flow regimes may enhance some resources and ecological processes in this river ecosystem, and a science-based adaptive management process may ensure effective management that optimizes stakeholder concerns while affording appropriate protection of the river ecosystem. Colorado River ecosystem stakeholders have requested from GCMRC an annual scientific evaluation of the state of the ecosystem, and such a report fulfills part of the requirements of Section 1804, subsections (c) and (d) of the 1992 Grand Canyon Protection Act, as well as some requirements of the 1995 Glen Canyon Dam Environmental Impact Statement (GCD-EIS) and 1996 Record of Decision (ROD). This evaluation, combined with information on predictions of future reservoir storage and weather, can be used to discuss potential flow regimes to protect and/or enhance development of the Colorado River ecosystem.

This 1998 State of the Colorado River Ecosystem report provides information on current physical, aquatic biological, terrestrial biological, cultural and socioeconomic resource conditions over time, and especially related to 1996-1998 flows, including the March/April 1996 beach habitat building flow (BHBF), the November 1997 31,000 cfs habitat maintenance flow (HMF), and 1998 flows.