ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY: Robert D. Bush Date: 2/8/94

Executive Director

BUREAU OF RECLAMATION

BY: Robert Johnson Date: 8/12/93

Title: Regional Director

ARIZONA STATE HISTORIC PRESERVATION OFFICER

BY: James W. Garrison Date: 8/17/93

Title: State Historic Preservation Officer

NATIONAL PARK SERVICE, WESTERN REGION

BY: Stanley T. Albright DATE: 11/23/93

Title: Regional Director, Western Region

NATIONAL PARK SERVICE, ROCKY MOUNTAIN REGION

BY: R. Everhart for DATE: DEC 7 1993

Robert M. Baker, Regional Director, RMR

HAVASUPAI TRIBE

BY:______________________ Date:

Title: ______________________

HOPI TRIBE

BY: Ferrell Secakuku Date: 8-30-94

Title: Chairman

HUALAPAI TRIBE

BY: [signature] Date: 02-15-94

Title: Chairman, Hualapai Tribal Council

KAIBAB PAIUTE TRIBE

BY: [signature] Date: 4/12/94

Title: Tribal Chairperson

NAVAJO NATION

BY: [signature] Date: 1/3/94

Historic Preservation Officer

SAN JUAN SOUTHERN PAIUTE TRIBE

BY:____________________ Date:

PAIUTE INDIAN TRIBE OF UTAH FOR:
SHIVWITS PAIUTE TRIBE

BY: [signature] Date: April 20, 1994

Tribal Chairman

ZUNI PUEBLO

BY: [signature] Date: 7-6-93

Title: Governor, Pueblo of Zuni

ATTACHMENT 6

Supporting Data on Alternatives

A. Formula for determining minimum and maximum flows under the Moderate and Seasonally Adjusted Fluctuating Flow Alternatives (October-May). Minimum and maximum flow restrictions would be determined from the mean release for the month (Qmean). Qmean would be determined from the scheduled monthly release volume using the following equation.

$$Qmean = \frac{\text{Volume}}{\text{No. days per month}} \times \frac{43{,}560\ ft^2 \bullet day}{86{,}400\ acre \bullet sec}$$

Where volume is the scheduled monthly release volume in acre-feet per month and Qmean is the equivalent release in cfs

The minimum (Qmin) and maximum (Qmax) flows would be determined by the following equations

for $Qmean \leq 9{,}091$ cfs $Qmin = 5.000$ cfs
for $Qmean \geq 9{,}091$ cfs $Qmax = Qmean - C$

for $Qmean \leq 25{,}500$ cfs $Qmax = Qmean + C$
for $Qmean \geq 25{,}500$ cfs $Qmax = 31{,}500$ cfs

where

for $Qmean \leq 13{,}333$ cfs $C = 0.45 \times Qmean$
for $Qmean \geq 13{,}333$ cfs $C = 6{,}000$ cfs

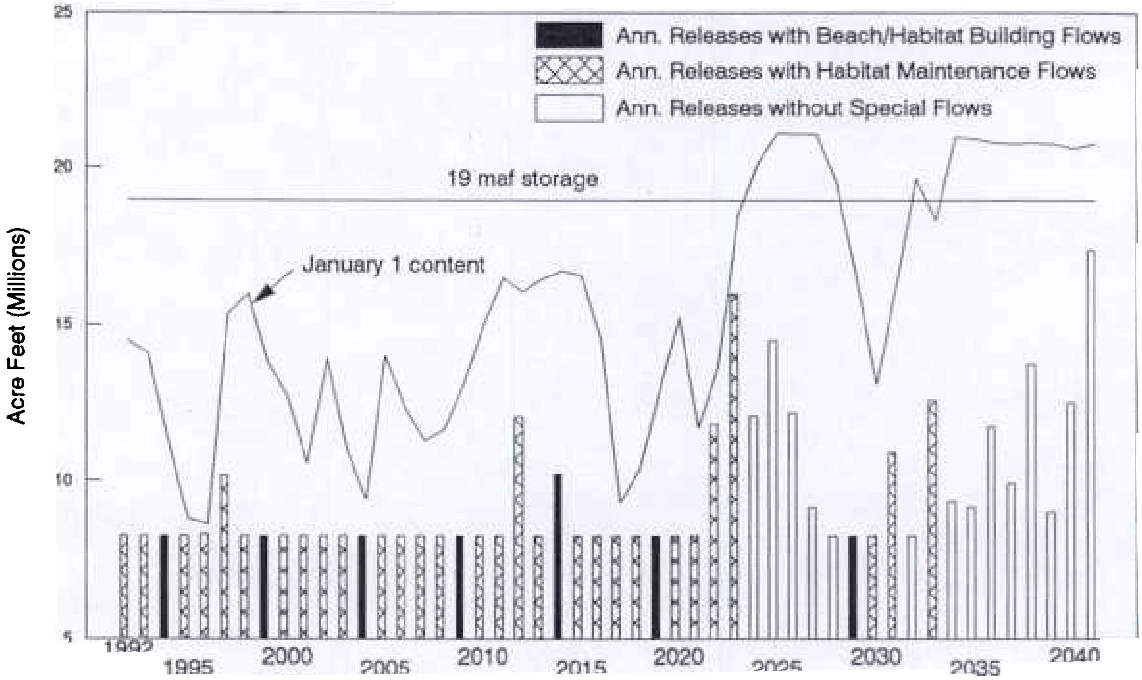
Releases rates would be allowed to fluctuate daily and hourly between the minimum and maximum limits.

B. Monthly release volumes for alternatives incorporating the habitat maintenance flow, example water year 1989 (8.2 million acre-feet) in thousand acre-feet

Month	No Action	Moderate and Modified Low Fluctuating Flow	Seasonally Adjusted Steady Flow
Oct	520	484	499
Nov	616	580	477
Dec	644	608	500
Jan	760	724	655
Feb	671	635	587
Mar	607	1,006	1,086
Apr	548	512	723
May	540	504	1,073
Jun	763	727	1,037
Jul	841	805	682
Aug	884	848	474
Sep	823	787	449

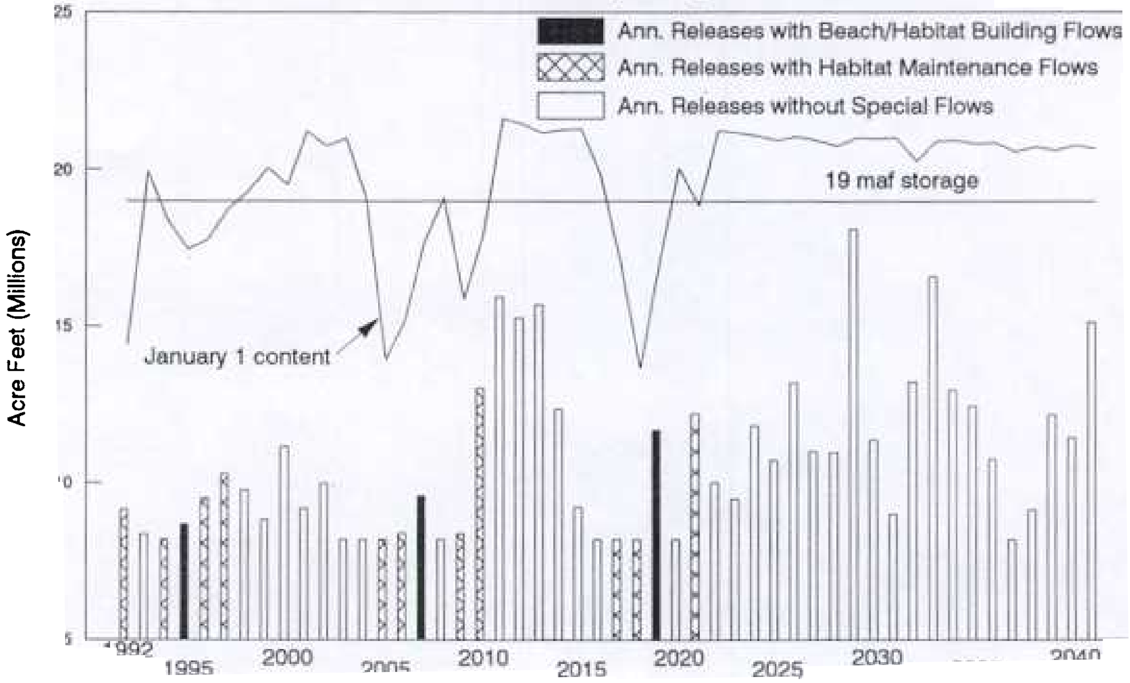
Example Scheduling of Special Flows

Modified LFF - CRSS Hydrologic Trace No. 48



Example Scheduling of Special Flows

Modified LFF - CRSS Hydrologic Trace No. 60



Emergency Operations Guidelines

Inflow Forecasting

National Weather Service inflow projections, received twice a month, are used to project a 3- to 4-month period. This data comes from a satellite telemetered network of more than 100 Upper Colorado River Basin data collection points. These points gather snow water content, precipitation, temperature, and streamflow information. The water year begins in October, with later adjustments made for anticipated targets such as annual volumes and flood control elevations. Starting on January 1, forecasts are made for the April through July inflow, the peak runoff period. These early forecasts may contain large errors due to climatic variability as well as modeling and data uncertainties. Uncertainty decreases as the snow accumulation period progresses into the runoff season. As the runoff season progresses, monthly scheduled releases are modified to accommodate projected runoff changes.

Operational Emergencies

The North American Electrical Reliability Council (NERC) has established guidelines for emergency operations of interconnected systems. These guidelines apply to Glen Canyon Dam operations and may account for operational changes outside of those identified in descriptions of the alternatives. These changes in operations are intended to be of short duration as a result of emergencies at the dam or within the transmission network. NERC provides the following guidelines for system emergencies. Because of the technical nature of the descriptions, only examples are given here.

Insufficient Generation Capacity. When a control area has an operating capacity emergency, it must promptly balance its generation and interchange schedules to its load, without regard to financial cost, to avoid prolonged use of the assistance provided by interconnection frequency bias. The emergency reserve inherent in frequency deviation is intended to be used only as a temporary source of emergency energy and must be promptly restored so the interconnected systems can withstand the next contingency A control area unable to balance its generation and interchange schedules to its load must remove sufficient load to permit correction of its Area County Error.

If a control area anticipates an operating capacity emergency, it must bring on all available generation, postpone equipment maintenance, schedule interchange purchases well in advance, and prepare to reduce load.

An example of insufficient generation capacity and the appropriate response would be as follows: if any coal-fired powerplant in Western's load control area were unexpectedly lost, the response would be an increase in Colorado River Storage Project (CRSP) generation or imports to cover the change in anticipated generation within the control area.

Transmission (Overload, Voltage Control). If a transmission facility becomes overloaded or if voltage levels are outside of established limits and the condition cannot be relieved by normal means (such as adjusting generation or interconnection schedules) and a credible contingency under these conditions would adversely impact the interconnection, appropriate relief measures, including load shedding, shall be implemented promptly to return the transmission facility to within established limits. This action shall be taken by the system, control area, or pool causing the problem if it can be identified; or by other systems or control areas, as appropriate, if identification; cannot be readily determined.

An example of a response to an overloaded transmission system would be automatic relay tripping and taking a transmission line, such as the Glen Canyon-Flagstaff 345-kilovolt line, out of service. This action would cause Glen Canyon powerplant generation to be reduced instantaneously to a predetermined level based on the capacity of the line taken out of service.

Load Shedding. After taking all other steps, a system or control area whose integrity is in jeopardy due to insufficient generation or transmission capacity shall shed customer load rather than risk an uncontrolled failure of interconnection components.

An example requiring the extreme step of load shedding could occur if there were an interruption of the transmission capacity between the heavy load areas of Southern California and Arizona and the heavy generation areas of the Pacific Northwest, Colorado, Wyoming, and Montana. In this situation, Glen Canyon would be isolated with the heavy load areas. The response would be for Glen Canyon to swing from existing generation levels to maximum powerplant capacity. Then the automatic relay protection would open the transmission lines to the heavy load area, reducing the generation at Glen Canyon.

System Restoration. After a system collapse, restoration shall begin when it can proceed in an orderly and secure manner. Systems and control areas shall coordinate their restoration actions. Restoration priority shall be given to the station supply of powerplants and the transmission system. Even though the restoration should be expeditious, system operators should avoid premature action to prevent a recollapse of the system.

Customer load shall be restored as generation and transmission equipment becomes available, while keeping load and generation in balance at normal frequency as the system is restored.

Emergency Information Exchange. A system control area or pool experiencing or anticipating an operating emergency should communicate its current and future status to neighboring systems, control areas, or pools and throughout the interconnection. Systems able to provide emergency assistance must make known their capabilities.

Special System or Control Area. Because the facilities of each system may be vital to the interconnection's secure operation, systems and control areas shall make every effort to remain connected. However, if a system or control area determines that it is endangered by remaining interconnected, it may take action as necessary to protect its system.

If a portion of the interconnection becomes separated from the remainder of the interconnection, abnormal frequency and voltage deviations may occur. To permit resynchronizing, relief measures should be applied by those separated systems contributing to the frequency and voltage deviations.

An example of when Western might choose to disconnect the Glen Canyon Powerplant from the interconnected system would be in the case of a search and rescue operation in the canyon when there would be a need to control the releases.

Although the situations are infrequent, they do occur and require immediate, short-term changes in dam operation. In general, changes resulting from emergencies at Glen Canyon would result in decreases in flows. Emergencies in the system away from the dam would result in increases in flows.

Humanitarian Situations

There are occasions when managing agencies and local authorities, such as the police, request that the flows from the dam be reduced so that search and rescue procedures can be conducted or fatalities can be recovered from the river. In these situations, flows will be reduced for an agreed upon period of time. When returning to normal operations, flows will be brought up quickly to the minimum flow identified in the alternative and then may be increased at the ramping rate identified in the alternative.

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