

Draft

FISCAL YEAR 1997

**REPORT TO CONGRESS: OPERATIONS OF THE
ADAPTIVE MANAGEMENT PROGRAM UNDER THE
1992 GRAND CANYON PROTECTION ACT**

To

Secretary of the Interior

By

Grand Canyon Monitoring and Research Center

November 1997

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HISTORICAL FACTORS CONTRIBUTING TO

FORMATION OF THE ADAPTIVE MANAGEMENT PROGRAM

The Colorado River Storage Project (CRSP) Act of 1956 authorized the construction, operation, and maintenance of Glen Canyon Dam (GCD) to regulate the flow of the Colorado River for flood control, consumptive use, and the generation of hydroelectric power. Seven years later, in 1963 the Glen Canyon Dam was completed.

GCD made Lake Powell the key storage unit for CRSP. In addition to water storage for flood control and consumptive uses, the dam was built as a hydroelectric power peaking facility, permitting it to move from low electrical output during low power demand to high output in peak demand periods. Thus, flow releases from the dam were adjusted daily to respond to these variances in electrical demand.

At optimum operations, GCD's generators are capable of producing 1.38 million kilowatts of power. The recreation, irrigation and hydropower benefits introduced to the Southwest by GCD are extensive and continue to expand.

At the same time, and as a result of the construction of GCD, the Colorado River ecosystem below the dam differs significantly from its pre-dam natural character. In addition, GCD's highly variable flow releases from 1966 to 1991 caused additional concern over resource degradation resulting from dam operations. As a result, restrictions were placed on flows for an interim period, until an environmental impact statement (EIS) could be developed on the operation of GCD.

Since 1991 flows from GCD have been managed within a narrow range of historical seasonal flows. Normally these flows do not exceed 25,000 cubic feet per second (cfs), and range most often between 5,000 to 16,000 cfs.

Water releases from the GCD occur at 20 - 23 feet below the surface of Lake Powell, which results in clear cold water with year round temperatures of 41 to 45° F. Although this creates an acceptable habitat for introduced cold water trout fisheries, it is a hostile environment for native suckers and chubs, most of which are now isolated in river segments below tributaries and streams, such as the Little Colorado River or Kanab Creek.

Since the damming of the river in 1963, there has been only one flow release which approached pre-dam spring floods. In 1983, a combination of unanticipated hydrologic events in the upper Colorado River Basin, combined with available storage space in Lake Powell, resulted in emergency spillway releases from GCD which reached 97,000 cfs. Except for the 1983 event, releases over the last 32 years have ranged between 2,000 and 25,000 cfs, with flows further constrained to the range of 5,000 to 16,000 cfs since 1991.

A NEED FOR SCIENCE

Responding to concerns that changes to the Colorado River ecosystem were resulting from dam operations, the US Bureau of Reclamation (Reclamation) launched the Glen Canyon Environmental Studies (GCES) program in 1982. The research program's first phase, 1982-1988, focused on developing baseline resource assessments of physical and biotic resources. The second program phase, 1989-1996, expanded research programs in native and nonnative fishes, hydrology and aquatic habitats, terrestrial flora and fauna, cultural and ethnic resources, and social and economic impacts. Developing spatial and temporal data using GIS has also been a critical part of the second phase.

The GCES annual budget in millions varied significantly from \$1-\$12 million since 1982. The budget for the last five years of the program ranged from \$8.0-\$12.0 million.

By the late 1980s, sufficient knowledge had been developed to raise concerns that downstream impacts were occurring, and that additional information needed to be developed to quantify the effects and to develop management actions that could avoid and/or mitigate the impacts. This collective information and other factors led the Secretary of the Interior (Secretary) to direct Reclamation to prepare an EIS on operation of GCD. The intent was to evaluate alternative operation strategies that would minimize adverse impacts and restore or improve some natural processes.

Concerned over the required time to complete the EIS, in 1991 the Secretary directed the Commissioner of Reclamation to operate the GCD under interim flows until the EIS was completed. These flows of approximately 5,000 to 16,000 cfs represented a more narrow range than the 1,000 to 25,000 cfs flows occurring between 1966 and 1991.

Responding to continued concerns over potential impacts of GCD operations on downstream resources, Congress enacted the Grand Canyon Protection Act (GCPA) in 1992 (PL92-105). The GCPA directs the Secretary to operate GCD,

"In such a manner so as to protect, mitigate adverse impacts to and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to, natural and cultural resources and visitor use."

The GCPA also directs the Secretary to

"Establish and implement long-term monitoring programs and activities that will insure the Glen Canyon Dam is operated in a manner consistent with the above actions . . . On the natural, recreation, and cultural resources of Grand Canyon."

And, that this

"Long-term monitoring of Glen Canyon Dam should include any necessary research and studies to determine the effect of the Secretary's actions on Grand Canyon National Park and Glen Canyon National Recreational Area."

REPORT TO CONGRESS

The GCPA requires the Secretary to submit to Congress an annual report as follows:

A. GCPA, Sec. 1804 (c) (2) "The Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report separate from and in addition to the report specified in section 602(b) of the Colorado River Basin Project Act of 1968 on the preceding year and the projected year operations undertaken pursuant to this Act."

This report responds to the above noted reporting requirements specified in the GCPA, Sec. 1804 (c) (2). The report focuses on activities included in the Adaptive Management Program (AMP) in FY97 and projected activities planned for FY98.

Extensive administrative, technical, and science reports are the basis for information presented in this report. In the final section we provide source contacts for any additional reports needed for clarification of information presented. Reviewers of this report may access any additional information through these contacts.

AN ADAPTIVE MANAGEMENT PROGRAM (AMP)

The GCPA gives general guidance to implement programs to mitigate adverse impacts to natural, recreation, and cultural resources of Grand Canyon National Park and Glen Canyon National Recreation Area. The final Glen Canyon Dam Environmental Impact Statement (GCDEIS) (USBR 1995) specifies an "Adaptive Management Program" (AMP) as the required process for incorporating science and diverse stakeholders in the evaluation and management of future dam operations. The AMP calls for continued interaction of managers and scientists to both monitor the effects of current dam operations on the Colorado River ecosystem and conduct research on alternative dam operations that can increase protection of resources and improve natural processes.

The AMP, schematically characterized in Figure 1 identifies the following entities that contribute to the adaptive management process.

- Adaptive Management Work Group (AMWG)
- Technical Work Group (TWG)
- Grand Canyon Monitoring and Research Center (GCMRC)
- ~~Independent Science Review Groups (ISRG)~~

INITIATING THE ADAPTIVE MANAGEMENT PROGRAM

The Adaptive Management Work Group (AMWG) consists of a group of stakeholders that are federal and state resource managers, Native American Tribes, power marketers, environmental groups, recreationists and other interest groups. The Technical Work Group (TWG) is composed of AMWG technical representatives. The roles and responsibilities of these groups are outlined in the GCDEIS.

The AMWG is established to develop and evaluate alternative operations strategies for GCD. This is accomplished by the AMWG specifying management objectives and information needs. The TWG then translates the AMWG management objectives into research needs for the GCMRC, which in turn conducts appropriate science activities. The results of these scientific activities are provided to the AMWG. AMWG uses the results of GCMRC scientific activities to evaluate differing operating criteria and recommend continuance or changes in criteria.

The AMWG does not displace Reclamation and its authority and responsibility to operate GCD in the best interests of both the environment and society. Reclamation maintains the final authority for dam operations. The GCDEIS does specify a different process for deriving dam operation strategies into the future. That process specifies that Reclamation will operate through the AMP with stakeholders, and will utilize ecosystem science to evaluate and select future operation strategies for GCD.

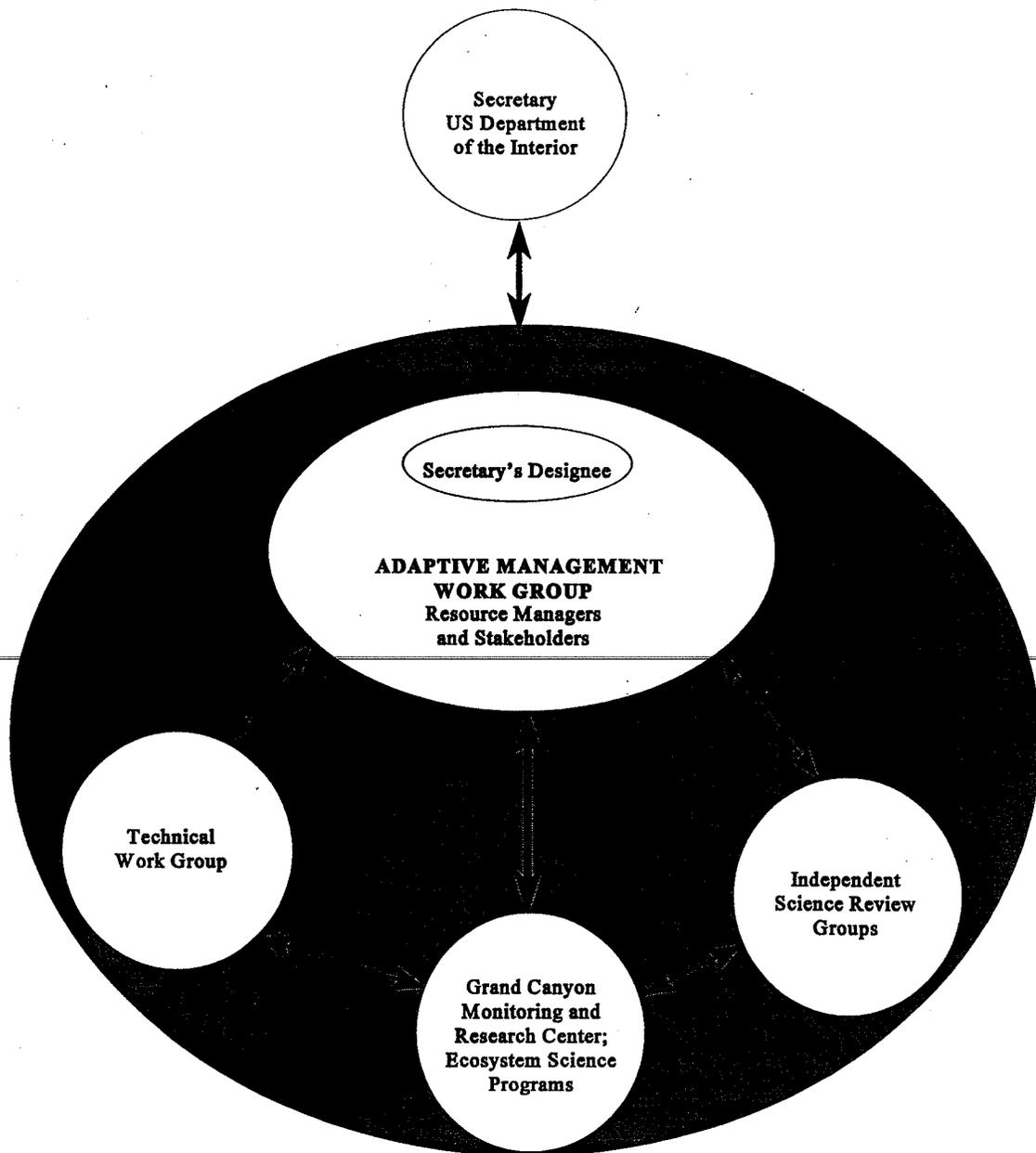


Figure 1. The Adaptive Management Program and processes for determining future operations of the Glen Canyon Dam.

The Grand Canyon Monitoring and Research Center (GCMRC) was established with a specific applied science mission. The mission is to provide scientific understanding on the response of physical, biological, socioeconomic and cultural resources in the Colorado River ecosystem¹ to differing operations criteria for GCD. As such, the GCMRC is a science information center; it does not assume the federal responsibilities for project area resources that are vested with other agencies for resource protection and mitigation.

The adaptive management process is a new approach in management, which incorporates science on a continuing basis for assessing outcomes from management alternatives. Figure 1 characterizes the environment in which the AMWG obtains new science and technical understanding from the GCMRC, TWG and independent science review groups, so that appropriate recommendations can be made to the Secretary through his/her designee

ADAPTIVE MANAGEMENT PROGRAM ACTIVITIES: FISCAL YEAR 1997

In FY97, significant progress was made on activities relating to the AMP, including:

1. Establishment of the AMP. The AMP was established by the Secretary through the development and approval of the Charter for the AMWG.
2. Formation of the AMWG and TWG and associated programs.
3. Complete formation of the GCMRC, completion of a "Transition Plan" for moving all activities from the GCES program to GCMRC, and development of long-term and annual monitoring and research plans.

The Adaptive Management Program (AMP)

The AMP approach specified in the GCDEIS was officially established in the Record of Decision (ROD) signed by the Secretary on October 8, 1996. Under section VI, 1.0 Environmental Commitments and Monitoring, Adaptive Management is called for as follows:

“The AMP includes the establishment of an Adaptive Management Work Group, chartered in accordance with the Federal Advisory Committee Act; and the development of a long-term monitoring, research, and experimental program which could result in recommendations to the Secretary for additional operational changes. However, any operational changes will be carried out in compliance with NEPA.”

1

The Colorado River ecosystem is defined as the Colorado river mainstem corridor and interacting resources in associated riparian and terrace zones, located primarily from the forebay of GCD to the western boundary of Grand Canyon National Park, a distance of approximately 293 river miles.

The AMP was officially implemented with Secretarial approval of the AMWG charter on January 15, 1997. The AMP provides for monitoring the results of the operating criterion and plans adopted by the Secretary and changes to those operating criterion and plans.

The Adaptive Management Work Group (AMWG) and Technical Work Group (TWG)

The AMWG charter established the AMWG as a Federal Advisory Committee to advise the Secretary on the impacts of GCD operations on downstream resources.

The Charter describes the purpose of the AMWG as follows:

“The AMWG will facilitate the AMP, recommend suitable monitoring and research programs, and make recommendations to the Secretary as required to meet the requirements of the GCPA. The AMWG may recommend research and monitoring proposals outside the Act which complement the AMP process, but such proposals will be funded separately and do not deter from the focus of the GCPA.”

The AMWG meets biannually or as needed. Its duties as specified in the Charter include:

1. Establish AMWG operating procedures.
2. Advise the Secretary in meeting environmental, operational, and cultural commitments of the GCDEIS, as requested.
3. Recommend the framework for the AMP policy, goals, and direction.
4. Develop recommendations for modifying operating criteria and other resource management actions pursuant to the GCPA.
5. Define and recommend resource management objectives for development and implementation of a long-term monitoring plan, and any necessary research and studies required to determine the effect of the operation of GCD on the natural, recreational, and cultural resources of the Grand Canyon National Park and Glen Canyon National Recreation Area.
6. Review and provide input to the Secretary on the reports required in Sections 1804 (c)(2) and 1804 (d).
7. Facilitate input and coordination of information from stakeholders to the Secretary to assist in meeting consultation requirements under Sections 1804 (c)(3) and 1805 (c) of the GCPA.
8. Monitor and report on compliance of all program activities with applicable laws, permitting requirements, and the GCPA. The duties and functions of the AMWG are in an advisory capacity only.

The AMWG appointed by the Secretary has a broad cross section of membership specified as follows:

1. Secretary's Designee, who shall serve as chairperson for the AMWG.
2. One representative each from the 12 cooperating agencies associated with the EIS:

1. Bureau of Reclamation
 2. Bureau of Indian Affairs
 3. U.S. Fish and Wildlife Service
 4. National Park Service
 5. Western Area Power Administration
 6. Arizona Game and Fish Department
 7. Hopi Tribe
 8. Hualapai Tribe
 9. Navajo Nation
 10. San Juan Southern Paiute Tribe
 11. Southern Paiute consortium
 12. Pueblo of Zuni
3. One representative each from the seven basin states:
1. Arizona
 2. California
 3. Colorado
 4. Nevada
 5. New Mexico
 6. Wyoming
 7. Utah
4. Two representatives each from:
1. Environmental groups
 2. Recreation interests
 3. Contractors who purchase Federal power from Glen Canyon Powerplant

Actions taken for FY97 in the first meeting of the AMWG were as follows:

1. Approval of operating procedures for the AMWG.
2. Recommendations to the Secretary to approve the GCMRC FY98 research and monitoring plan (referenced in following section).
3. Recommendation to the Secretary for the GCMRC to develop and initiate FY98 monitoring and research programs for Lake Powell.
4. Objectives, and information needs for all programs are to be reviewed in FY98, for implementation in FY2000.
5. Recommendations to the Secretary to initiate a $\approx 31,000$ cfs test flow in October/November of FY98 to conserve sediment resources.
6. Recommendation to the Secretary to evaluate the effects of a $\approx 45,000$ cfs beach/habitat-building flow (BHBF) between January to June, 1998 to mitigate the potentially negative effects of sustained high steady releases on the biological, physical and cultural resources and riverine processes.

7. Selection of a TWG to work closely with the GCMRC in developing objectives, information needs and monitoring and research programs.

The TWG, established as a subgroup of the AMWG implemented the following activities in FY97.

1. Initiated development of protocols and processes to evaluate and implement Adaptive Management flow regimes as recommended by the AMWG.
2. Review and evaluation of GCMRC FY99 Annual Monitoring and Research Plan.
3. Review and evaluation of GCMRC, FY97, State of Natural & Cultural Resources in the Colorado River Ecosystem Report.
4. Review and evaluation of GCMRC information on the effects of a $\approx 45,000$ cfs BHBF between January to June, 1998.

The Grand Canyon Monitoring and Research Center (GCMRC)

~~The GCMRC was established November 11, 1995 by the Assistant Secretary for Water and Science, U.S. Department of the Interior. The program was established in the Assistant Secretary's office, at the request of stakeholders, to represent and respond to the broad spectrum of resource, research and monitoring needs that would have to be addressed in the AMP. It was established early so that it could accomplish a critical transition from the GCES program, which had been in place since 1982.~~

The GCMRC accomplished two major objectives in FY97. The first related to developing and implementing the transition program to phase out the GCES program and launch the GCMRC in the office of the Assistant Secretary, Water and Science. The intent was to have the GCMRC fully operational and able to respond to establishment of the AMWG in September 1997.

The second major objective involved translating stakeholders' objectives and information needs into long-term and annual monitoring and research plans, and implementing a FY1998 program.

FY97 Transition Program

The FY97 Transition Program from the GCES to GCMRC was completed in FY97. This included changes in personnel and staff locations. In July, 1996, the Transition Plan was drafted by GCMRC, GCES, and Reclamation for implementation. This joint GCES/GCMRC Plan focused on assuring appropriate transition in five areas: (1) budget, (2) personnel, (3) programs, (4) equipment, and (5) data files. The following information relates to how objectives were accomplished.

Accommodation of Transition Activities on a Pre-approved \$7,300,000 Budget: By delaying placement of several GCMRC employees until FY98 and reducing equipment and logistic costs, expenditures were held to the \$7,300,000 budget level approved for the year. The program for FY97 was established in FY96 by GCES. Therefore, approximately \$6,300,000 of the \$7,300,000 program expenditures for FY97 were generally fixed and not under control of GCMRC.

GCES/GCMRC Personnel. GCMRC established personnel needs and a staffing plan for the 5-year program that included utilization of many existing GCES employees.

Positions developed and in place for the next 5 years are as follows: Twelve permanent FTEs, ten term appointments of 2-4 year length, and six-to-eight student temporary hires. Eleven of the permanent and term employees were transferred from the GCES program. The following schematic provides a listing of all staff positions (Figure 2).

It is anticipated that the number of staff noted can manage the GCMRC program over the next 5 years, assuming the current Lake Powell program. Involvement in project applications such as selective withdrawal or flash boards may require additional staff. Under the new GCMRC program direction, some research is accommodated in-house, but most is contracted out to various state and federal agencies, Native American tribes, universities, and other institutions. This approach should minimize staff needs in an expanding program.

Program Changes. The new GCMRC program is an adaptive management program oriented towards ecosystem assessment. Research direction is provided by the broad-based constituency which makes up the AMWG. All GCMRC program activities are reviewed and recommended for implementation to the Secretary, by the AMWG.

All GCMRC research and monitoring programs are based upon ecosystem science and management concepts. This new direction requires significant planning and clarification of program goals, objectives, and information needs by the AMWG and TWG. The Long-Term Strategic Monitoring and Research Plan and Annual Monitoring and Research Plan are developed by the GCMRC research staff for evaluation and review by the AMWG for responsiveness to information needs and other specified requirements.

Implementation of most of the monitoring and research projects are through a competitive proposal process. This approach is designed to increase the amount of science independence and creativity, assure cost effectiveness, and encourage ecosystem science.

In FY97, a total of thirty-three differing independent projects were launched. In FY98, nineteen differing integrated projects have been developed. At the request of Reclamation, additional tribal and NPS projects associated with the Programmatic Agreement are funded through GCMRC. The Programmatic Agreement represents a separate mandated program authorized by the National Historic Preservation Act (1966, 1992) and implementing regulations under 36 CFR 800. This program complements the GCMRC cultural program,

Grand Canyon Monitoring and Research Center Staffing Structure

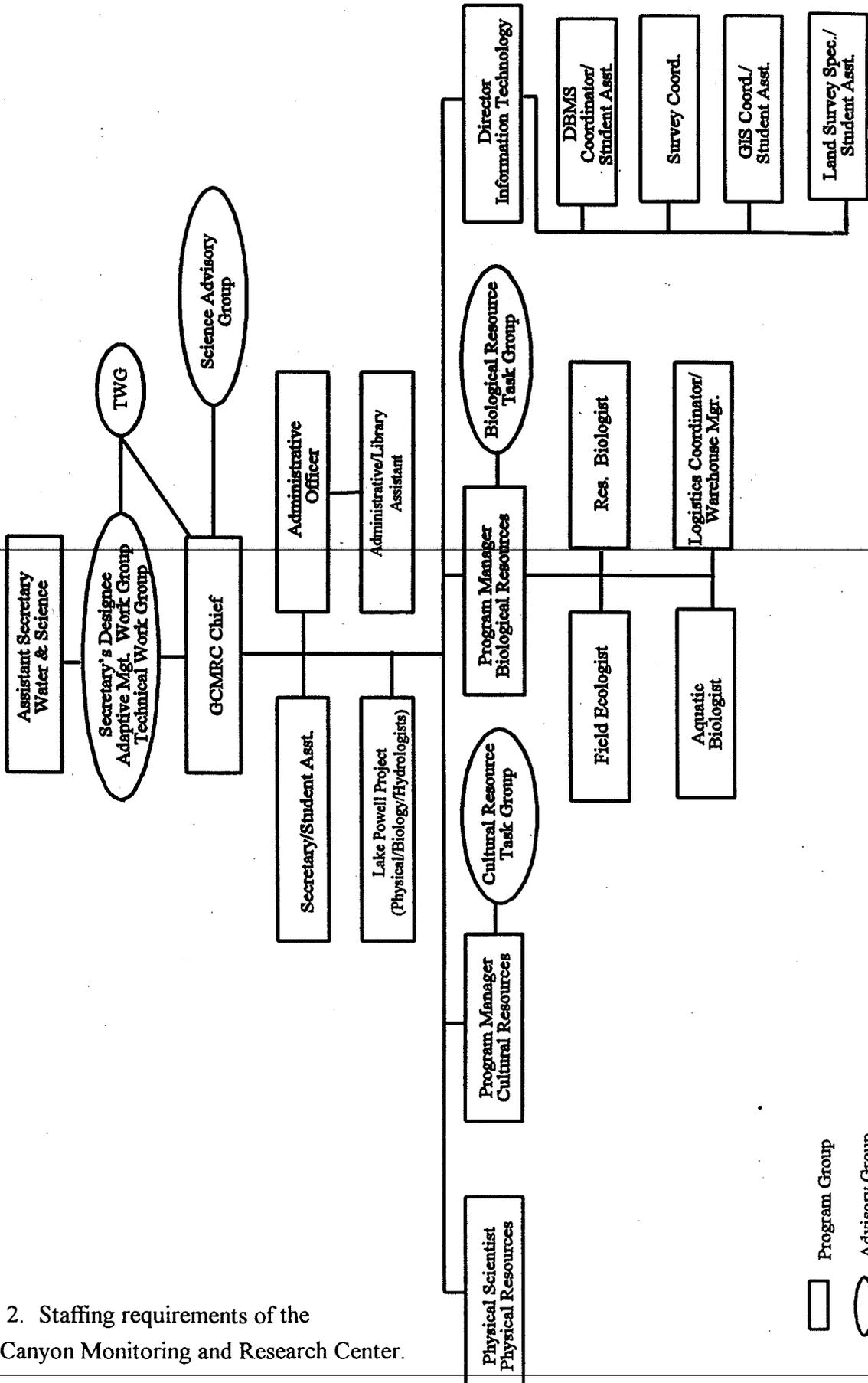


Figure 2. Staffing requirements of the Grand Canyon Monitoring and Research Center.

□ Program Group
 ○ Advisory Group

but remains the legal responsibility of Reclamation (NHPA Section 106) and the NPS (NHPA Section 110).

Equipment Transfers. Equipment associated with operation of the GCES program has been identified and transferred to GCMRC inventory where appropriate, moved to the Reclamation's inventory or placed on surplus. Two areas where significant new equipment has been purchased includes computer systems and river logistics equipment.

GCMRC will provide its own river logistics internally for the years FY97, 98 and 99, instead of contracting logistics out. The change was implemented to accomplish two ends:

1. Reduce cost by approximately 25% and provide an equitable bid basis for entities responding to Requests For Proposals;
2. Increase control over logistics operations, to facilitate integrated monitoring and research designs, and interdisciplinary team research.

Data File Transfers. All files and data from Reclamation's GCES Flagstaff facility have been moved to GCMRC. No files or data from GCES have been lost. In addition, there is an aggressive effort underway by GCMRC to capture all data that has been collected over the past 13 years by GCES but not brought into the Flagstaff GCES data base. These data/files reside in many data bases without designed access parameters.

FY97 Programs

The GCMRC has developed extensive planning and documentation regarding its operation and monitoring and research plans. Operation Protocols, Stakeholder Information Needs, a Long-Term Plan, the FY98 Annual Plan, and the State of Natural and Cultural Resources in the Colorado River Ecosystem Reports were developed in FY97. In addition, the GCMRC managed 33 separate research projects to completion.

Operations protocols were specified for GCMRC cooperatively with stakeholders and addresses planning, implementation instruments (Interagency and Cooperative Agreements) and program and product reviews.

Stakeholder information needs were developed by all stakeholders in cooperation with the GCMRC. Needs were specified for a five year period.

A 5-Year strategic and FY98 annual plan were developed, reviewed by the stakeholders and recommended for approval by the Secretary.

A 1997 State of the Natural and Cultural Resources in the Colorado River Ecosystem Resources report was developed to assist the AMWG in evaluating any new or modified dam operations criteria they might recommend. The resources report will be drafted annually.

A Total of 33 differing independent monitoring and research projects were managed by the GCMRC. These and other science activities contributed to 42 differing technical reports and publications from the GCMRC in 1997.

A science symposium on the 1996 BHBF was convened by the GCMRC. Three major science proceedings are expected to result from the symposium.

PLANNED ADAPTIVE MANAGEMENT PROGRAM OPERATIONS FOR FY98

The AMP, as envisioned and specified in the GCDEIS is fully operational with the primary entities and required individuals for the program in place. The independent review groups specified in the GCDEIS are partially in place. An oversight review group to assist the AMWG and GCMRC will be in place during FY98.

The activities of the AMP in FY98 are included in the following list of planned activities for the AMWG/TWG and GCMRC.

FY98 AMWG/TWG Activities

AMWG/TWG activities include a broad cross section of programs as follows:

- Continued Development of protocols/procedures for operation of AMWG/TWG.
- Review of AMP budget process and budget allocations for short and long-term programs.
- Review and revision of objectives and information needs for the Colorado River Ecosystem and Lake Powell Monitoring and Research programs.
- Participation in Conceptual Modeling Workshops for the Colorado River Ecosystem and Lake Powell programs.
- Review and recommendation of the following GCMRC documents.
 - FY98 Adaptive Management Flow Regime Information.
 - FY98 Contingency Monitoring and Research Plans for scheduled and unscheduled high flows.
 - FY99 Monitoring and Research Plan.
 - FY98 State of Natural and Cultural Resources in the Colorado River Ecosystem Report.
- Development of improved processes for implementing Adaptive Management flows/activities.
- Development of objectives and information needs for long-term planning for Selective Withdrawal (temperature control) programming.

FY98 GCMRC Activities

The GCMRC will implement diverse activities in FY98 to accommodate long and short-term objectives and information needs of the AMWG/TWG. These activities are:

- Develop Final FY99 Annual Monitoring and Research Plan, RFPs, and cooperative agreements for implementation.
- Draft Final FY98 State of the Natural and Cultural Resources of the Colorado River Ecosystem Report.
- Draft Summary of Program Accomplishments for FY98.
- Evaluate AMWG specified adaptive management flows of 31,000 and 45,000 cfs on Colorado River ecosystem and Lake Powell resources.
- Evaluate long-term sustained flows of 22,000-27,000 cfs, during much of 1997, on Colorado River ecosystem and Lake Powell resources.
- Initiate program to develop conceptual ecosystem models for Colorado River Ecosystem Resources and Lake Powell Resources.
- Review and revise where appropriate all measurement and assessment protocols for GCMRC monitoring and research programs.

Budgets

The projected budgets in millions of dollars for the AMP over the period FY98-FY2002 are as follows: These amounts are estimates and they are contingent upon work plans that are being developed or will be developed in the future.

FY1998	FY1999	FY2000	FY2001	FY2002
7.1	7.2	8.0	7.5	7.2

The breakdown of the proposed FY99 budget is as follows:

	<u>000 of \$</u>
• Reclamation Administration of AMP/TWG	211
• Overhead Services Reclamation	283
• GCMRC Operations, Personnel, Contract Services	1,912
• Information Technologies	488
• Biological Resources Science, including Logistics	1,390
• Physical Resources Science, including Logistics	1,175
• Cultural Resources Science, including Logistics	1,188
• Socioeconomic Resource Science and the Lake Powell program	313
• Independent Review Groups	246
	\$7,193,000

Reporting

The program activities reported in this document require extensive planning and documentation as noted earlier, for every activity and element specified in this report, one or more documents are developed and archived. In any one year over 40 technical reports, publications, articles etc. are developed by the GCMRC.

The Chief of GCMRC or Reclamation's Program Manager for the Glen Canyon Dam AMP can be contacted directly for any documents or information referenced herein, or not referenced, but needed for clarification of information presented.

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