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FISCAL YEAR 1997

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

To

Secretary of Interior

By

Grand Canyon Monitoring and Research Center

August 1997

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ORGANIZATIONAL CHART

Grand Canyon Monitoring and research Center Staff Structure

FISCAL YEAR 1997

REPORT TO CONGRESS ON OPERATIONS

OF THE ADAPTIVE MANAGEMENT PROGRAM UNDER

THE GRAND CANYON PROTECTION ACT

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HISTORICAL FACTORS CONTRIBUTING TO

FORMATION OF THE ADAPTIVE MANAGEMENT PROGRAM

In 1963 the Glen Canyon Dam was complete, with the intent of significantly altering flow regimes through Glen, Marble and Grand Canyons. Lake Powell was created above the dam, with over 3,154 kilometers of shoreline. The lake is capable of storing 10,522,056 hectare meters of water in its 299 kilometer-long storage area. The recreation, irrigation and hydropower benefits introduced to the Southwest by the dam are extensive and continue to expand.

Glen Canyon Dam made Lake Powell the key storage unit in the far reaching water development plan called the Colorado River Storage Project (CRSP) (US BOR 1995). The dam was built as a electric power peaking facility, permitting it to move from low electrical output during low power demand, to high output in peak demand periods. Flow releases from the dam must be adjusted daily to respond to these variances in electrical demand. At optimum operations, the dam's generators are capable of producing 1.38 million kilowatts of power.

Placement of the dam created downstream changes, some of which have not been viewed as beneficial. In addition, its highly variable flow releases from 1966 to 1991 caused concern over resource degradation. As a result, restrictions were placed on flows for an interim period, until an environmental impact statement (EIS) could be developed on operation of the dam. Since 1991 flows from Glen Canyon Dam have been managed to a narrow range of historical seasonal flows. Normally these flows do not exceed 25,000 cubic ft. per second (cfs), and range most often between 141 and 453 cfs.

Colorado River flows are taken from the forebay of Glen Canyon Dam, 67-76 meters below the surface of Lake Powell, which results in clear cold water with year round temperatures of 41° F to 45° F. Although 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 to river segments below side channel rivers and streams, such as the Little Colorado River or Kanab Creek (NRC 1991).

Since damming of the river in 1963, there has been only one flow release which approached pre-dam spring floods. In 1983, a combination of events in the upper and lower Colorado River Basin required emergency releases from Glen Canyon Dam which reached 97,000 cfs. Except for the 1983 event, releases over the last 32 years have ranged between 56 cms and 707 cms with flows further constrained to the range of 141 to 453 cms since 1991.

A NEED FOR SCIENCE

In the late 1970's it became obvious to scientists and managers that changes to the river and its environs caused by dam operations needed intensive study to determine impacts on downstream resources. To respond to these concerns the US Bureau of Reclamation launched the Glen Canyon Environmental Studies program in 1982 (NRC 1987, US BOR 1989). 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 (NRC 1991, 1996). Developing spatial and temporal data using GIS has also been a critical part of the second phase. The annual budget in millions, for the program varied significantly from \$1-\$12 million since 1982. The last five year annual budgets ranged from \$8.0-\$12.0 million.

By the late 1980s, sufficient knowledge had been developed to determine that impacts were occurring, and that they needed to be avoided and/or at least mitigated. This knowledge and other factors led the Secretary of the interior to direct the Bureau of Reclamation to prepare an environmental impact statement on operation of the Glen Canyon Dam (US BOR 1995). The intent was to evaluate alternative operation strategies that would minimize adverse impacts, and hopefully restore or improve some natural processes.

Concerned over the required time to complete the EIS, in 1991 the Secretary directed the Director of U.S. BOR to operate the Glen Canyon Dam under interim flows until the EIS was completed (NRC 1996). These flows of approximately 141 to 452 cms represented a more narrow range than the 30 to 700 cm flows occurring between 1966 and 1991.

Responding to continued concerns over potential impacts of Glen Canyon Dam operations on downstream resources, Congress enacted the Grand Canyon Protection Act in 1992 (US BOR, 1995). The Act directs the Secretary of Interior to operate Glen Canyon Dam,

"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 Grand Canyon Protection Act also directed the Secretary of Interior 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 of Interior 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 document responds to the above noted reporting requirements specified in GCPA, Sec. 1804, C, 2. This fiscal year 1997 report focuses on activities included in the Adaptive Management Program in fiscal year 1997 and projected activities planned for fiscal year 1998.

AN ADAPTIVE MANAGEMENT PROGRAM

The Grand Canyon Protection Act gives general guidance on but not explicitly state how the Secretary of the Interior is to implement programs to mitigate adverse impacts to

natural, recreation, and cultural resources of the Grand Canyon. However, the environmental impact statement on future Glen Canyon Dam operations (US BOR 1995) does specify an "Adaptive Management Program" as the required process for incorporating science and diverse stakeholders in future dam operations evaluation and management. The "Adaptive Management Program" specified in the EIS calls for continued interaction of managers and scientists, to both monitor the effects of current dam operations on the river ecosystem, and research new alternatives that increase protection of resources and improve natural processes.

The Adaptive Management Program, schematically characterized in Figure 1 identifies the following entities who are to 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) and Technical Work Group (TWG) goals are clearly articulated in the Glen Canyon Dam EIS (US BOR 1995). The AMWG is established to develop and evaluate, with scientific data, alternative operations strategies for the Glen Canyon Dam. This is accomplished by the various agencies and stakeholders specifying research objectives and information needs for the GCMRC and using developed science and information to specify operations criteria for Glen Canyon Dam. The TWG continually articulates the AMWG objectives into revised research needs to the Center, which in turn provides continuing monitoring and science data to the AMWG to evaluate selected operations criteria and revise new criteria where needed or appropriate.

The AMWG is comprised of federal and state resource managers, Native American Tribes, power marketers, environmental groups, recreationists and other stakeholders. It does not displace the Bureau of Reclamation and its authority and responsibility to operate Glen Canyon Dam in the best interests of both the environment and society. The Bureau maintains the final authority for dam operations (NRC 1996). The EIS does specify a different process for deriving dam operation strategies into the future. That process specifies that the BOR will operate within the Adaptive Management Work Group with other federal and state agencies and stakeholders, and will utilize ecosystem science to monitor, evaluate and select future operation strategies for the dam.

The Grand Canyon Monitoring and Research Center (GCMRC) is established with a specific applied science mission. The mission is to provide scientific understanding of

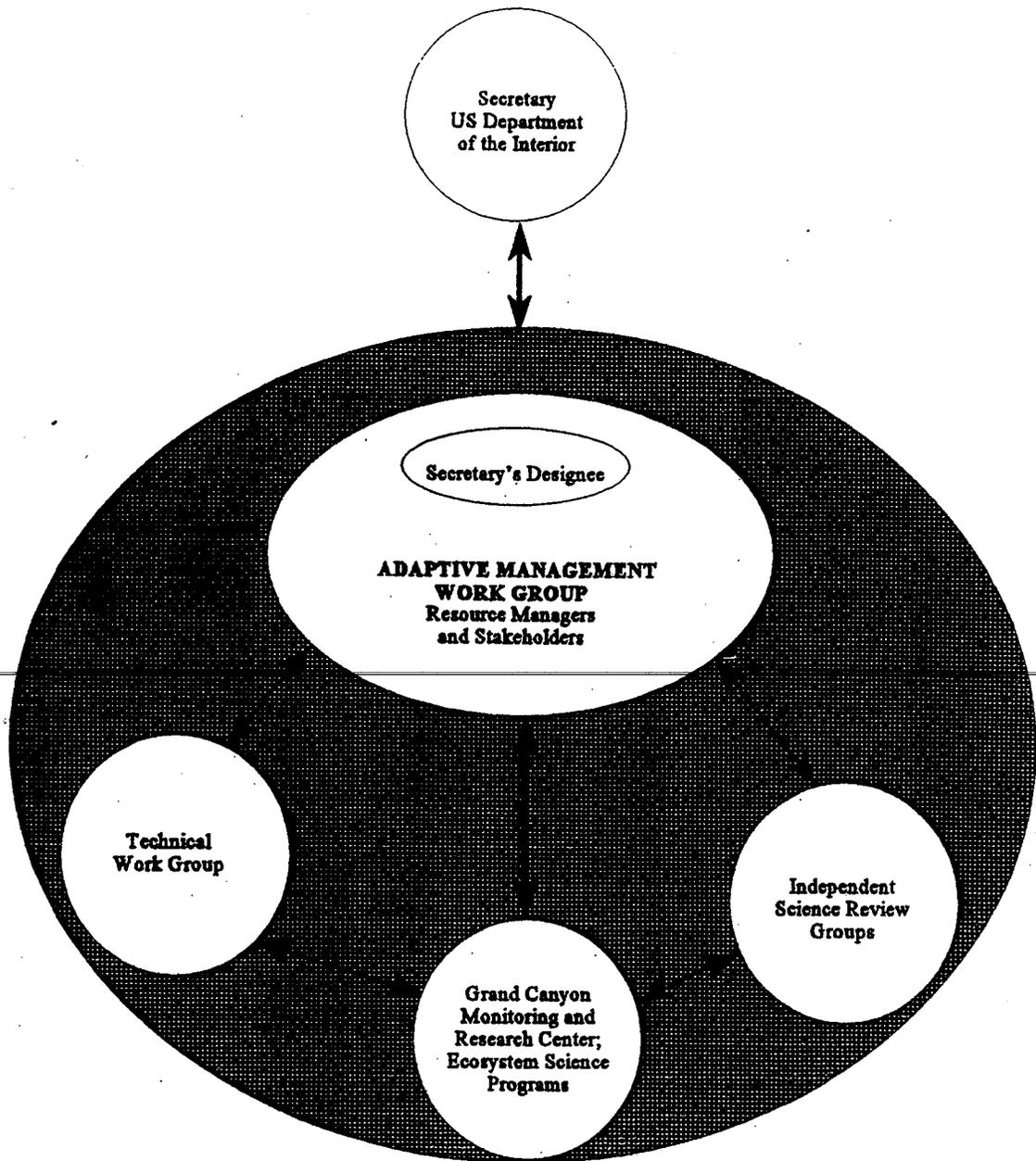


Figure 1. The Adaptive Management Program and processes for determining future operations of the Glen Canyon Dam.

physical, biological, socioeconomic and cultural resource response to alternative operations criteria for the Glen Canyon Dam.

The adaptive management process is a new approach in management, which incorporates science on a continuing basis in assessment of outcomes from management alternatives (ESA 1994, Walters 1986). Figure 1 characterizes the environment in which the Adaptive Management Work Group obtains new science and technical understanding from the GCMRC, TWG and independent science reviewers, so that appropriate recommendations can be made to the Secretary through his/her designee

ADAPTIVE MANAGEMENT PROGRAM ACTIVITIES: FISCAL YEAR 1997

In fiscal year 1997, significant progress was made on activities relating to the Adaptive Management Program. These included the following:

1. Establishment of the Adaptive Management Program. The AMP was established by the Secretary of Interior in development and approval of the Charter for the Adaptive Management Work Group.
2. Formation of the Adaptive Management Work Group (AMWG) and Technical work Group (TWG) and associated programs.
3. Complete formation of the Grand Canyon Monitoring and Research Center (GCMRC), completion of a "Transition Plan" for moving all activities from the Glen Canyon Environmental Studies Program (GCES) to GCMRC, and development of monitoring and research plans.

The Adaptive Management Program

The Adaptive Management Program approach specified in the Glen Canyon Dam EIS was officially established in the EIS Record of Decision signed by the Secretary of Interior October 8, 1996. Under section VI, 1.0 Environmental Commitments and Monitoring, Adaptive Management is called for as follows:

1. Adaptive Management: this commitment includes the establishment of an Adaptive management workgroup, chartered in accordance with the Federal Advisory Committee Act; and development of a long-term monitoring, research, and experimental program which could result in some additional operational changes. However, any operational changes will be carried out in compliance with NEPA.

The Adaptive Management Program was officially implemented with secretariat approval of the charter for the Adaptive Management Work Group in January 1997.

The Adaptive Management Work Group and Technical Work Group

The Adaptive management Work Group charter was signed by the Secretary of Interior January 15, 1997. This charter establishes a Federal Advisory Committee to advise the Secretary of the Interior on the impacts of Glen Canyon Dam operations. As noted above, as part of the long-term monitoring, the Secretary's Record of Decision (ROD) mandates development of an Adaptive Management Program (AMP). 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 AMP includes an Adaptive Management work Group (AMWG).

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 Act. 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 Act.

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

- A. Establish AMWG operating procedures.
- B. Advise the Secretary in meeting environmental and cultural commitments of the EIS, as requested.
- C. Recommend the framework for the AMP policy, goals, and direction.
- D. Develop recommendations for modifying operating criteria and other resource management actions pursuant to the Act.
- E. 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 Glen Canyon Dam on the natural, recreational, and cultural resources of the Grand Canyon National Park and Glen Canyon National Recreation Area.
- F. Review and provide input to the Secretary on the reports required in Sections 1804 (c)(2) and 1804 (d).

- G. 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 Act.
- H. Monitor and report on compliance of all program activities with applicable laws, permitting requirements, and the Act. 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:

- A. Secretary's Designee, who shall serve as chairperson for the AMWG.
- B. 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
- C. One representative each from the seven basin states:
 - 1. Arizona
 - 2. California
 - 3. Colorado
 - 4. Nevada
 - 5. New Mexico
 - 6. Wyoming
 - 7. Utah
- D. Two representatives each from:
 - 1. Environmental groups
 - 2. Recreation interests

3. **Contractors who purchase Federal power from Glen Canyon Powerplant**

Actions taken for Water Year 1997 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 1998 Fiscal Year research and monitoring plan (referenced in following section).**
3. **Recommendation to the Secretary for the GCMRC to develop and initiate Fiscal Year 1998 monitoring and research programs for Lake Powell. Objectives, and information needs for all programs are to be reviewed in Fiscal Year 1998, for implementation in Fiscal Year 2000.**
4. **Recommendations to the Secretary to initiate a 31,200 cfs Adaptive Management flow in October/November of Fiscal Year 1998 to enhance sediment resources.**
5. **Recommendation to the Secretary to evaluate initiation of a \approx 45,000 cfs flow in the winter/spring of Fiscal Year 1998 to enhance biological, physical and cultural resources and riverine processes.**
6. **Selection of a Technical Work Group to work closely with the GCMRC in developing objectives, information needs and monitoring and research programs.**

The Technical Work Group, established as a subgroup of the AMWG implemented the following activities in 1997.

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 Fiscal Year 1999 Annual Monitoring and Research Plan.**
3. **Review of evaluation of GCMRC Fiscal Year 1997 State of Colorado Riverine Corridor Resources Report.**
4. **Review and evaluation of GCMRC information on a potential Adaptive Management Hydrograph for a \approx 45,000 cfs release in spring 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 better represent and respond to the broad spectrum of resource research and monitoring needs that would have to be addressed in the Adaptive Management Program. It was established early so that it could accomplish a critical transition from previous Bureau of Reclamation programs, that had been in place since 1982.

The GCMRC accomplished two major objectives in FY1997. The first related to developing and implementing the transition program to both phase out the Upper Colorado BOR Glen Canyon Environmental Studies Program (GCES), and launch the new Grand Canyon Monitoring and Research Center (GCMRC) Programs in the office of the Assistant Secretary, Water and Science, Department of the Interior. The intent was to have the new Center fully operational to respond to establishment of the AMWG in September 1997.

The second major objective involved establishing with stakeholders' objectives and information needs, and developing long-term and annual monitoring and research plans.

FY97 Transition Program

The FY97 Transition Program from the USBOR/Glen Canyon Environmental Studies Program (GCES) to the Assistant Secretary's Grand Canyon Monitoring and Research Center's program was completed in FY 1997, except for minor changes in personnel and staff locations. In July, 1996, the Transition Plan was drafted by GCMRC, GCES, and UC USBOR 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.

Accommodating all Transition Activities on a Pre-approved \$7,300,000 Budget: By delaying placement of all GCMRC employees until FY1998 and reducing equipment and logistics, 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 FY1997 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 attached schematic provides a listing of all staff positions.

It is anticipated that this number of staff can manage the GCMRC program over the next 5 years, with a moderate Lake Powell program. Involvement in programs involving selective withdrawal 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, 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 a broad-based constituency formally developed as a Federal Advisory Committee (AMWG). All program implementation is reviewed and recommended by the AMWG.

The focus of all research programs are ecosystem science and management. 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 research staff for review by the AMWG as to how well they respond to information needs and requirements specified by the AMWG.

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 are planned, as well as eight Tribal programs under the Programmatic Agreement.

Equipment Transfers. Equipment associated with operation of the GCMRC program has been identified and transferred to GCMRC inventory where appropriate, and if not appropriate, moved to the UC USBOR inventory or placed on surplus. Two areas where significant new equipment has been purchased includes computer systems and river logistics equipment.

GCMRC will conduct its own 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 approximately 25% and provide an equitable bid basis for entities responding to call for proposals;
2. Have more control over logistics operations, so as to facilitate integrated monitoring and research designs, requiring interdisciplinary team research.

Data File Transfers. All files and data from the GCMRC Flagstaff facility have been moved to GCMRC. No files or data from GCMRC 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.

FY1997 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 FY1998 Annual Plan and the State of Riverine Corridor Resources Reports were developed in FY1997. In addition, the GCMRC managed 33 separate research projects to completion.

Operations protocol were specified for the Center cooperatively with stakeholders and cover planning, implementation instruments (contracts, IAGS') and program and product reviews.

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

~~A 5-Year strategic and FY1998 annual plan~~ were developed, reviewed by the stakeholders and recommended for approval by the Secretary.

A 1997 State of the Colorado Riverine Corridor 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 Center. These and other science activities contributed to 42 differing technical reports and publications from the Center in 1997.

A science symposium on the 1996 beach habitat building flow was convened by the Center. Three major science proceedings are being drafted from science developed from the symposium.

PLANNED ADAPTIVE MANAGEMENT PROGRAM OPERATIONS FOR FY1998

The Adaptive Management Program, as envisioned and specified in the Glen Canyon Dam EIS is fully operational with the primary entities and required individuals for the program in place. The independent review groups specified in the EIS are partially in place. An oversight review group to assist the AMWG and GCMRC will be placed in FY1998.

Activities for the AMP in FY1998 are captured in the following description of planned activities for the AMWG/TWG and GCMRC.

FY1998 AMWG/TWG Activities

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

- 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 Colorado Riverine Corridor and Lake Powell Monitoring and Research programs.
- Participation in Conceptual Modeling Workshops for the Colorado Riverine Corridor and Lake Powell programs.
- Review and recommendation on the following GCMRC documents.
 - FY1998 Adaptive Management Flow Regime Information.
 - FY1998 Contingency Monitoring and Research Plans for scheduled and unscheduled high flows.
 - FY1999 Monitoring and Research Plan.
 - FY1998 State of Riverine Corridor Resources Report.
- Developing improved processes for implementing Adaptive Management flows/activities.
- Develop objectives and information needs for long-term planning for Selective Withdrawal programming.

FY1998 GCMRC Activities

This Grand Canyon Monitoring and Research Center will implement diverse activities in FY1998 to accommodate requested long and short-term objectives and information needs of the AMWG/TWG. These activities are as follows:

- Develop Final FY1999 Annual Science Plan and RFP and cooperative agreements for implementation.
- Draft Final FY1998 State of the Colorado Riverine Corridor Resources.
- Draft Summary of Program Accomplishments for FY1998.

- Evaluate AMWG specified Adaptive Management flows of 31,200 and 45,000 cfs on riverine and Lake Powell resources.
- Evaluate long-term sustained flows of 22,000-27,000 cfs on riverine and Lake Powell resources.
- Initiate program to develop conceptual ecosystem models for Colorado Riverine Corridor 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 FY1998-FY2002 are as follows:

FY1998	FY1999	FY2000	FY2001	FY2002
7.1	7.1	8.0	7.5	7.2

The breakdown of the proposed FY1999 budget is as follows:

	<u>000 of \$</u>
• BOR Administration of AMP/TWG	211
• Overhead Services BOR	229
• Operations, Personnel, Contract Services	2,100
• 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, including Lake Powell program	313

*does not incl → \$7,094,000
\$100,000 outside
Funding (UP Pgm, etc).*

Reporting

The program activities reported in this document require extensive planning and documentation. 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 the Grand Canyon Monitoring Research Center or the Upper Colorado Region BOR Program Manager for the Glen Canyon Dam Adaptive Management program

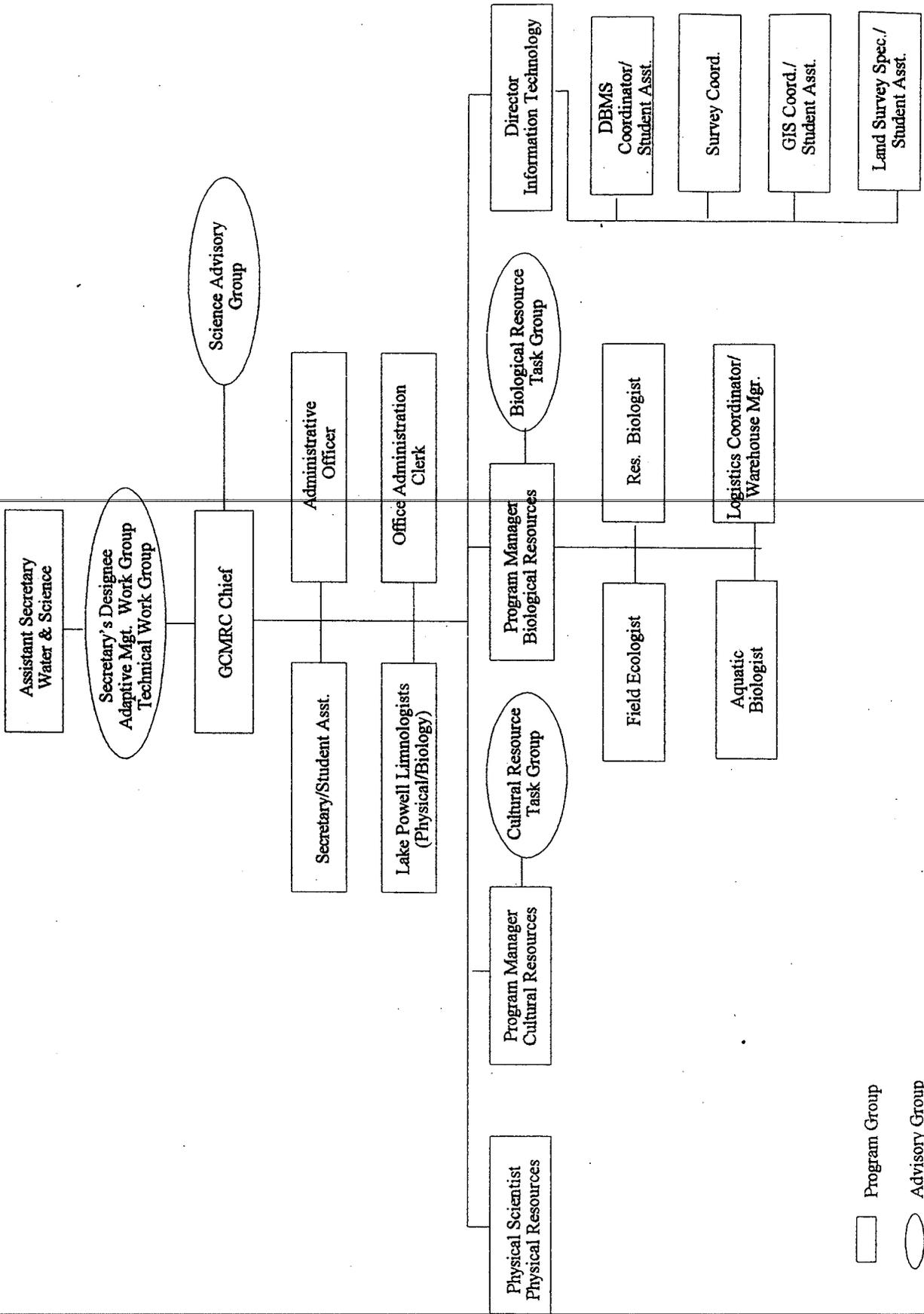
can be contacted directly for any documents or information regarding reported elements herein.

Their addresses are:

Lawrence D. Garrett
US Department of the Interior
Grand Canyon Monitoring
and Research Center
2255 N. Gemini Dr., Room 341
Flagstaff, AZ 86001

Bruce Moore
Program Manager
Glen Canyon AMP
Upper Colorado Bureau
of Reclamation
UC205
124 S. State St.
Salt Lake City, Utah 84125

Grand Canyon Monitoring and Research Center Staffing Structure



Program Group
 Advisory Group