

# **Strategic Plan**

## **Glen Canyon Dam Adaptive Management Program**

**Final Draft**

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# FOREWORD

This strategic plan is a guidance document for the Glen Canyon Dam Adaptive Management Program and was developed by program members. Elements of this plan include the Glen Canyon Dam Adaptive Management Work Group's vision and mission statements, as well as principles, goals, and management objectives. One of the primary objectives of the program is to meet the environmental and monitoring commitments of the Glen Canyon Dam Final Environmental Impact Statement and Record of Decision, and comply with the Grand Canyon Protection Act of 1992. The Grand Canyon Protection Act mandated the preparation of the Final Environmental Impact Statement and Record of Decision to direct operations of Glen Canyon Dam and use other authorities in such a manner 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. Recognizing the complexity of this task, the Record of Decision for the Operation of Glen Canyon Dam Final Environmental Impact Statement directed the Bureau of Reclamation and other interested agencies, tribes, organizations, and individuals to use an adaptive management approach for implementing the preferred alternative. This approach is described in this strategic plan.

It is anticipated that this strategic plan is a long-term plan; however, it is recommended that the Adaptive Management Work Group review this plan at the beginning of every other federal fiscal year. The review process should be completed within six months of the beginning of the fiscal year in which the review takes place. If any of the stakeholders or the interested public identify changes that are needed to the strategic plan, including changes to any of the goals, management objectives, or information needs, these recommendations will be made to the Adaptive Management Work Group for approval and incorporation in a revised plan.

# 1 INTRODUCTION

This strategic plan describes the adaptive management approach that the Glen Canyon Dam Adaptive Management Program uses in making recommendations to the Secretary of the Interior regarding management of the Colorado River ecosystem (see Glossary). This strategic plan presents the vision, mission, principles, goals, management objectives, information needs, and management actions of the Glen Canyon Dam Adaptive Management Program. As the main planning document of the Adaptive Management Program, this plan has been prepared based on consultation and coordination among those organizations, institutions, and individuals with interests in the operation of Glen Canyon Dam and its effects on the Colorado River ecosystem.

The plan presents the background and history of the Glen Canyon Dam Adaptive Management Program, the scope of the program, the program members or stakeholders, the statutory and organizational framework, and the details of how the Adaptive Management Program operates. The plan details the specific management objectives needed to realize the vision and goals of the program, and whether they are achieved through the Adaptive Management Program or supplemented by funds outside the Program. Supporting documents are provided in a series of appendices.

## ADAPTIVE MANAGEMENT PROGRAM ORGANIZATIONAL FRAMEWORK

### What is Adaptive Management?

Adaptive management has gained widespread acceptance in resource management since Holling (1978) developed the concept. Lee (1993:9) defines adaptive management with a simple imperative: “policies are experiments; *learn from them.*” Other characteristics (as described by Nyberg 1998; Walters 1986; Taylor et al. 1997) include:

- A focus on ecosystems;
- Experimentation and manipulation of managed ecosystems;
- A time scale based on the biological generation or longer;
- Acknowledgement of uncertainty about what policy or practice is best for a particular management issue;
- Careful implementation of a plan of action designed to reveal the critical knowledge;
- Monitoring of key response indicators;
- Analysis of outcomes in consideration of original objectives; and
- Incorporation of results into future decisions.

### Glen Canyon Dam Adaptive Management Program Defined

Due to the significant levels of uncertainty surrounding the resources of the Colorado River ecosystem and the effects of dam operations on those resources, the Glen Canyon Dam Environmental Impact Statement stipulated an adaptive management approach. This approach allows for scientific experimentation that adds to the knowledge base of effects of the operation

of Glen Canyon Dam, primarily on downstream resources, and results in the development of recommendations to the Secretary of the Interior regarding additional operational changes.

The adaptive management approach being taken to manage Glen Canyon Dam operations and the resources affected by dam operations is as follows:

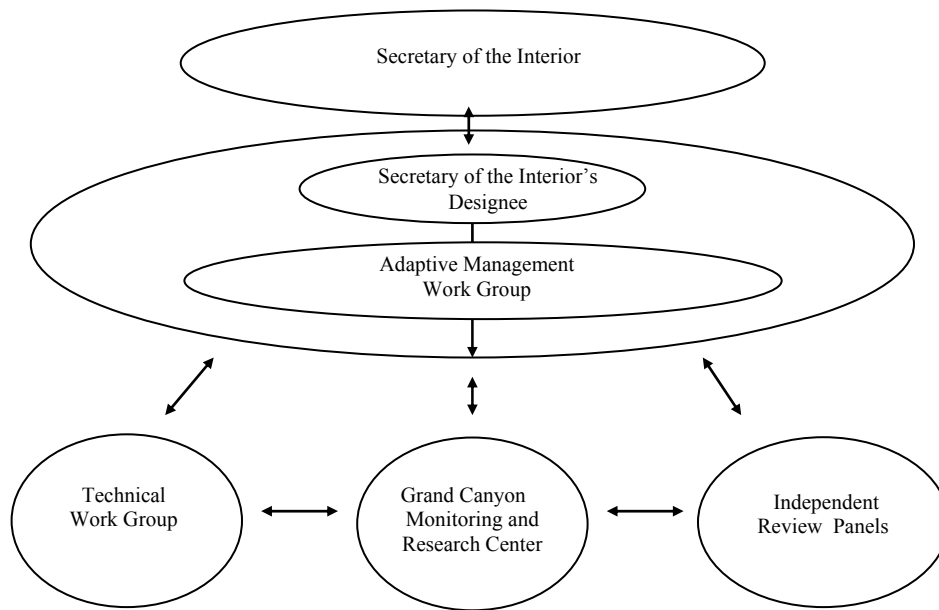
- The Adaptive Management Program focus is on the Colorado River ecosystem;
- Models are developed to reveal the potential effects of policies, activities, or practices that are being considered for implementation;
- Questions are formulated as testable hypotheses regarding the expected responses or linkages of the Colorado River ecosystem to dam operations and other management actions;
- Questions are formulated as testable hypotheses;
- Experiments are conducted to test hypotheses and answer questions;
- Management activities reveal, through monitoring and evaluation of results, the accuracy or completeness of the earlier predictions; and
- New knowledge and information produced through experimentation are incorporated into management discussions and recommendations to the Secretary of the Interior.

### **Organizations and Positions Within the Glen Canyon Dam Adaptive Management Program**

With the signing of the Record of Decision for the Glen Canyon Dam Environmental Impact Statement (Reclamation 1996), the Glen Canyon Dam Adaptive Management Program was established, along with the following positions or organizations:

- Secretary of the Interior's Designee
- Adaptive Management Work Group
- Technical Work Group
- Independent review panels
- Grand Canyon Monitoring and Research Center

The roles, functions, and relationships of these positions and organizations are graphically depicted in Fig. 1 and are described in detail below based on the descriptions in the Glen Canyon Dam Environmental Impact Statement (Reclamation 1995) and Record of Decision (Reclamation 1996).



**Figure 1. Organizational components of the Glen Canyon Dam Adaptive Management Program.**

*Secretary of the Interior's Designee*

The Secretary of the Interior's Designee serves as the principal contact for the Glen Canyon Dam Adaptive Management Program and as the focal point for issues and decisions associated with the program. Responsibilities of the position include:

- Chairs the Adaptive Management Work Group;
- Ensures that the Department of the Interior complies with its obligations under the Grand Canyon Protection Act and Record of Decision for the Glen Canyon Dam Environmental Impact Statement;
- Ensures that the Department of the Interior fulfills its trust responsibilities to American Indian tribes with interests or assets affected by the program; and
- Reviews, modifies, accepts, or remands recommendations from the Adaptive Management Work Group in making decisions about any changes in dam operation and other management actions and forwards the approved recommendations to the Secretary of the Interior.

*Adaptive Management Work Group*

The Adaptive Management Work Group is a Federal Advisory Committee that includes representatives from the stakeholder tribes, organizations, and institutions listed below. The Secretary of the Interior appoints the Adaptive Management Work Group members. Responsibilities of the Adaptive Management Work Group as delineated in the Glen Canyon Dam Environmental Impact Statement (Reclamation 1995:36) are:

- Provides the framework for Glen Canyon Dam Adaptive Management Program policy, goals, direction, and priorities;
- Develops recommendations to the Secretary of the Interior for modifying operating criteria and other resource management actions, policies, or procedures;
- Facilitates coordination and input from interested parties;
- Reviews and forwards the annual report to the Secretary of the Interior and his/her designee on current and projected year operations;
- Reviews and forwards annual budget proposals; and
- Ensures coordination of operating criteria changes in the Annual Operating Plan for Colorado River Reservoirs and other ongoing activities.

Note that “dam operations” refers to the operation of the power plant and other release structures, such as bypass structures, spillways, and, potentially, a temperature control device, among others. Their uses conform to applicable law. The Adaptive Management Work Group develops recommendations for all of the dam’s structures to further the purposes of the Grand Canyon Protection Act, the Glen Canyon Dam Environmental Impact Statement, and Record of Decision. This is done within the limits of the Record of Decision and through experimentation.

Representatives from the following tribes, organizations, or interest groups are presently included in the Adaptive Management Work Group:

- Arizona Department of Water Resources
- Arizona Game and Fish Department
- Bureau of Reclamation
- Bureau of Indian Affairs
- Colorado River Board of California
- Colorado River Commission of Nevada
- Colorado River Energy Distributors Association
- Colorado Water Conservation Board
- Grand Canyon River Guides
- Grand Canyon Trust
- Hopi Tribe
- Hualapai Tribe
- National Park Service
- Navajo Nation
- New Mexico State Engineer’s Office
- Pueblo of Zuni
- Southern Paiute Consortium
- Southwest Rivers
- Trout Unlimited
- U. S. Fish and Wildlife Service
- Utah Associated Municipal Power Systems
- Utah Division of Water Resources
- Western Area Power Administration
- Wyoming Interstate Streams Engineer

### *Technical Work Group*

The Technical Work Group is comprised of technical representatives of Adaptive Management Work Group members and operates at the direction of the Adaptive Management Work Group. The Technical Work Group's main function is to provide technical assistance to the Adaptive Management Work Group. Technical Work Group functions may include (Reclamation 1995:37):

- Developing, with the Grand Canyon Monitoring and Research Center, criteria and standards for monitoring and research programs and providing periodic reviews and updates of these;
- Developing, with the Grand Canyon Monitoring and Research Center, resource management questions (i.e., information needs);
- Reviewing and commenting on the scientific studies conducted or proposed by the program;
- Provide a forum for discussion by Technical Work Group members, external scientists, the public, and other interested persons;
- Providing information as necessary for preparing annual resource reports and other reports as required by the Adaptive Management Work Group; and
- Reviewing strategic plans, annual work plans, long-term and annual budgets, and other assignments from the Adaptive Management Work Group.

### *Grand Canyon Monitoring and Research Center*

The Grand Canyon Monitoring and Research Center was created to fulfill the mandate in the Grand Canyon Protection Act for the “establishment and implementation of a long-term monitoring and research program to ensure that Glen Canyon Dam is operated in a manner that protects the values for which the Grand Canyon National Park and the Glen Canyon National Recreation Area were created.” The Grand Canyon Monitoring and Research Center serves as the science center for the Glen Canyon Dam Adaptive Management Program. The Grand Canyon Monitoring and Research Center leads the monitoring and research of the Colorado River ecosystem and facilitates communication and information exchange between scientists and members of the Technical Work Group and Adaptive Management Work Group. Other functions of the Grand Canyon Monitoring and Research Center are:

- Advocate quality, objective science, and the use of that science in the adaptive management decision process;
- Provide scientific information about resources in the Colorado River ecosystem;
- Support the Secretary of the Interior's Designee and the Adaptive Management Work Group in a technical advisory role;
- Develop research designs and proposals for implementing (by the Grand Canyon Monitoring and Research Center or its contractors) monitoring and research activities in support of information needs;
- Coordinate review of the monitoring and research program with independent review panels;
- Coordinate, prepare, and distribute technical reports and documentation for review and as final products;
- Prepare and forward technical management recommendations and annual reports, as specified in Section 1804 of the Grand Canyon Protect Act, to the Technical Work Group;
- Manage data collected as part of the Adaptive Management Program and serve as a repository for other information about the Colorado River ecosystem;
- Administer research proposals through a competitive contract process, as appropriate;

- Develop, with the Technical Work Group, criteria and standards for monitoring and research programs; and
- Develop, with the Technical Work Group, resource management questions (i.e., information needs).
- Produce the State of the Colorado River Ecosystem Report.

### *Independent Review Panels*

Independent Review Panels, as called for in the Glen Canyon Dam Environmental Impact Statement (Reclamation 1995:38), are comprised of qualified individuals not otherwise participating in the long-term monitoring and research studies. The panels include peer reviewers, science advisors, and protocol evaluation panels whose primary responsibility is to assess the quality of research, monitoring, or science being conducted by the Adaptive Management Program and to make recommendations to improve it. Responsibilities of the panels include:

- Reviewing Glen Canyon Dam Adaptive Management Program monitoring and research programs and protocols;
- Providing reports based on their review to the Grand Canyon Monitoring and Research Center, Technical Work Group, and Adaptive Management Work Group;
- Making recommendations and providing advice to the Adaptive Management Work Group, Technical Work Group, and Grand Canyon Monitoring and Research Center regarding science activities;
- Assessing proposed research plans and programs, technical reports and publications, and other program accomplishments; and
- Conducting five-year reviews of Grand Canyon Monitoring and Research Center monitoring and research protocols.

### **History of the Glen Canyon Dam Adaptive Management Program**

This strategic plan and the Glen Canyon Dam Adaptive Management Program cannot be understood without referencing key events since completion of Glen Canyon Dam in 1963. The plan and program arose from the Bureau of Reclamation's proposal to install additional generators on the bypass tubes and to rewind and uprate the existing generators at Glen Canyon Dam. This proposal resulted in the establishment of the Glen Canyon Environmental Studies that existed from 1982 through 1996.

### *Glen Canyon Environmental Studies*

While the National Park Service, Native Americans, river runners, and scientists had noticed that some beaches were disappearing and that plant and animal life along the Colorado River were changing since Glen Canyon Dam was completed in 1963, the Glen Canyon Environmental Studies program of the Bureau of Reclamation was the first systematic effort to investigate the effects of dam operations on downstream resources. The program began in 1982 and lasted through 1996. The Glen Canyon Environmental Studies did identify a mix of positive and negative consequences of dam operations on the downstream environment. In response to substantial public concern over the findings of the Glen Canyon Environmental Studies, in 1989 the Secretary of the Interior announced that an environmental impact statement would be completed to evaluate the operation of Glen Canyon Dam. With this announcement, the Glen

Canyon Environmental Studies focused on providing specific data for use in the Glen Canyon Dam Environmental Impact Statement (Reclamation 1995).

### *Grand Canyon Protection Act*

The Grand Canyon Protection Act (Appendix A) was enacted on October 30, 1992. Section 1802 states:

(a) IN GENERAL.—The Secretary shall operate Glen Canyon Dam in accordance with the additional criteria and operating plans specified in Section 1804 and exercise other authorities under existing law in such a manner 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.

(b) COMPLIANCE WITH EXISTING LAW.—The Secretary shall implement this section in a manner fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in Arizona vs. California, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River Basin.

(c) RULE OF CONSTRUCTION.—Nothing in this title alters the purposes for which the Grand Canyon National Park or the Glen Canyon National Recreation Area were established or affects the authority and responsibility of the Secretary with respect to the management and administration of the Grand Canyon National Park and Glen Canyon National Recreation Area, including natural and cultural resources and visitor use, under laws applicable to those areas, including, but not limited to, the Act of August 25, 1916 (39 Stat. 535) as amended and supplemented.

The Secretary of the Interior was also directed to establish and implement long-term monitoring programs and activities to ensure that Glen Canyon Dam is operated in a manner consistent with the Grand Canyon Protection Act. These programs include necessary research and studies to determine the effect of management of the dam on the natural, recreational, and cultural downstream resources. These actions will also be undertaken in consultation with other federal agencies, the Governors of the Basin States, Indian Tribes, and the general public, including representatives of academic and scientific communities, environmental organizations, the recreation industry, and contractors for the purchase of federal power produced at Glen Canyon Dam. To accomplish these requirements, the Glen Canyon Dam Adaptive Management Program was established.

### *Glen Canyon Dam Environmental Impact Statement*

The Glen Canyon Dam Environmental Impact Statement (Reclamation 1995) was completed in March 1995. Its purpose was to “determine specific options that could be implemented to minimize—consistent with law—adverse impacts on the downstream environmental and cultural resources and Native American interests in Glen and Grand Canyons.” The Glen Canyon Dam

Environmental Impact Statement analyzed nine alternatives to allow the Secretary of the Interior to balance competing interests and to meet statutory responsibilities for protecting downstream resources and producing hydropower, and to protect affected Native American interests. The preferred alternative was the Modified Low Fluctuating Flow Alternative.

### *Record of Decision on the Operation of Glen Canyon Dam*

On October 9, 1996, the Secretary of the Interior signed the Record of Decision that presented the rationale for choosing the Modified Low Fluctuating Flow Alternative. As noted in the Record of Decision:

The goal of selecting a preferred alternative was not to maximize benefits for the most resources, but rather to find an alternative dam operating plan that would permit recovery and long-term sustainability of downstream resources while limiting hydropower capability and flexibility only to the extent necessary to achieve recovery and long-term sustainability. [Reclamation 1996:10]

The Record of Decision (Appendix G) included seven environmental and monitoring commitments:

- Adaptive Management
- Monitoring and Protection of Cultural Resources
- Flood Frequency Reduction Measures
- Beach/Habitat-Building Flows
- New Population of Humpback Chub
- Further Study of Selective Withdrawal
- Emergency Exception Criteria

The commitments are explained in detail in the Record of Decision (Reclamation 1996; Appendix G) and in the Glen Canyon Dam Environmental Impact Statement (Reclamation 1995:33-34); however, it should be noted that subsequent work of the Technical Work Group and Adaptive Management Work Group have altered some commitments (Technical Work Group 1998) with Endangered Species Act and National Environmental Policy Act compliance.

### *Statutes, Policies, and Resolutions*

The Colorado River is managed and operated under numerous compacts, federal and state laws, court decisions and decrees (including Native American water claim settlements), contracts, treaties, and regulatory guidelines collectively known as the Law of the River. This collection of documents apportions the water among the seven Basin States and Mexico, and regulates and manages the river flows of the Colorado River. Some of the statutes included within the Law of the River that have a major impact on dam operations are the Colorado River Compact of 1922, the Upper Colorado River Basin Compact of 1948, the Colorado River Storage Project Act of 1956, the Colorado River Basin Project Act of 1968, and the Grand Canyon Protection Act of 1992. In addition to Colorado River specific legislation, the Endangered Species Act of 1973 and court decrees including *Arizona v. California* affect the extent to which water developments

and diversions can be utilized in the Colorado River Basin. The Law of the River and this additional legislation control and influence the Adaptive Management Program.

Additional laws, Acts of Congress, executive orders, policies, tribal resolutions, etc., that control or influence the Adaptive Management Program include the National Park Service Organic Act, enabling legislation for Grand Canyon National Park and Glen Canyon National Recreation Area, and Executive Orders that established reservation boundaries for the Navajo Nation and the Hualapai Tribe. In addition, Section 204 of Title II of Public Law 106-377 controls the level of funding of Adaptive Management Program activities from Colorado River Storage Project power revenues. The Federal Advisory Committee Act controls operation of the Adaptive Management Work Group and the Technical Work Group.

Environmental laws and regulations are important to the Adaptive Management Program. These include, but are not limited to, the Endangered Species Act, National Historic Preservation Act of 1966, and National Environmental Policy Act of 1969. Adaptive Management Program compliance with these statutes, regulations, policies, directives, etc., is described in a later section.

#### *Guidance Document for the Adaptive Management Program*

Since the Adaptive Management Program became fully operational in 1997, questions and uncertainties have arisen over the relationships of program elements, compliance priorities, and other legal matters. Answers were sought from a Department of the Interior Solicitor. The questions posed and answers received from the Department of the Interior's Solicitor (Loveless 2000) are called the "Guidance Document for the Adaptive Management Program." This document is provided as Appendix B.

#### **Summary of the Glen Canyon Dam Adaptive Management Program**

The Adaptive Management Program was developed and designed to provide an organization and process for a collaborative, science-based integration of monitoring and research information to make formal recommendations to the Secretary of the Interior. These recommendations must recognize the environmental commitments of the Glen Canyon Dam Environmental Impact Statement and Record of Decision, and comply with the Grand Canyon Protection Act. The Adaptive Management Program must also remain in compliance with the Law of the River and relevant environmental statutes, regulations, and policies. With all these demands, the Adaptive Management Work Group devised a vision and mission statement and principles to guide its activities and decision making.

## **2 DESIRED RESOURCE CONDITIONS**

### **VISION AND MISSION**

The combined Vision and Mission statement reads as follows:

The Grand Canyon is a homeland for some, sacred to many, and a national treasure for all. In honor of past generations, and on behalf of those of the present and future, we envision an ecosystem where the resources and natural processes are in harmony under a stewardship worthy of the Grand Canyon.

We advise the Secretary of the Interior on how best to protect, mitigate adverse impacts to, and improve the integrity of the Colorado River ecosystem affected by Glen Canyon Dam, including natural biological diversity (emphasizing native biodiversity), traditional cultural properties' spiritual values, and cultural, physical, and recreational resources through the operation of Glen Canyon Dam and other means.

We do so in keeping with the federal trust responsibilities to Indian tribes, in compliance with applicable federal, state, and tribal laws, including the water delivery obligations of the Law of the River, and with due consideration to the economic value of power resources.

This will be accomplished through our long-term partnership utilizing the best available scientific and other information through an adaptive ecosystem management process.

### **PRINCIPLES**

The nine principles of the Glen Canyon Dam Adaptive Management Program are:

1. The goals represent a set of desired outcomes that together will accomplish our vision and achieve the purpose of the Grand Canyon Protection Act. Some of the objectives and actions that fall under these goals may not be the responsibility of the Adaptive Management Program, and may be funded by other sources, but are included here for completeness.
2. The construction of Glen Canyon Dam and the introduction of non-native species have irreversibly changed the Colorado River ecosystem.
3. Much remains unknown about the Colorado River ecosystem below Glen Canyon Dam and how to achieve the Adaptive Management Program goals.
4. The Colorado River ecosystem is a managed ecosystem. An ecosystem management approach, in lieu of an issues, species, or resources approach, will guide our efforts. Management efforts will prevent any further human-induced extirpation or extinction of native species.
5. An adaptive management approach will be used to achieve Adaptive Management Program goals, through experimentation and monitoring, to meet the intent of the Grand Canyon Protection Act, Glen Canyon Dam Environmental Impact Statement, and the Record of Decision.

6. Dam operations and management actions will be tried that attempt to return ecosystem patterns and processes to their range of natural variability. When this is not appropriate, experiments will be conducted to test other approaches.
7. Because management actions to achieve a goal may benefit one resource or value and adversely affect another, those action alternatives that benefit all resources and values will be pursued first. When this is not possible, actions that have a neutral impact, or as a last resort, actions that minimize negative impacts on other resources, will be pursued consistent with the Glen Canyon Dam Environmental Impact Statement and the Record of Decision.
8. If the target of a management objective proves to be inappropriate, unrealistic, or unattainable, the Adaptive Management Program will reevaluate that target and the methods used to attain it.
9. Recognizing the diverse perspectives and spiritual values of the stakeholders, the unique aesthetic value of the Grand Canyon will be respected and enhanced.

## **GOALS**

The 12 goals of the Adaptive Management Program are:

1. Protect or improve the aquatic foodbase so that it will support viable populations of desired species at higher trophic levels.
2. Maintain or attain viable populations of existing native fish, remove jeopardy from humpback chub and razorback sucker, and prevent adverse modification to their critical habitat.
3. Restore populations of extirpated species, as feasible and advisable.
4. Maintain a naturally reproducing population of rainbow trout above the Paria River, to the extent practicable and consistent with the maintenance of viable populations of native fish.
5. Maintain or attain viable populations of Kanab ambersnail.
6. Protect or improve the biotic riparian and spring communities, including threatened and endangered species and their critical habitat.
7. Establish water temperature, quality, and flow dynamics to achieve the Adaptive Management Program ecosystem goals.
8. Maintain or attain levels of sediment storage within the main channel and along shorelines to achieve the Adaptive Management Program ecosystem goals.
9. Maintain or improve the quality of recreational experiences for users of the Colorado River ecosystem, within the framework of the Adaptive Management Program ecosystem goals.
10. Maintain power production capacity and energy generation, and increase where feasible and advisable, within the framework of the Adaptive Management ecosystem goals.
11. Preserve, protect, manage, and treat cultural resources for the inspiration and benefit of past, present, and future generations.
12. Maintain a high quality monitoring, research, and adaptive management program.



## **INFORMATION NEEDS**

To be completed.

## **MANAGEMENT ACTIONS**

To be completed.

# **3 SUPPLEMENTAL INFORMATION**

## **PROGRAMMATIC AND GEOGRAPHIC SCOPE**

The programmatic scope of the Adaptive Management Program is to provide advice and recommendations to the Secretary of the Interior on whether the environmental commitments and constraints of the Record of Decision are being met, and to ensure that the intent of the Record of Decision and Grand Canyon Protection Act are being met. If not, the Adaptive Management Program recommends changes in dam operations and implementation of other management actions.

With respect to dam operations, the Guidance Document for the Adaptive Management Program states:

Long-term monitoring and research, including test flows within the current range of authorized operations, are intended to enable finer and finer tuning of operations over time, as additional knowledge and experience are gained, to better achieve the target mix of resource benefits, as outlined in the Glen Canyon Dam Environmental Impact Statement, pages 54-65. [Loveless 2000]

However, the Grand Canyon Protection Act authorizes other management actions to accomplish its intent of protecting the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. Examples could include water temperature modification, stabilization of historic properties, non-native fish control, and removal of exotic vegetation.

The programmatic scope of the Adaptive Management Program is limited by the range of dam operations and other management actions available to achieve a desired resource effect. This is complicated by the fact that the dam and immediate downstream areas are located at approximately the mid-point between the origin of the Colorado River in the Rocky Mountains and its terminus in the Gulf of California. Many activities, facilities, and conditions on the river occur both upstream and downstream of the geographic area covered by the Adaptive Management Program. The Adaptive Management Program has little or no control over these other areas.

In addition, the Adaptive Management Work Group may coordinate with other organizations and programs and offer recommendations to the Secretary of the Interior regarding actions that may be undertaken by other agencies. As stated in the Adaptive Management Work Group Charter (Appendix C), activities outside the scope of the Adaptive Management Program will be funded separately and do not deter from the focus of the Grand Canyon Protection Act.

The geographic scope of the Adaptive Management Program is the Colorado River mainstem corridor and interacting resources in associated riparian and terrace zones, located primarily from the forebay of Glen Canyon Dam to the western boundary of Grand Canyon National Park. It includes the area where dam operations impact physical, biological, recreational, cultural, and other resources. The scope of Adaptive Management Program activities may include limited investigations into some tributaries (e.g., the Little Colorado and Paria Rivers). The lateral scope is an issue of ongoing research and investigation to determine where the effects of dam operations are located along the floodplain.

The Adaptive Management Program may do research outside the geographic scope defined above to obtain needed information. Such linkages with other areas “should be made on a case-by-case basis, considering ecosystem processes, management alternatives, funding sources, and stakeholder interests.” (National Research Council 1999:43; Loveless 2000)

## **INSTITUTIONAL SCOPE — WHAT THE PROGRAM INFLUENCES OR IS INFLUENCED BY**

### **Annual Operating Plan Process**

The Annual Operating Plan process enables Reclamation to plan and project future Colorado River system reservoir contents and downstream releases for the upcoming water year. The planning process allows the Secretary of the Interior to determine and meet Colorado River Basin water delivery obligations. This process is conducted with input from the Colorado River Management Work Group and other members of the public in accordance with the Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs, and Sections 1802(b) and 1804(c) of the Grand Canyon Protection Act.

Individual reservoir operations in the Colorado River reservoir system are based on appropriate consideration of uses of the reservoirs for all purposes, as required by the Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs. Because hydrologic conditions will vary from any assumptions utilized in the Annual Operating Plan process, projected reservoir operations and dam releases are subject to monthly revision during the year to accommodate changing hydrologic conditions. However, releases must be governed in accordance with the Law of the River.

As a part of this Annual Operating Plan process, the decision on releases to the Lower Division states must be made in accordance with a “surplus,” “normal,” or “shortage” determination. Releases must also meet treaty delivery obligations to Mexico.

The Grand Canyon Protection Act requires criteria, operating plans, and reports “separate from and in addition to” those mandated by the Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs, noting that the Grand Canyon Protection Act is implemented fully consistent with and subject to the water allocation and development provisions of previous compacts and statutes contained in the Law of the River. As noted in the Grand Canyon Protection Act report language, these criteria primarily affect the Glen Canyon Dam powerplant operations and do not affect any delivery obligations to the Lower Basin or Mexico.

### **Tribal Interests Within the Colorado River Ecosystem**

The Navajo Nation, Hualapai Tribe, and Havasupai Tribe have reservation lands, resources, and ownership concerns that may be affected by Adaptive Management Program activities, projects, or proposals. As discussed under the Tribal Consultation section of this plan, government-to-government consultation with these tribes must take place. On tribal land, special tribal permits or permissions must be obtained for activities of the Adaptive Management Program to remain in compliance with tribal laws, codes, resolutions, policies, or executive orders. Other tribes, including the Hopi Tribe, the Pueblo of Zuni, and various bands among the Southern Paiute Consortium, have interests and concerns with resources or places that may be affected by the operation of Glen Canyon Dam or with the management actions or recommendations of the Adaptive Management Program.

### **National Park Service Management Policies and Activities**

As manager of Grand Canyon National Park and Glen Canyon National Recreation Area, the National Park Service is the steward of the downstream natural and cultural resources affected by Glen Canyon Dam operations. The National Park Service’s authority for resource management activities derives from a variety of laws, including the National Park Service Organic Act of 1916, the General Authorities Act of 1970, and the 1978 amendments to this Act (the Redwoods Amendment). Although the Organic Act and the Redwoods Amendment use different language, they define a single standard for the management of the national park system. The basic principles governing management of all units of the National Park Service system are first to conserve park resources and values and second to provide for the enjoyment of park resources and values by the people of the United States.

The National Park Service has three levels of guidance documents: (1) National Park Service Management Policies (National Park Service 2001) that is the basic policy document of the National Park Service, (2) interim updates or amendments accomplished through Director’s Orders, and (3) detailed and comprehensive handbooks or reference

manuals issued by associate directors. These documents provide National Park Service field employees with guidance to carry out Management Policies and Director's Orders.

The primary responsibility of National Park Service managers is to preserve park resources and values without impairment. Impairment is defined as a loss or harm to the integrity of park resources or values. The National Park Service cannot conduct or allow activities in parks that would impair park resources and values unless provided for by legislation or by the proclamation establishing the park. In cases of doubt as to the impact of activities on park resources, the National Park Service will decide in favor of protecting the resources.

Whether an impact constitutes impairment depends on the specific resources or values affected; the severity, duration, and timing of the influence; the direct and indirect effects of the influence; and the values and purposes for which a particular park unit was established. However, the laws do give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, so long as the impact does not constitute impairment.

The National Park Service has established a tiered planning process with General Management Plans as the highest tier. The General Management Plans for Grand Canyon National Park and Glen Canyon National Recreation Area reflect the service-wide guidance that applies to all National Park Service areas, as well as the specific authorizing legislation that established these areas. They focus on what management should be achieved and maintained over time to provide a foundation from which to protect park resources while providing for meaningful visitor experiences.

The next tier of park planning is implementation plans. These deal with complex, technical, and sometimes controversial issues with a level of detail and analysis beyond that appropriate at the General Management Plan or strategic plan level. The Grand Canyon National Park General Management Plan (National Park Service 1995) builds upon several implementation plans relevant to the Adaptive Management Program, including the 1988 Backcountry Management Plan, 1989 Colorado River Management Plan, and 1994 Resource Management Plan. Other relevant implementation plans subsequent to the Grand Canyon National Park General Management Plan include the 1997 Resource Management Plan and the 1998 Draft Wilderness Management Plan.

### **Operation of the Colorado River Storage Project Power System**

The Glen Canyon Dam powerplant is tied to a vast system of generators, transmission lines, and delivery points in the western United States, Canada, and Mexico. It is legally obligated to provide electricity to wholesale electrical customers and others in the West. The Bureau of Reclamation operates Glen Canyon Dam in close coordination with the Western Area Power Administration. The Western Area Power Administration markets the electrical power produced by the Colorado River Storage Project dams and owns and operates the federal transmission system that delivers the electricity.

### *Long-Term Firm Electrical Power*

Under the authorizing legislation for the Colorado River Storage Project, federal dam operators are required to produce “the greatest practicable” amount of long-term firm power at Glen Canyon Dam, integrating the operation of Glen Canyon Dam with the other Colorado River Storage Project powerplants and other federally-owned electrical powerplants.

The Western Area Power Administration’s long-term contracts for electricity are with small municipalities, other political subdivisions, rural electrical cooperatives, federal defense facilities and other federal and state institutions, and Indian tribes. This power is sold strictly in the Colorado River Storage Project market area that includes Colorado, Wyoming, Utah, Arizona, New Mexico, and Nevada. Revenues from these sales are placed into the Basin Fund, a fund that repays the United States Treasury the capital costs of the Colorado River Storage Project mainstem dams and the irrigation assistance portion of the Upper Basin participating projects. Revenues from the sale of power also fund much of the cost of the Adaptive Management Program.

Long-term firm electrical power has been sold according to a marketing plan established by the Western Area Power Administration. The contracts for electricity made possible under this plan end in 2024. The Western Area Power Administration is obligated to deliver electricity in the amounts specified in these contracts. This can be supplied by the Colorado River Storage Project generators or the Western Area Power Administration may purchase some of this power from other generators. The contract amount can be adjusted every five years to take into account changing circumstances or resources.

### *Operation for a Federal Load Control Area*

The Western Area Power Administration operates two load control areas that are electrically tied to Glen Canyon Dam. A load control area is a geographical area assigned to a controller to monitor electrical demand and generation and make sure that they “match” on a moment-by-moment basis. This is referred to as “regulating.” Currently, Glen Canyon Dam generation can change by up to 1,000 cubic feet per second to adjust to these “swings” in demand. The contribution by Glen Canyon Dam to these two load control areas is evenly divided. The Western Area Power Administration’s Operation Center in Phoenix, Arizona, sends a “regulation” signal every few seconds directly to Glen Canyon Dam.

### *Reserve Sharing Groups*

Reserves are required by electrical production and distribution companies to serve as a “back-up” in case of unforeseen electrical system problems. The existence of reserves minimizes the possibility of interruption of electrical service. The Western Area Power Administration has contractual agreements with two reserve sharing groups. Reserve sharing groups are formed to share the “damage” caused by generator and transmission outages, transmission overloads and other emergencies, or unplanned events.

For the two reserve sharing groups, the Western Area Power Administration is obligated to provide up to 70 megawatts of power from one or more of the Colorado River Storage Project powerplants. Typically, Glen Canyon Dam has provided the bulk of this service.

### *Emergency Service*

The Western Area Power Administration calls upon Glen Canyon Dam and other Colorado River Storage Project dams to respond to a variety of electrical system emergencies. These emergencies and the responses to them by the Western Area Power Administration and Bureau of Reclamation are a requirement of all participating members of the Western Systems Coordinating Council. These are described in the Glen Canyon Dam Environmental Impact Statement and are authorized in the Record of Decision. Further details on the emergency exception criteria are contained in the Operating Agreement Associated with Glen Canyon Dam Operating Criteria between the Bureau of Reclamation and the Western Area Power Administration dated July 7, 1997. Generally, these emergencies are related to transmission line and generation outages. During these emergencies, the operating limitations on Glen Canyon Dam contained in the Record of Decision may be exceeded.

## **PROTOCOLS AND PROCEDURES — HOW THE ADAPTIVE MANAGEMENT PROGRAM WORKS**

### **Charter**

The Charter of the Adaptive Management Program (Appendix C) was recently renewed as a formal Federal Advisory Committee Act committee for an additional two years.

### **Operating Procedures of the Adaptive Management Work Group and Technical Work Group**

Current operating procedures of the Adaptive Management Work Group and Technical Work Group are in Appendices D and E, respectively. These procedures have been formally recommended by these two groups and are consistent with the Adaptive Management Work Group Charter (Appendix C). The procedures serve to give formal structure to Glen Canyon Dam Adaptive Management Work Group and Technical Work Group meetings.

## **Science Within the Glen Canyon Dam Adaptive Management Program**

The goal of scientific inquiry within the Adaptive Management Program is to discover facts about the Colorado River ecosystem using a rigorous program of monitoring, research, and adaptive management. While significant knowledge of the ecosystem has been gained since the Glen Canyon Environmental Studies, the ecosystem is extraordinarily complex. Much is still unknown.

Research and monitoring activities are designed to enhance our understanding of ecosystem functions, processes, and patterns. Long-term monitoring is critical to understanding the status and trends of important resources, as well as the effects of the Secretary of the Interior's actions in operating the dam on those resources of special concern, such as endangered species or resources of tribal interest. Long-term monitoring also informs on the success or failure of management actions and produces data for long-term research hypotheses about the functioning of the Colorado River ecosystem. A stable monitoring program allows repetitive measurements on a consistent time scale, which allows short- and long-term comparison with previous measurements. Methods range from traditional field sampling techniques to multispectral remote sensing designed to identify stability or trends in key resources or indicator species.

Research activities often require experimental comparisons of an alternative treatment against a controlled or baseline environment. The experiments attempt to separate the cause of a particular effect from the suite of possible confounding factors. Understanding of ecological patterns and processes has changed substantially as a result of these monitoring and research activities. The resulting answers to questions and hypotheses thus add to the knowledge base available to the Adaptive Management Work Group as it makes recommendations to the Secretary of the Interior.

## **Management Within the Glen Canyon Dam Adaptive Management Program**

The Adaptive Management Program does not derogate any agency or tribal authority or responsibility for management or stewardship of resources. Instead, the Adaptive Management Program makes formal recommendations through the Adaptive Management Work Group to the Secretary of the Interior regarding dam operations and other management actions to meet the environmental and monitoring commitments of the Environmental Impact Statement and Record of Decision, comply with the Grand Canyon Protection Act, and remain in compliance with the Law of the River and relevant environmental statutes, regulations, and policies. These recommendations are made by consensus where possible, but as stated in the Adaptive Management Work Group Charter (Appendix C): "...in the event that consensus is not possible, a vote should be taken." Whether achieved through consensus or by majority vote, recommendations are transmitted to the Secretary of the Interior through the Secretary of the Interior's Designee.

The Secretary of the Interior, as the final decision maker, responds to these recommendations either directly or through actions of the agencies with delegated authority. In the latter case, implementation of these recommendations by a federal agency often depends on internal discussions between the management agency and the Secretary of the Interior.

### **How Science and Management are Integrated into the Adaptive Management Program**

The Grand Canyon Monitoring and Research Center provides scientific data and syntheses to the Adaptive Management Program. In general, the Grand Canyon Monitoring and Research Center provides scientific data and syntheses to the Technical Work Group, which then uses this information to create management recommendations for consideration by the Adaptive Management Work Group. The Grand Canyon Monitoring and Research Center may also bring scientific information directly to the Adaptive Management Work Group. Any of the organizational components within the Adaptive Management Program may call upon the independent review panels for advice (Fig. 1).

After approval by the Adaptive Management Work Group, the Secretary of the Interior's Designee forwards recommendations to the Secretary of the Interior. Secretarial decisions are communicated back to the members of the Adaptive Management Program.

### **How Management of One Resource Affects Other Resources**

The Adaptive Management Program recognizes that the Colorado River below Glen Canyon Dam is part of a large and complex ecosystem. Management actions proposed to benefit one resource might adversely impact another due to the interrelationships within the system. For example, a river flow designed to benefit a threatened or endangered native fish might result in reduced recreational opportunities or limits on the access of Native Americans to a sacred sites.

When the benefit to one resource is proposed as part of a legal compliance responsibility, it is particularly important to maintain an ecosystem perspective. One example comes from the planning of the experimental Beach/Habitat-Building Flow in 1996. This experimental flow was designed to test the hypothesis that Colorado River flows greater than powerplant capacity would mobilize sediment stored in the river channel and deposit it on the river banks. However, while designing and scheduling the experimental flow for sediment conservation, the effects of the higher flow on the aquatic food base, Kanab ambersnail, Southwestern willow flycatcher, and tamarisk had to be considered. Similarly, tribes needed to be consulted on impacts to resources of tribal concern or access to sacred sites. Impacts to recreational users and power generation also had to be factored into the experiment.

## **Tribal Consultation and Coordination Within the Adaptive Management Program**

Federally-recognized Indian tribes are domestic sovereign nations, and the legal relationship between the federal government and tribes is one set forth in the United States Constitution, treaties, statutes, executive orders, secretarial orders, and court decisions. Indian tribes have a guaranteed right to self-govern and to exercise inherent sovereign powers over their members and reservations. The federal government works with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-governance, trust resources, and Indian tribal treaty and other rights. Tribal trust resources include land and natural resources either on or off Indian reservations, and other assets retained by or reserved by or for Indian tribes, held by the federal government in trust and protected by a fiduciary obligation on the part of the United States.

To ensure meaningful consultation and collaboration with Indian tribal governments, various executive orders, secretarial orders, and memoranda have been issued recently, e.g. Executive Order 13084, Executive Order 13007, Secretarial Order 3175, Secretarial Order 3206, and *Federal Register* 94-10877.

To ensure fulfillment of the federal Indian trust responsibility, the Department of the Interior has established policies and procedures for government-to-government consultation with federally-recognized Indian tribes and tribal members for the identification, conservation, and protection of American Indian trust resources, trust assets, or tribal health and safety. Indian trust assets are values derived from land resources including surface water and groundwater, natural vegetation and wildlife, and air quality. Any potential impacts from federal actions or activities to tribal trust assets must be properly addressed between the affected tribe and the appropriate federal agency prior to any disturbance to such resources.

## **Tribal Trust Responsibilities and the Adaptive Management Program**

Within the Adaptive Management Program, the federal government's trust responsibility to the interested Native American tribes (Havasupai, Hopi, Hualapai, Kaibab Band of Paiute Indians, Navajo Nation, San Juan Southern Paiute Tribe, Paiute Indian Tribe of Utah, and the Pueblo of Zuni) is realized through treaties, Executive Orders, and various levels of consultation. Section 1805(c)(3) of the Grand Canyon Protection Act requires the Secretary of the Interior to consult with Indian tribes regarding the implementation of the long-term monitoring program and activities to ensure that Glen Canyon Dam is operated in a manner consistent with that of Section 1802 of the Grand Canyon Protection Act.

Tribal participation and representation at the Adaptive Management Work Group and Technical Work Group levels is one aspect of the Secretary of the Interior's consultative requirement under the Grand Canyon Protection Act. However, given the nature and management of Native American traditional knowledge and concerns, it may be necessary for the Grand Canyon Monitoring and Research Center, Bureau of

Reclamation, National Park Service, and any other federal agency involved in long-term monitoring, research, or other associated activities to engage in more specific consultation with each of the identified Native American tribes. This is especially true for those tribes (Havasupai and San Juan Southern Paiute) that are not actively engaged in the Adaptive Management Program. This more specific form of consultation may require the Grand Canyon Monitoring and Research Center, Bureau of Reclamation, and National Park Service to engage in a face-to-face consultation with each tribe, their tribal representatives, and identified traditional leaders regarding monitoring and research activities, proposed management actions, and any other related Adaptive Management Program activities. The result of this consultation effort is to fully and meaningfully engage the appropriate tribes in the decision-making process regarding activities that may affect resources of tribal concern.

## **HOW COMPLIANCE IS INTEGRATED INTO THE ADAPTIVE MANAGEMENT PROGRAM**

Compliance with the Endangered Species Act, National Environmental Policy Act, and National Historic Preservation Act, has particular impact on the Adaptive Management Program and is described below:

### **Endangered Species Act**

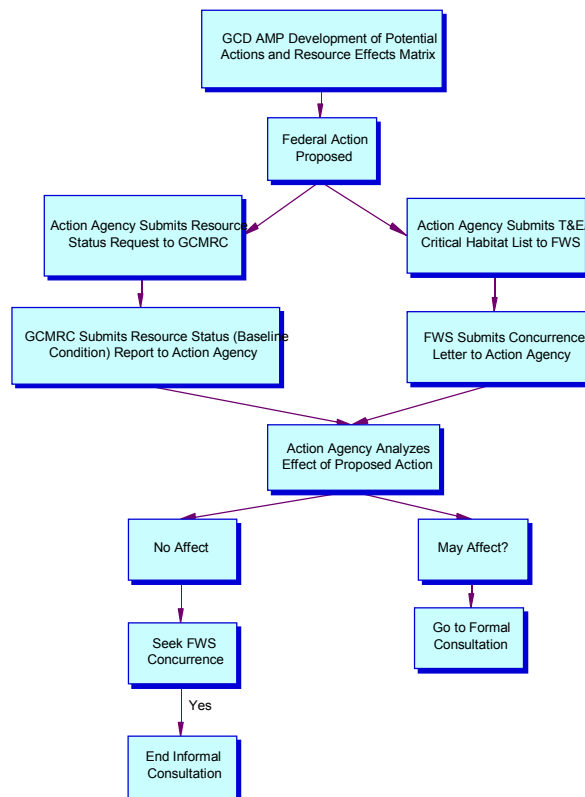
The Adaptive Management Program is highly focused on compliance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, and its implementing regulations (50 Code of Federal Regulations [CFR] 402). This section addresses consultation between the action agency (usually the Bureau of Reclamation) and the U.S. Fish and Wildlife Service on the effects of a proposed action on federally-listed species. This section requires that any action a federal agency authorizes, funds, or carries out must not jeopardize the continued existence of any listed species or adversely modify designated critical habitat (see Appendix F). The process utilized by the federal agencies in the Adaptive Management Program for Endangered Species Act consultation is illustrated in Figs. 2, 3, and 4.

Biological opinions contain the U.S. Fish and Wildlife Service's recommendations to the action agency. Consultation is concluded when the action agency responds to the U.S. Fish and Wildlife Service by accepting the biological opinion as written, or describing if and how they will implement the biological opinion. Once this commitment has been made, the action agency is responsible for implementation.

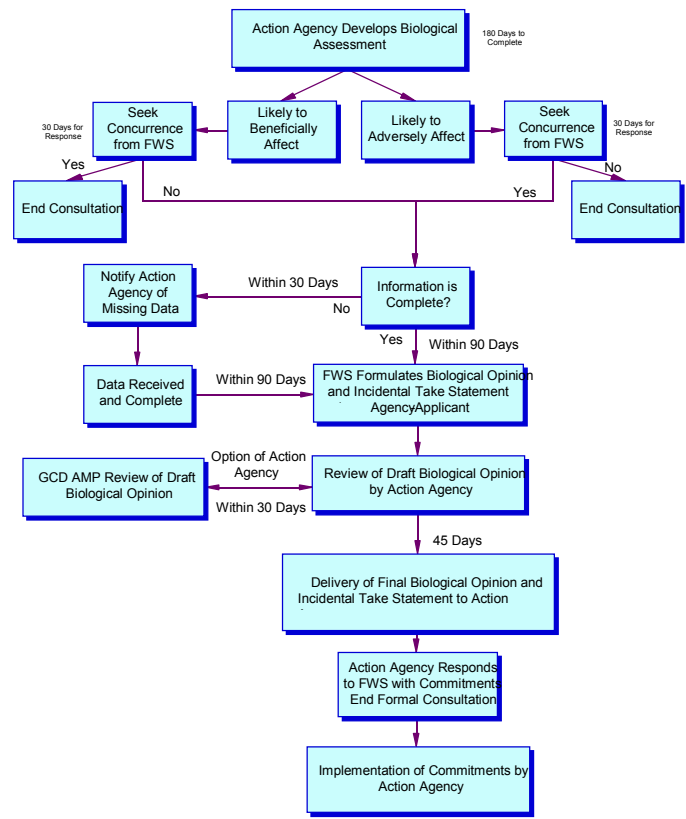
The Endangered Species Act primarily affects the Adaptive Management Program through: (1) the requirement to consult with the U.S. Fish and Wildlife Service on any discretionary action which may affect listed species or adversely modify designated critical habitat prior to taking the action; and (2) through commitments an action agency makes to conserve species in response to Reasonable and Prudent Alternatives in biological opinions. The Regional Director of the Bureau of Reclamation sent a

memorandum to the Regional Director of the U.S. Fish and Wildlife Service identifying the elements of the Reasonable and Prudent Alternative for the operation of Glen Canyon Dam that will be implemented (Calhoun 1995). These elements include:

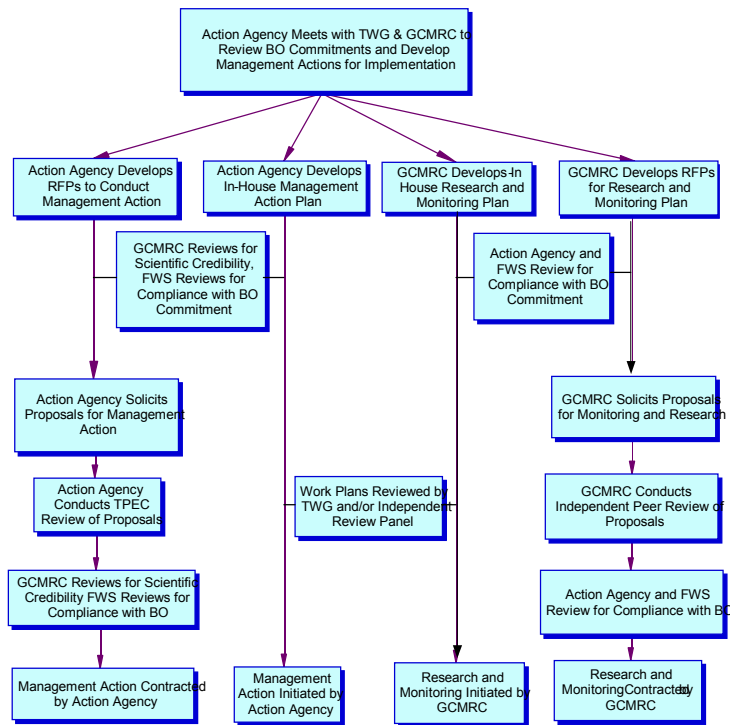
- Formulation of an Adaptive Management Program.
- Experimental flows to benefit endangered fish.
- Determine the feasibility and expected results of installing and operating a selective withdrawal structure (temperature control device) on Glen Canyon Dam.
- Studies of the response of native fish to various temperature regimes and river flows.
- Coordinate preparation of a Little Colorado River management plan.
- Conduct a Razorback sucker workshop.
- Establish a second spawning aggregation of humpback chub in the mainstem or tributaries.
- Evaluate the over-winter survival of young-of-year humpback chub.
- Study Kanab ambersnail life cycle and distribution.



**Figure 2. Glen Canyon Dam Adaptive Management Program Section 7 Informal Consultation Process.**



**Figure 3. Glen Canyon Dam Adaptive Management Program Section 7 Formal Consultation Process.**



**Figure 4. Glen Canyon Dam Adaptive Management Program Section 7 Consultation Process: Implementation of Biological Opinion.**

The Superintendent of Grand Canyon National Park sent a memorandum to the Regional Director of the U.S. Fish and Wildlife Service identifying additional elements they would implement (Arnberger 1998). These elements include:

- Conduct translocation of Kanab ambersnails subject to flows below 45,000 cubic feet per second from Glen Canyon Dam.
- Complete monitoring of the status of the translocated population.
- Evaluate, and where appropriate, utilize augmentation opportunities.

### **National Environmental Policy Act**

The National Environmental Policy Act has five basic mandates that the Adaptive Management Program must continue to follow:

- Supplemental mandate: adds to the existing authority and responsibility of every federal agency to protect the environment when carrying out the agency mission.
- Affirmative mandate: agencies must make decisions that restore and enhance the environment.

- Substantive mandate: agencies must recognize that each person should have a healthful environment and must contribute to the protection of that environment for present and future generations.
- Procedural mandate: agencies must use their planning and decision-making process to give appropriate consideration to environmental value and amenities.
- Balancing mandate: agencies, to the fullest extent possible and consist with other essential policy considerations, must make decisions to achieve productive harmony between people and nature.

As long as the Adaptive Management Program meets the commitments made in the Record of Decision, no additional National Environmental Policy Act compliance is needed. However, if the Adaptive Management Program makes a recommendation to the Secretary of the Interior that deviates from the Record of Decision (Reclamation 1996), then the National Environmental Policy Act requires further compliance.

### **National Historic Preservation Act**

The Glen Canyon Dam Environmental Impact Statement included the Programmatic Agreement for Cultural Resources that represents alternate procedures by which the Bureau of Reclamation will achieve compliance with Section 106 of the National Historic Preservation Act for the continued operation of Glen Canyon Dam. The Programmatic Agreement is a legally binding document among the Advisory Council on Historic Preservation, Arizona State Historic Preservation Officer, National Park Service, Bureau of Reclamation, Hopi Tribe, Hualapai Tribe, Paiute Indian Tribe of Utah, Kaibab Band of Paiute Indians, Pueblo of Zuni, and Navajo Nation. With proposed amendments to the Programmatic Agreement, the Western Area Power Administration, the Bureau of Indian Affairs, and possibly the Havasupai Tribe and San Juan Southern Paiute Tribe, may become signatories.

The Programmatic Agreement is a process whereby all the signatories agree to specific actions relative to management of National Register eligible historic properties affected by Glen Canyon Dam. The Programmatic Agreement has stipulations which include: (1) identification and evaluation of all historic properties within the area of potential effects of dam operations; (2) development of a plan for monitoring the effects of Glen Canyon Dam operations on historic properties and for carrying out remedial actions to address the effects of ongoing damage to historic properties; and (3) preparation of an historic preservation plan.

In the Adaptive Management Program, Programmatic Agreement signatories, Grand Canyon Monitoring and Research Center staff, and associated scientists provide input to Adaptive Management Work Group and Technical Work Group members on cultural resource issues. The Technical Work Group and Adaptive Management Work Group are considered interested parties to the Section 106 compliance process. Since the Programmatic Agreement is a component of the Adaptive Management Program, the Technical Work Group and Adaptive Management Work Group have input to the Programmatic Agreement program through their review and recommendations to the Secretary of the Interior. As the lead agency, the Bureau of Reclamation has primary

responsibility for ensuring that the stipulations of the Programmatic Agreement are implemented.

## **ANNUAL ADAPTIVE MANAGEMENT PROGRAM CYCLE**

### **Budget Development Process**

The budget development process is detailed in Appendix H.

### **Annual Report to Congress**

As authorized by the Grand Canyon Protection Act, each year the Adaptive Management Program prepares a report to be transmitted to Congress. The report describes the long-term operations and other reasonable mitigation measures taken to protect, mitigate adverse impacts to, and improve the condition of the natural, recreational, and cultural resources of the Colorado River ecosystem.

The report also serves to provide an update on the status of the resources addressed by the Grand Canyon Protection Act. The annual State of the Colorado River Ecosystem report prepared by the Grand Canyon Monitoring and Research Center provides valuable input to the Annual Report to Congress.

### **State of the Colorado River Ecosystem Report**

Communication between scientists and managers is vital in the Adaptive Management Program. The State of the Colorado River Ecosystem report serves the critical purpose of assessing the condition of the ecosystem, including a comprehensive reporting of status and trends among Colorado River ecosystem resources. Through the use of qualitative and quantitative targets, it also provides a mechanism for determining if the management objectives are being met. This crucial feedback loop guides adaptive management decisions, and incorporates results into recommendations of the Adaptive Management Work Group. It helps the Adaptive Management Work Group to learn from implementation of its policies, thereby refining and improving results and achieving its goals.

Results of annual monitoring and research activities should be made available to the Technical Work Group and Adaptive Management Work Group by April of each year. Results of the science program, both data and synthesis reports, are available at the Grand Canyon Monitoring and Research Center. The Grand Canyon Monitoring and Research Center provides many of the reports on the Internet. Copies are also provided to the National Archives in compliance with the Federal Records Act.

## **Annual Science Plan**

Each year the Grand Canyon Monitoring and Research Center prepares a detailed science plan describing the monitoring and research activities proposed for the upcoming year. The plan is discussed with the Technical Work Group and the Technical Work Group budget ad hoc group in an effort to identify both important monitoring and research questions and relative priorities among the scientific activities. The Grand Canyon Monitoring and Research Center also consults with the Programmatic Agreement signatories to determine if there are any potential effects from the proposed monitoring or research activities delineated in the annual science plan. Final recommendation to the Secretary of the Interior rests with the Adaptive Management Work Group.

The annual science plan is critical to the evaluation of the effectiveness of actions taken to protect downstream resources. The plan must have a stable and long-term monitoring component to address long-term trends. It must also have a research component to address new questions that arise through scientific investigations. Finally, it must have the statistical rigor required to substantiate its conclusions. The annual work plan will include a report on the prior year's activities.

## **Request for Proposal Process**

The Grand Canyon Monitoring and Research Center utilizes a competitive proposal solicitation process open to government employees, public sector contractors, and universities through an open Request for Proposals process. All Adaptive Management Program monitoring and research projects are selected on the basis of their support of scientific capability and merit, submission timeliness on previous work (as evaluated through an independent, objective, and unbiased peer review process), management objectives and information needs, demonstrated capabilities of proposers, and cost effectiveness. Following the selection of proposals, appropriate procurement mechanisms (i.e., grants, contracts, and cooperative agreements) are utilized for supporting selected projects.

The Grand Canyon Monitoring and Research Center is committed to the use of peer review and has peer review guidelines that describe the processes it follows in reviewing all Grand Canyon Monitoring and Research Center proposals, programs, publications, and other products or deliverables. The guidelines will convey the unambiguous standard of scientific objectivity and credibility followed by the Adaptive Management Program.

In general, following approval by the Adaptive Management Work Group of the long-term monitoring and research strategic plan, an annual monitoring and research program will be completed and approved each year in April. After approval of the annual monitoring and research plan, Request for Proposals will be issued. Proposals will be screened by the program managers for their responsiveness to the Request for Proposals, and all qualified proposals will undergo an independent and objective scientific peer review. Awards will be made based on the results of peer review, the program manager's evaluation of project relevance, and technical contracting requirements.

# APPENDICES