Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
August 24-25, 2010

Agenda Item

Desired Future Conditions Ad Hoc Group Report

Action Requested

✓ The following motion will be proposed:

AMWG recommends that the Secretary of the Interior accept the narrative Desired Future Conditions (DFCs) for the Glen Canyon Dam Adaptive Management Program as described in the memorandum dated August 4, 2010 from George Caan and Larry Stevens, including the DFCs attached to that memorandum, and that he direct the AMWG to use this document as a basis to define quantitative DFCs (Phase 2) for the program, acknowledging that the narrative DFCs may change as the quantitative DFCs are developed.

Presenters

George Caan, AMWG member (State of Nevada) and DFCs Ad Hoc Group Co-Chair
Larry Stevens, AMWG member (Grand Canyon Wildlands Council) and DFCs Ad Hoc Group Co-Chair
Team Leads for each DFC:
- Clayton Palmer (Western Area Power Administration) – Colorado River Ecology
- Mike Yeatts (Hopi Tribe) – Cultural
- Sam Jansen (Grand Canyon River Guides) – Recreation
- Leslie James (CREDA) – Power

Sam Spiller (Fish and Wildlife Service) – resource agency spokesperson

Previous Action Taken

✓ By the Regional Directors of the AMP DOI agencies:
In August 2008, the Regional Directors from the five GCDAMP Department of the Interior (DOI) agencies (NPS, Bureau of Indian Affairs, US Fish and Wildlife Service, US Geological Survey, and BOR) began work on the development of DOI DFCs. The starting point used in the development of these DFCs was the 12 GCDAMP goals from the Strategic Plan and the work completed by the TWG DFCs Ad Hoc Group.

✓ By the Secretary's Designee: On January 22, 2010, Secretary's Designee Anne Castle distributed a draft document entitled "Draft Desired Future Conditions (DFCs) for the Colorado River Ecosystem" from the Department of the Interior. These are available starting on page 5 of the document found at http://www.usbr.gov/uc/rm/amp/amwg/mtgs/10feb03/Attach_12.pdf.

✓ By AMWG: At its February 2010 meeting, AMWG passed the following motion by consensus:
To establish a Desired Future Conditions Ad Hoc Group to consider and make recommendations to AMWG on the draft Phase I DFC statements developed by the DOI agencies and dated January 22, 2010, and describe

linkages among resources, prior to the Phase II development of quantitative DFCs.

- ✓ By the Secretary's Designee: On February 23, 2010, Secretary's Designee Anne Castle sent direction to the co-chairs of the DFCs Ad Hoc Group. In part, this direction read, "The process envisioned for the DAHG in the near term is to prepare and recommend qualitative DFCs. This is viewed as Phase 1, with an expectation that a future Phase 2 will result in specific quantitative DFCs for each qualitative DFC *[emphasis in original]*. Phase 1 involves policy issues; Phase 2 will require more technical expertise. Phase 2 will be a more difficult and time-consuming process. But the end result of the Phase 1 process should be a document that provides a clear understanding of what the recommended DFCs mean."

Relevant Science

N/A

Background Information

The attached memorandum to Anne Castle from the DFCs Ad Hoc Group co-chairs and copied to AMWG members, provides additional background information on the process, a discussion of issues raised, recommendations for Phase 2, and a list of laws and compliance documents associated with the DFCs. The recommended DFCs with a cover memorandum from the Ad Hoc Group co-chairs are also attached.

The DFCs Ad Hoc Group consists of the following persons, all of whom are AMWG members except as noted:

George Caan – State of Nevada (co-chair)
Larry Stevens – Grand Canyon Wildlands Council (co-chair)
Perri Benemelis – State of Arizona
Marianne Crawford – Bureau of Reclamation (TWG alternate)
Loretta Jackson-Kelly – Hualapai Tribe
Leslie James – Colorado River Energy Distributors Association
Sam Jansen – Grand Canyon River Guides (nominated)
Rick Johnson – Grand Canyon Trust (AMWG alternate)
Robert King – State of Utah (AMWG alternate)
Ted Kowalski – State of Colorado (TWG alternate)
Don Ostler – States of Wyoming and New Mexico (AMWG alternate)
Clayton Palmer – Western Area Power Administration (AMWG alternate)
Randy Seaholm – State of Colorado (consultant to the state)
Mike Senn – Arizona Game and Fish Department
Sam Spiller – U.S. Fish and Wildlife Service
Mike Yeatts – Hopi Tribe (AMWG alternate)

The DFCs Ad Hoc Group used the narrative DFCs prepared by the DOI agencies, and the Secretary's Designee's memorandum referenced above under "Previous Action Taken," as foundational documents for its work to prepare and recommend DFCs to the AMWG. The Ad Hoc Group divided the DFCs into four categories, and established four subcommittees to draft the

DFCs. The four subcommittees and their chairs are Cultural, Mike Yeatts; Recreation, Sam Jansen; Power, Leslie James; and Colorado River Ecology, Clayton Palmer.

In addition to the subcommittee work, the full Ad Hoc Group held the following meetings to complete its work.

Conference calls:
- May 5
- May 27
- June 30

Face-to-face meetings:
- May 17
- June 15
- July 19

At one of the face-to-face meetings, the resource agencies (Bureau of Reclamation, Fish and Wildlife Service, USGS-Grand Canyon Monitoring and Research Center, and National Park Service) were invited to comment on the draft DFCs. All but the National Park Service were able to attend. The NPS provided written comments and participated in the June 30 conference call with the Ad Hoc Group to discuss their comments. The proposed DFCs were amended based on comments received from these agencies.

At the AMWG meeting, each subcommittee chair will present his or her DFCs. There will be time for questions, discussion, and then action on the motion noted above.

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

February 23, 2010

DRAFT

To: **George Caan and Larry Stevens**
Co-Chairs, Desired Future Conditions Ad Hoc Group
Glen Canyon Dam Adaptive Management Work Group

From: **Anne Castle** by
Secretary's Designee
Assistant Secretary for Water and Science, Department of the Interior

Subject: **Direction to Desired Future Conditions Ad Hoc Group**

My thanks to both of you for your agreement to co-chair the Desired Future Conditions Ad Hoc Group. This is very important work for the Glen Canyon Dam Adaptive Management Work Group, and I am delighted that you both will be leading this effort. I encourage you to check in with me on the progress of the DAHG and feel free to discuss any issues that come up. This memo is intended to set out our collective thinking about the goals for the DAHG and the process that will be utilized.

While a set of twelve goals and management objectives have been adopted by the AMWG as part of the GCDAMP strategic plan in 2002, those goals have not as yet been translated into detailed "Desired Future Conditions" or "DFCs" as guides for the recommendations of the AMWG to the Secretary of the Interior concerning the operation of Glen Canyon Dam. Without more specific ends in mind, it is difficult, if not impossible, to design appropriate management strategies. We need to know where we want to go in order to map the route.

A DFC Ad Hoc Group (DAHG) was formed by the AMWG on February 3, 2010 to discuss appropriate Phase 1 DFCs (as described below) for the GCDAMP and to make recommendations to the AMWG for DFCs that would in turn be recommended to the Secretary. A list of the AMWG representatives and other parties who have indicated an interest in participating on the DAHG is attached. Pursuant to our discussion on February 19, 2010, my expectation is that the DAHG will have a recommendation on a set of DFCs to the AMWG at the August 2010 meeting.

Representatives of the Interior agencies involved in the AMWG have prepared and collectively endorsed a draft set of DFCs, a copy of which is attached. This document is the starting point for DAHG. Use of the draft DFCs is not intended to limit the scope of the DAHG's review. Interior agency representatives will participate *ex officio* (non-voting) on the DAHG, among other reasons in order to ensure that any questions about the draft can be answered.

Discussion about the DFCs occurred at the February 3, 2010 AMWG meeting. A summary of the comments of the AMWG representatives at the February meeting on the DFCs is attached hereto for your use.

The process envisioned for the DAHG in the near term is to prepare and recommend qualitative DFCs. This is viewed as Phase 1, with an expectation that a future Phase 2 will result in specific quantitative DFCs for each qualitative DFC. Phase 1 involves policy issues; Phase 2 will require more technical expertise. Phase 2 will be a more difficult and time-consuming process. But the end result of the Phase 1 process should be a document that provides a clear understanding of what the recommended DFCs mean.

The DAHG should anticipate that the Phase 1 DFCs may not be entirely or collectively achievable. There may be direct trade-offs between one DFC and another. It is not necessary at this time to balance these trade-offs, or to determine whether a certain resource should take priority over another. This balancing process will take place during Phase 2, and most likely will continue over the entire existence of the AMWG, that being the nature of adaptive management. Recognizing that the Phase 1 DFCs may be conflicting does not mean, however, that they are intended to be impractical dreams. I request that the DAHG consider and recommend to the AMWG realistic desired future conditions, achievable through the operation of Glen Canyon Dam, subject to the Law of the River and consistent with the Grand Canyon Protection Act.

The discussion at the February 2010 AMWG meeting recognized the existence of "linkages" between and among the DFCs, that is, relationships and interdependencies of one resource with another. Some of these linkages are positive such that positive change of one resource likely signals positive change in the other, while other linkages are negative such that benefits to one resource are likely detrimental to the other. Those linkages will no doubt become more apparent during your discussions in the DAHG. In order to take advantage of your thinking and provide the best platform for the Phase 2 DFC process, I would like to request that the DAHG describe for each DFC any linkages identified and whether those linkages are positive or

negative. This end product will also be helpful in laying a foundation for further AMWG discussion.

Given the importance of this effort, AMWG and TWG representatives and individuals and groups interested in the GCDAMP will want to follow the DAHG process. We have discussed various methods of communicating with interested parties during the period of time the DAHG is working. Please feel free to use whatever method of communication you feel works best for this process, including email updates and web site postings. I simply request that the DAHG keep in regular communication with me and the AMWG, and provide advance notice of scheduled meetings or conference calls so that other interested parties can participate if desired.

Again, I want to convey my gratitude to both of you for taking on this critical task. The Secretary and I value very highly the experience, knowledge, and passion about these issues that the AMWG representatives bring to these discussions, and any recommendations from the AMWG on DFCs will be considered most seriously. We will support you in these efforts, and look forward to our continuing relationship.

cc: AMWG members and alternates

Formation of new AMWG Ad Hoc Group

Name of Group: Desired Future Conditions Ad Hoc Group (DAHG)

Date established: February 3, 2010

Purpose: To consider and make recommendations to AMWG on draft Phase I DFC statements developed by the DOI agencies and dated January 22, 2010, and describe linkages among resources, prior to the Phase II development of quantitative DFCs.

Membership:

Name	Affiliation	Status
Perri Benemelis	Arizona Department of Water Resources	AMWG Alternate
George Caan (co-chair)	Colorado River Commission of Nevada	AMWG Member
Loretta Jackson-Kelly	Hualapai Tribe	AMWG Member
Leslie James	Colorado River Energy Distributors Assn. (CREDA)	AMWG Member
Rick Johnson	Grand Canyon Trust	AMWG Alternate
Robert King	Utah Division of Water Resources	AMWG Alternate
Ted Kowalski	Colorado Water Conservation Board	TWG Alternate
Don Ostler	Upper Colorado River Commission	AMWG Alternate
Clayton Palmer	Western Area Power Administration	AMWG Alternate
Andre Potochnik	Grand Canyon River Guides	AMWG Member
Tom Ryan	Bureau of Reclamation	AMWG Alternate
Mike Senn	Arizona Game and Fish Department	AMWG Member
Sam Spiller	U.S. Fish and Wildlife Service	AMWG Member
Larry Stevens (co-chair)	Grand Canyon Wildlands Council	AMWG Member
Mike Yeatts	Hopi Tribe	AMWG Alternate

From: Caramanian, Lori
Sent: Friday, January 22, 2010 4:25 PM
To: Whetton, Linda A; Archuleta, Deanna; Caan, George M.; Castle, Anne; Charley Bulletts; Gimbel, Jennifer; Gold, Anamarie; Groseclose, Jay C.; Heuslein, Amy; Jackson-Kelly, Loretta; James, Leslie; Kucate, Arden; Lash, Nikolai; Martin, Steve P; Orton, Mary; Potochnik, Andre; Rampton, Ted; Senn, Michael J.; Shields, John W.; Sam Spiller; Steffen, Mark; Stevens, Larry; Strong, Dennis J.; Walkoviak, Larry P.; Warren, Brad; Werner, Bill; Zimmerman, Gerald R.; Balsom, Jan; Barrett, Clifford; Benemelis, Perri; Cantley, Garry; Christensen, Kerry; Davis, William; Dongoske, Kurt; Hahn, Martha; Harris, Christopher; Johnson, Rick; King, Robert; Glen Knowles; O'Brien, John; Ostler, Don; Palmer, S. Clayton; Persons, Bill; Peterson, McClain; Ryan, Thomas P; Seaholm, Dwight Randolph; Skrzynski, LeAnn; Steffen, Tim; Yeatts, Michael; estevan.lopez@state.nm.us
Cc: Shane Capron; Cutler, Christopher R; M3Research L.D. & P.J. Garrett
Subject: Additional information for Feb. 3-4, 2010 AMWG meeting
Attachments: Final AMWG HFE notice (2).pdf; Final DFC memo Jan 22.pdf; Draft DFC Jan22.pdf

Dear AMWG members—Linda is out so I'm distributing documents in her stead. If I've missed anyone on the regular email list because of that, please forgive me. Assistant Secretary Anne J. Castle had explained at the January 14, 2010 informational call that we would distribute our draft DFCs to you this week. That document is attached, along with a cover memorandum. I also attach a short scoping notice for the high flow experiment.

Hope everyone who is in the midst of the snow event is staying safe and warm. Have a great weekend.
Thank you.

Lori Caramanian
Counselor
Office of the Assistant Secretary for Water and Science

To: Glen Canyon Dam Adaptive Management Work Group (AMWG) Members
From: Secretary's Designee, Assistant Secretary Anne Castle
Date: January 22, 2010
Re: Desired Future Conditions

Dear AMWG Colleagues:

As I committed to you during the call on January 14, 2010 concerning Desired Future Conditions (DFCs) for the Glen Canyon Dam Adaptive Management Program (AMP), attached hereto is the initial draft of the DFCs developed by the five Department of Interior Adaptive Management Work Group agencies. These DFCs address ten different resource categories. The DFCs take into account both the Grand Canyon Protection Act's directive to "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" and its directive to implement the Act in a manner fully consistent with the specified provisions of the Law of the River.

The initial draft DFCs describe the objectives for various resource areas in qualitative, narrative terms, taking into account the fact that we are dealing with an altered ecosystem. These are objectives that the Interior agencies have determined would be our preferred future conditions. The purpose of this first phase in the development of DFCs is to flesh out in qualitative form the future conditions the AMWG would recommend to the Secretary of the Interior for adoption.

We recognize that there may be varying perspectives about the feasibility of achievement of certain of these individual objectives, as well as whether certain objectives are only achievable at the expense of others. In this document, we have not attempted to answer those questions, nor have we considered the expense of attaining any particular objective or performed any type of cost/benefit analysis. I am seeking your input on these broad expressions of preferred conditions. We will have time for discussion at the AMWG meeting on Feb. 3, and I anticipate forming a subcommittee or ad hoc group to put serious effort into the Phase 1 DFCs prior to the following AMWG meeting. At that time, I anticipate that we will have a thoroughly vetted set of DFCs for consideration by the full AMWG.

After qualitative DFCs are in place, the second phase of the DFC process will be the development of quantitative targets that align with the qualitative descriptions. We expect that this development effort will require thorough technical review that takes into account changing climatic conditions, cost, technical feasibility, and the nature of an altered ecosystem due to the existence of Glen Canyon Dam, among many others. In addition, it is clear that there will always be competing considerations and trade-offs among the various parameters that make up a suite of desired future conditions. In the second phase, I expect we will undertake the more difficult tasks of evaluating the Phase 1 DFCs from a technical standpoint to arrive at a better understanding of feasibility and achievability and developing appropriate metrics that would provide additional detail for the Phase 1 parameters.

I look forward to continuing to work with you on these issues and to our discussion on this effort in our upcoming February AMWG meeting.

January 22, 2010
DRAFT DRAFT DRAFT

Department of the Interior
Draft Desired Future Conditions (DFCs) for the Colorado River Ecosystem*
(Based on the Adaptive Management Program Strategic Goals)

**For purposes of these DFCs the Colorado River Ecosystem is defined as the Colorado River and related resources and tributaries from Lake Powell to Lake Mead.*

Introduction

"As outlined in the Grand Canyon Protection Act of 1992, the actions considered in this EIS are intended to protect and mitigate adverse impacts to and improve the natural and cultural resource values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. Many resources in Glen and Grand Canyons developed in response to conditions created by the dam. Reasonable objectives, developed by the management agencies, are goals for future management of these resources and provide meaning to the terms 'protect, 'mitigate,' and 'improve.'" (1995 Glen Canyon Dam EIS at 54).

Also outlined in the GCPA is section 1802. Protection of Grand Canyon National Park.

(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 v. 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.

Section 1806, Rules of Construction, provides:

> Nothing in this title is intended to affect in any way –
> (1) the allocations of water secured to the Colorado Basin States by any compact, law, or decree; or
> (2) any Federal environmental law, including the Endangered Species Act (16 U.S.C. 1531 et seq.).

Enforceability

This document, styled as "Desired Future Conditions" is a policy and guidance document. This document is intended to guide, assist and improve the internal and

ongoing efforts of the Glen Canyon Dam Adaptive Management Work Group to assess and prioritize its recommendations in the future, and assist decision-making as part of the Glen Canyon Dam Adaptive Management Program. This document is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or equity by a party against the United States, its departments, agencies, instrumentalities or entities, its officers or employees, or any other person. Nothing in this document is intended to interpret the provisions of federal law or establish enforceable requirements of any kind. This document is not a rule, regulation or requirement of the Department of the Interior, and is only to be used as a guidance document as part of the Glen Canyon Dam Adaptive Management Program.

Management Context

To carry out the direction of the GCPA and 1996 Glen Canyon Dam Record of Decision (ROD), the Department of the Interior (DOI) management agencies have developed 10 desired future condition goals (DFCs) and associated resource condition objectives. These goals and objectives are best realized given the following understandings and collaborative efforts.

- The DOI agencies agree to use the best information (scientific, social, economic, traditional and other) available to inform development of management direction (i.e., adaptive management) and achieve the desired future conditions.
- The DOI agencies agree to use the DOI Adaptive Management Technical Guide as a basis for implementing adaptive management that is consistent with the intent of the GCPA.
- The DOI agencies agree to use an interdisciplinary ecosystem approach to understand how resources respond to internal natural ecosystem drivers, human activities, and outside forces.
- The DOI agencies agree to use objective, scientifically valid and measurable research and monitoring data to assess progress towards attaining the DFCs.
- The DOI agencies agree to develop and implement a management decision process for evaluating tradeoffs among competing goals.
- The DOI agencies agree to maintain an effective stakeholder involvement process that functions on an advisory level to the agencies in fulfilling the requirements of the 1996 Glen Canyon Dam Record of Decision.
- The DOI agencies agree to manage high priority Colorado River ecosystem resources using an ecosystem approach that addresses the interrelationship among resources and natural ecosystem processes.
- The DOI agencies agree each bureau has unique defined responsibilities for the stewardship elements of the adaptive management process and specific resource and land management authorities that need to be met. Through collaboration the DOI agencies agree to respect and integrate those responsibilities into the adaptive management process.
- The DOI agencies agree to resolve issues concerning meeting Federal, Tribal and State (AZ) water quality standards.

- The DOI agencies agree that Government-to-Government consultation is an ongoing and effective protocol in addressing Tribal concerns for resources protection.
- The DOI agencies agree that administrative use, such as management and research activities, is conducted in a manner that is consistent with National Park Service Management Policies (i.e., the use of the minimum tool) and activities are managed in a manner consistent with the preservation of wilderness character of the river environment. Adverse effects and cumulative impacts on natural and cultural resources, as well as the visitor experience, will be minimized.
- The DOI agencies agree to use, learn from, recognize and evaluate Tribal traditional ecological knowledge.
- The DOI agencies agree to manage to sustain key resources and permit recovery and long-term sustainability of key downstream resources while limiting hydropower capability and flexibility only to the extent necessary to achieve recovery and long-term sustainability.

* Management agencies include the Bureau of Reclamation, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, and the National Park Service. The US Geological Survey is a participating DOI agency, but USGS does not take a direct part in management decisions.

Ecological Concerns

There is a need to anticipate the ecological factors beyond our local human control and incorporate that understanding into scientific examination and management actions. For example, climate change is a major ecological concern and considerable uncertainty exists with regard to how climate change will alter the Colorado River ecosystem. Similarly, invasive and non-native species, diseases and/or parasites, and other factors may represent threats to conservation of humpback chub and other native species.

Desired Future Conditions Goals

1. Protect or improve the aquatic food base so that it supports viable populations of desired species at higher trophic levels.

Resource Elements to be addressed:
Biomass & Diversity
Primary producers
Macro-invertebrates

Resource Condition Objectives

- Critical biological elements of the aquatic food web (such as primary and secondary producers, their distribution, and biomass levels of these species in the Colorado River in Grand Canyon) have been determined.

- Critical biological elements necessary to support the aquatic food web are maintained.

- Critical physical elements necessary to support the aquatic food web are maintained. These elements may include, but are not limited to, carbon inputs, nutrients, water temperature, flow conditions and light regimes.

- Important food chain relationships necessary to maintain key terrestrial vertebrate species or species groups (e.g., riparian dependent bats, peregrine falcon, great blue heron, northern leopard frog, and neotropical migrant songbird species prey bases) have been identified and are maintained.

2. Maintain or attain viable populations of existing native fish, and prevent adverse modification to their habitat (including critical habitat).

Resource Elements to be addressed:
Humpback Chub
Critical Habitat
Threats from Non-native
Other native fish

Resource Condition Objectives

Humpback Chub Short-Term Objectives (10 years)

- The Grand Canyon population of humpback chub (including those found in the Little Colorado and Colorado Rivers) is maintained over a 5-year period (starting with the first point estimate acceptable to the Fish and Wildlife Service) such that the trend in adult (age 4+ years) humpback chub estimates and recruitment rates does not decline.

- The mainstem aggregations of humpback chub outside of the Little Colorado and Colorado Rivers are maintained.

- One spawning aggregation of humpback chub outside of the Little Colorado/Colorado River mainstem aggregation is established in an effort to partially restore the historic range of this species. Exact numbers to be targeted for this aggregation are to be estimated based on carrying capacity of the targeted aggregation area.

- At least one spawning aggregation in a tributary of the Colorado River in Grand Canyon other than the Little Colorado River has been established. Target tributaries and numbers of fish will be guided by the carrying capacity of the tributaries.

- Emerging threats are addressed and a contingency plans are developed and implemented, as needed.

- A broodstock management plan is established and being implemented, including the physical and genetic management of a humpback chub refuge population.

- A refuge population has been established in an appropriate facility to reduce or eliminate the potential for a catastrophic loss of the Grand Canyon population by providing a potential permanent source of genetically representative stock for emergency repatriation.

- The primary constituent elements of humpback chub critical habitat are provided and maintained.

Humpback Chub Long-Term Objectives (more than 10 years)

- A humpback chub population and their distribution have been maintained at a level that meets or exceeds short-term targets.

- Significant threats for this recovery unit have been addressed or eliminated (in particular, nonnative fish species have been reduced or controlled to levels that no longer constitute a threat to humpback chub).

- Refuges for humpback chub are maintained and supported.

Other Native Fish Species

- Viable populations of native fish in the river corridor (such as flannelmouth sucker, bluehead sucker and speckled dace) are maintained.

- Viable population numbers and age structure of these species have been determined and utilized to support target levels necessary to meet population maintenance needs.

3. Restore viable populations of extirpated species.

Resource Elements to be addressed:
Colorado Pikeminnow
Bonytail Chub
Roundtail Chub
Razorback Sucker
Northern Leopard Frog
River Otter
Extirpated Species Assessment

Resource Condition Objectives

- Populations of native fish, frogs, mammals, and other species, as appropriate and feasible, are restored.

- Biota in upriver and downriver reaches of the Colorado River have been compared to identify species that may be in decline or absent to support identification of potential extirpated species and to support their re-establishment.

4. Maintain a self-sustaining recreational trout fishery in the Lees Ferry reach.

Resource Elements to be addressed:
Rainbow trout population levels
Native fish population levels

Resource Condition Objectives

- Viable, self-sustaining recreational rainbow trout fishing is maintained in Lees Ferry reach above the Paria River confluence to the extent that the rainbow trout fishery has no significant detrimental impact on native fish populations below the Paria River.

5. Maintain or attain viable populations of the Kanab ambersnail.

Resource Elements to be addressed:
Population levels
Habitat

Resource Condition Objectives

- Maintain viable populations of Kanab ambersnails at Vasey's Paradise and Upper Elves' Chasm.

6. Protect or improve the biotic riparian, wetland, spring and old high water zone plant communities and their associated biological processes within the Colorado River ecosystem (including threatened and endangered species and their habitat).

Resource Elements to be addressed:
Diversity of neo-tropical bird species
Control of exotics
Stand density & diversity
Backwaters & springs

Resource Condition Objectives

- The abundance and distribution of key native plant species (e.g. honey mesquite, catclaw acacia, apache plum, netleaf hackberry, Gooding willow) in both New

High Water Zone (NHWZ) and Old High Water Zone (OHWZ) plant communities is maintained at or above the level of diversity.

- OHWZ vegetation and springs above the NHWZ portions of the Colorado River watershed are maintained in a natural condition with no net loss of native species.

- The functional relationship between the productivity of the aquatic and terrestrial systems in the Colorado River ecosystem is maintained.

- The abundance and distribution of invasive, non-native plant species in the riparian corridor are minimized.

- The natural and beneficial values of wetlands are enhanced with no net loss or degradation of wetlands. It is acknowledged that wetland vegetation may be lost for periods of time in association with beach habitat and high flow tests and/or other environmental factors.

- Restoration plans are developed with a goal of shifting noncompliant areas in a trajectory toward achieving wetland management goals and meeting applicable state and federal requirements.

- The health and stability of plant species of management concern (SOMC) are maintained or improved throughout the Colorado River ecosystem.

- The areal extent of five known habitat patches historically occupied by Southwestern willow flycatchers between River Miles 20 and 75 is maintained.

- Southwestern willow flycatcher marsh habitat (characterized by saturated soil and wetland vegetation) at Kwagunt and Cardenas Marshes is restored.

- Habitat quality is restored to 10 historical Southwestern willow flycatcher territories above the Lake Mead full pool level (elevation 1229'), between River Miles 246 and 278.

- Peregrine falcon abundance and distribution are maintained.

- Peregrine falcon and bat use of riparian and backwater habitats have increased over base-line conditions.

- Nesting and migratory neo-tropical songbird use of native riparian vegetation is maintained.

- The Northern leopard frog's occupied habitats are documented and protected and limiting factors identified.

- Occupancy and productivity of five Mexican spotted owl Protected Activity Centers are maintained.

- Important plant or food chain components necessary to support restoration of biological diversity are identified (as necessary) to support extirpated species if they are determined appropriate for re-establishment.

7. Maintain or attain levels of sediment storage within the main channel and along shorelines to achieve ecosystem goals.

Resource Elements to be addressed:
Sandbars (in the form of campsites, backwaters and other terrestrial/aquatic habitats; such as active dunes, marshes, etc.)
Sand mass-balance that is sufficiently positive to achieve sandbar and related habitat objectives
Cultural resources & native riparian community

Resource Condition Objectives

- High elevation open sand deposits are created and maintained along the Colorado River in sufficient volume, area, and distribution so as to allow transport of fine sediment by wind to other high elevation areas of the river corridor sufficient to sustain native plants, animals, and the cultural resources that depend on the perpetuation of wind blown sand habitat for their continued existence.

- Over the long term a generally positive mass balance of sediment is achieved in the system, recognizing that a negative mass balance (only for short durations) over some time periods (e.g. for short duration high flows) may be required to achieve objectives for sand bars, campsites, and backwater habitats. Specific objectives may include, but are not limited to, abundance, grain size, and distribution, including volume and areal extent.

- Encroachment of NHWZ vegetation into campsite boundaries is minimized.

- Sediment throughout the system is sufficient to enhance near shore habitat and restore riparian function.

- The old high water zone/terrace deposits and a dynamic ecosystem comprised of diverse representative groups of native and riparian vegetation species at different stages of succession and at different elevations above the water line are maintained.

- Emergent marsh vegetation is sustained as a functioning, dynamic resource providing wildlife habitat that change in location and extent in response to flow and geomorphic processes.

8. Maintain or improve the quality of recreational experiences for users of the Colorado River ecosystem, within the framework of ecosystem goals.

Resource Elements to be addressed:
Diversity of opportunity
Quality of experience & education
Wilderness
Recreation & user carrying capacity

Resource Condition Objectives

- A diverse range of quality recreational opportunities for visitors to experience and understand the environmental interrelationships, resources and values of Grand Canyon National Park is maintained. This range of opportunities is consistent with the preservation of wilderness character.

- The wilderness character of the Colorado River corridor is stable or improving.

- The wilderness ecological systems are substantially free from the effects of modern civilization.

- The wilderness character of the river corridor provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including values of inspiration and physical and mental challenge.

- The quality, quantity, and distribution of campable areas are maintained for the benefit of the recreation users.

9. Maintain power production capacity and energy generation, and increase where feasible and advisable, within the framework of the Adaptive Management ecosystem goals.

Resource Elements to be addressed:
Energy
Load following
Capacity

Resource Condition Objectives

- When feasible within the framework of the ecosystem goals and in concert with progress toward the DFCs, marketable capacity and energy levels may be increased, if the increases can occur without impacting progress toward achieving the DFCs.

- Forty megawatts of regulation (an instantaneous variation of approximately plus or minus 1200 cfs in the release) is maintained as Glen Canyon Power Plant's share of overall system regulation within the power control area.[1]

- Existing emergency criteria at Glen Canyon Dam is maintained for system reliability.

10. Preserve, protect, manage and treat cultural resources for the inspiration and benefit of past, present, and future generations.

Resource Elements to be addressed:
Archeological
Ethnographic
Historic
Cultural Landscapes
TCP's
Sacred places
Access for traditional places
Important Resources

Resource Condition Objectives

- Class I and II archaeological sites remain accessible to users of the river corridor while retaining their significance and integrity. Approximately 90% of Class I sites are stable and require no preservation treatment.

- Class III sites maintain their significance and integrity. At least 60% of Class II and Class III are stable and require no preservation treatment.

- Class IV sites show no impacts from visitation beyond traditional cultural use and show limited impacts from non-human agents of deterioration and maintain significance and integrity.

- Preservation treatments are implemented in a timeframe that does not allow site integrity to degrade and impact mitigation activities are implemented when irretrievable loss is imminent.

[1] Regulation (also called Automated Generation Control) allows for very short instantaneous responses to unanticipated changes in demand on the power grid and is important for power system reliability. At Glen Canyon Dam 40 MW of regulation has historically been maintained. The 40 MW of regulation at Glen Canyon is "zeroed" out over every hour, such that for any given hour the scheduled volume of release is maintained. Because responses under the 40 MW of regulation are very short in duration and zeroed out over the hour, typically, there is no perceptible change in flow at the Lees Ferry gaging station due to the 40 MW of regulation at Glen Canyon Dam.

- The integrity of all National Register eligible or listed historic properties is maintained, in situ where possible, with preservation methods employed on a site specific basis.

- Appropriate types of data recovery is implemented (in consultation with tribes) when integrity is threatened and properties cannot be preserved.

Tribal Resource Condition Objectives

**Recommend that the agencies consult with the Tribes to insure these objectives are consistent with Tribal perspectives.*

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- Tribal resources are intact and accessible for traditional uses.

- Traditional Cultural Properties (TCPs) are indentified by Tribes and are protected pursuant to the National Historic Preservation Act.

- Associated groups can access ethnographic resources and places and utilize them in a traditional manner.

- Tribal users will evaluate ethnographic resources to determine which sites are in "good" condition.

- Tribal use values are incorporated into vegetation, wildlife, and other biological and physical monitoring programs.

- Important resources are identified by traditional ecological knowledge sources as developed in cooperation with the Tribes. Traditional ecological knowledge is used, recognized, and evaluated in management decisions.

ACTION: Public Scoping on Interior's proposal to develop an experimental high flow protocol.

SUMMARY: On December 10, 2009, Secretary of the Interior Salazar announced that the Department will undertake an important experimental initiative to improve the management of Glen Canyon Dam and the Colorado River as it flows through Grand Canyon National Park. The Secretary identified the initiative as the development of a protocol for conducting additional High Flow Experiments at the dam, building on knowledge accrued during three previous high flow experiments. Sediment is a primary component of the Colorado River ecosystem, and determining how sand conservation can be achieved has been identified as a high priority by AMWG stakeholders. The Department will develop a trigger for high flow releases that considers tributary sand inputs, as well as duration and timing considerations based on the 2008 HFE results and other information. The Department proposes to conduct a high flow test whenever the trigger conditions are met. This proposed protocol is the next step in determining the extent to which multiple high flows conducted under conditions of sand enrichment result in cumulative net increases in sandbar size. The experimental protocol is intended to develop information that will allow for evaluation of cumulative sandbar building and maintenance under repeated, sand-enriched high-flow experiments.

To: Ms. Anne Castle
Assistant Secretary for Water and Science
United States Department of the Interior

From: George Caan and Larry Stevens
Co-chairs: Desired Future Conditions Ad-Hoc group (DFC Ad-hoc)

CC: Adaptive Management Work Group

Date: August 4, 2010

Subject: Transmittal of Proposed Desired Future Conditions (DFC)
Completion of Phase 1 Project for Qualitative Assessment of DFC

As co-chairs of the DFC ad-hoc group created at the February 2010 Adaptive Management Work Group Meeting, we are pleased to transmit to you our completion of the Phase 1 efforts to draft desired future conditions (DFCs) for consideration and action by the AMWG at its August meeting. In this cover letter we describe the process used to derive DFCs in this ad hoc group, and we append a description of issues common to all DFCs (legal compliance, high quality science, etc.). We also describe the challenges we foresee in quantification of these DFCs in Phase 2, and our recommendation on how to move forward in that process.

Two broad categories of DFC were considered in the Phase 1 development. "Fundamental resource" DFCs are highest-level resources that stand at the top of the management pyramid. These are the resources and processes that are desired in and of themselves (e.g., healthy humpback chub and rainbow trout populations, and large, abundant camping beaches). "Means DFCs" are ecosystem components, characteristics, or processes needed to achieve fundamental resource goals as "means to an end." Means resources include water quality, food base, habitat, and sediment. We note that some resources can be both means and fundamental resources.

Phase 2 DFC progress will require clear quantification of fundamental resource DFCs prior to quantification of means DFCs. Also, desired resource conditions and desired ecosystem processes are not interchangeable from a planning standpoint. While both are equally important and laudable management goals, the approach of substituting "process" for a desired resource "condition" provides little guidance for monitoring and resource assessment, unless it is explicitly stated that the process itself <u>is</u> the desired resource condition.

The process the group used to arrive at these four DFCs included face-to-face meetings and conference calls. As source documents, we used your memo of February 22, 2010, and the DOI paper dated January 22, 2010. After a careful and diligent review of the material, we decided to draft four DFCs to organize the elements documented in the DOI

paper. The four DFCs attached are: (1) Colorado River ecosystem, (2) cultural, (3) recreation, and (4) power.

The group was pleased to receive useful and supportive comments from the DOI agencies including USBR, USFWS, NPS, and GCMRC. These comments helped immensely in developing these drafts.

The following paragraph is taken from your February 22, 2010 memo to our group. It informed much of the drafting of the DFC.

> *The DAHG should anticipate that the Phase 1 DFCs may not be entirely or collectively achievable. There may be direct trade-offs between one DFC and another. It is not necessary at this time to balance these trade-offs, or to determine whether a certain resource should take priority over another. This balancing process will take place during Phase 2, and most likely will continue over the entire existence of the AMWG, that being the nature of adaptive management. Recognizing that the Phase 1 DFCs may be conflicting does not mean, however, that they are intended to be impractical dreams. I request that the DAHG consider and recommend to the AMWG realistic desired future conditions, achievable through the operation of Glen Canyon Dam, subject to the Law of the River and consistent with the Grand Canyon Protection Act.*

This DFC Phase 1 process did not consider costs or funding sources for the resource conditions or means proposed. Those issues will need to be discussed during resolution of the DFC Phase 2 quantification process.

We can attest to the hard work the group put into drafting these documents and their faithful adherence to the guidance you set forth in your memo regarding our tasks. We also acknowledge the enormous amount of science already completed and the need for future basic and applied science to better understand the implications of meeting desired future conditions.

The linkages between management actions and experimental actions needs to be better understood. Specifically, the relationship of dam operations to achievement of DFCs is critical to understanding how to move forward. From the discussions of the group it is clear that, although much is understood regarding the influence of dam operations on resources, much remains to be learned.

The various, sometimes contradictory, laws, regulations and compliance requirements are additional complexities that influence the way forward for definition, quantification, and achievement of DFCs. Clarification or resolution of these issues in Phase 2 will help us better understand and improve the DFCs we describe in this document.

The group had many strong opinions on a number of issues that will certainly arise during the Phase 2 process. We agreed to transmit these DFCs with a number of comments, issues and suggestions for the next steps in the process. We attach these comments to this memo.

The Grand Canyon Trust participated in the initial sessions of the *ad hoc* group. The Trust recently advised the co-chairs that, in its view, the draft DFCs are not consistent with the park management policies and park plans. The Trust further advised that it wishes to go on record as not concurring with either the process or the products of the *ad hoc* group.

On behalf of the group, we want to thank you and your Department for your assistance, leadership, and support in this effort.

Attachment

General Comments Regarding Phase 1 Process

The process to complete the DFCs generated a number of common themes that we thought would be better relayed in an attachment to the transmittal letter. These comments are grouped as follows:

- Dam Operations, Limitations and Constraints
- Science and Monitoring
- Phase 2 DFC Challenges and Recommendations
- Compliance Responsibilities, Laws and Regulations

DAM OPERATIONS, LIMITATIONS AND CONSTRAINTS

Almost every means or fundamental DFC resource or process in the Colorado River ecosystem in Glen and Grand Canyons has some nexus to the operations of Glen Canyon Dam, and the existence of the dam is a given. The Grand Canyon Protection Act (GCPA) and the Adaptive Management Work Group (AMWG) Charter frame the discussion of system limitations and constraints, and pursuant to your direction, our DFC Phase 1 discussions focused on the definition of reasonableness and achievability of the DFCs proposed; however, many uncertainties exist over the nature and extent of dam impacts. Some resources, such as power, are clearly affected by Glen Canyon Dam operations, whereas the impacts of dam operations on other resources (e.g., water quality) are less clear at this time. The DAHC engaged in a rigorous discussion over what could be managed with dam operations and which resources and processes were not affected, or were only partially affected by dam operations. Teasing apart the ecosystem impacts of dam existence versus dam operations remains a challenge, both in terms of science and agency policy dynamics. For example, dam construction greatly reduced annual flow variability, and the potential ecological benefits and policy implications of MLFF flows with relatively small (45,000 cfs) HFEs are still being evaluated. It was agreed that additional direction and science are needed to help improve understanding of these relationships, limitations, and operational constraints, and that those topics should be key components of Phase 2 DFC discussions.

The GCPA provides for other management actions, and therefore may expand river ecosystem management to means other than through dam operations. The AMWG charter states that, “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.” Phase 2 DFC discussions will need to distinguish between dam operations and non-flow management responsibilities and actions. The AMWG will recommend to the Secretary appropriate long-term flow and non-flow management actions for implementation, addressing the funding for non-flow actions.

SCIENCE AND MONITORING

A rigorous, credible science program is essential for all aspects of DFC monitoring, research, and reporting for development of AMP advice to the Secretary. At present, science services are provided to the AMP by the U.S. Geological Survey through the Grand Canyon Monitoring and Research Center (GCMRC). While a DFC specifically for science integrity was considered by the DAHC, we view the need for AMP science and monitoring as programmatic, extending to all elements of the AMP. Therefore, achieving DFC and AMP goals requires the following from its science program(s).

1) Scientific information used for the AMP process must be reliable, of high quality, and rigorously reviewed. At present, the GCDAMP relies on dialogue between stakeholders and the GCMRC to establish research and monitoring tasks and priorities. Continued and even more rigorous review of scientific research plans and projects should be performed by the independent Science Advisors, and their recommendations should be implemented precisely.

2) Peer-reviewed publication of scientific findings in major scientific journals is the gold standard for scientific credibility, and peer-reviewed publication amplifies the credibility of the overall GCDAMP to the scientific community and to the public. Peer-reviewed publication is the norm for all scientific organizations; and we strongly recommend that all major GCDAMP projects undertaken by the USGS be prepared and submitted for peer-review publication, rather than being left in report form.

3) AMP data, reports, hard copy field notes and maps, meeting documentation, and other information should be compiled and archived in a fashion that makes it easy to access and easy to relate to contemporary and emerging issues. AMP information management, through both GCMRC and Reclamation, occasionally should be reviewed by the Science Advisors or by external information management experts, and recommendations from those reviews should be followed. A summary of findings and conclusions to date should be developed, maintained, and modified as appropriate to further guide the AMP process. An annotated, searchable administrative history of the AMP would be useful and improve information availability, project completion, AMP progress, and education of new AMWG members, and should help prevent duplication of effort over time.

4) Uncertainties, unrecognized linkages, unanticipated ecosystem events and processes, changing policies, and biases are abundant and affect our understanding of the Colorado River ecosystem and its dynamic character. Consequently, much uncertainty exists over CRE management appropriateness and effectiveness, particularly involving direct and indirect dam impacts of dam operations on biota, processes, and interactions. The implications of this uncertainty often are not clearly acknowledged or embraced in science planning. The extent, impacts, and risks of scientific uncertainty on monitoring, research, and management program success should be more clearly identified, assessed and communicated to the AMWG.

PHASE 2 DFC CHALLENGES AND RECOMMENDATIONS

Phase 2 Challenges

The Phase 1 DFC definition clarifies our (DAHC) vision for the Colorado River socio-ecosystem. Further DOI review of these DFCs is expected to help focus the AMP. Several conflicts and assumptions over AMP direction challenged Phase 1 DFC definition and remain unresolved.

- General programmatic conflicts are listed in the Policy Issues Ad Hoc Committee report (2009) and primarily involve conflicts among mandates and establishment of clear priorities. It would be advantageous for the DOI to resolve intra-departmental conflicts, and to identify a resolution strategy for inter-departmental conflicts that would help the AMP find a balance among competing laws and mandates.

- An assumption that perpetuates conflicts in DFC definition appears to be the direction and magnitude of the AMP: if environmental impacts stemming from dam operations can be successfully addressed, and other problems can be solved or mitigated outside the AMP, will the size and cost of the AMP program decrease?

- Phase 2 DFC quantification will require clarification of the scope of the AMP. Previous efforts have attempted to identify which elements lie within or outside the scope of AMP but have not been resolved and perpetuate controversy within the AMP. For example, how can the AMP be limited to dam operations if a fisheries recovery program addresses non-flow management activities? The scope of AMP activities may still need to be addressed through further discussion in the AMWG and the DOI.

- Phase 2 DFC should be structured to prioritize “fundamental” over “means” resources/processes, or to identify obstacles (including uncertainties) to that prioritization, where possible. A prioritized approach will help define and clarify the supporting ecological and sociological linkages needed to achieve DFCs move towards those goals through appropriate scientific endeavors.

- The relationship between the NPS and the GCD-AMP must be made clear. Grand Canyon National Park represents both itself and Glen Canyon National Recreation Area within the AMP. It can be argued that the NPS has full jurisdiction over all DFCs, except that for hydropower and the Tribal and joint-use lands in the river corridor. Other government agencies also claim responsibility for some cultural and natural resources in the river corridor (e.g., Tribal responsibilities for cultural resources, Arizona’s responsibilities for fish and wildlife). Reclamation, in full cooperation with the Colorado River Basin States and other stakeholders, has responsibility for water storage, delivery, and dam operations. Clarification and the balancing of jurisdictional responsibilities will help improve overall adaptive management process.

- In relation to the above, discussion on establishing a reference condition for management of the CRE has been a persistently divisive and controversial issue within AMWG. Should the reference point be the pre-dam condition, or is it one or more post-dam reference years (e.g., 1984 or the initiation of the AMP in 1997), varying among resources? Resolution of this issue is needed for DFC quantification in Phase 2.

Many of these issues are controversial. Therefore, we recommend that DFC Phase 2 be a facilitated discussion to identify, define, and resolve or clarify these and other conflicts prior to, and during, the Phase 2 DFC quantification process.

Phase 2 DFC Process Recommendations

We believe that there are a number of steps that should be taken as part of the Phase 2 process. The following is a list of some steps that might be considered.

- Design and conduct a facilitated AMP policy issues discussion process—perhaps as a workshop—to clearly identify, define, discuss, and where possible promote resolution of key issues of conflict among agencies. This process should focus initially on contentious issues among DOI agencies, such as NPS management for the natural (pre-dam condition) of the CRE and Reclamation's dam management policies and consequences. Progress on DFC quantification in Phase 2 also will require determining whether and how inter-agency conflicts may limit achievement of DFCs and how to resolve those conflicts.

- Establish priorities among fundamental and means DFC elements by considering ranking and weighting by: perceived importance, certainty of beneficial impact, agreement on methods and metrics to be used (standardized metrics may be most useful), legal requirements, compliance/acceptability, cost, time frame, and linkage to other prioritized actions (i.e., implications for quantification of some DFC variables that affect quantification of other variables). Towards this end, completion and utilization of the comprehensive, long-term planning process would likely prove beneficial.

- Determine how Phase 2 DFC priorities relate to AMP and GCMRC strategic plans and readjust monitoring priorities if necessary.

- After the development of the quantified Phase 2 DFCs, Interior should propose or develop a draft Phase 2 DFC implementation and funding strategy and plan, for review by all stakeholders, GCMRC, and the Science Advisors.

- A final DFC Phase 2 implementation plan should be provided to the AMWG by the Secretary for guidance.

COMPLIANCE RESPONSIBILITIES, LAWS AND REGULATIONS

Each DFC has associated laws, regulations and compliance responsibilities. A section was included in the DFC template to identify specific legal and compliance issues in each DFC. Many of these regulations are common to all DFCs but may be interpreted and applied differently, creating challenges in understanding linkages. We have provided a list of these laws and regulations below in order to facilitate the discussions that will occur during later phases of the project.

Partial List of Authorities (chronological if noted)

- Reclamation Act (1902)
- Grand Canyon National Monument (1908)
- National Park Service Organic Act (1916)
- Migratory Bird Treaty Act and Bald Eagle (1918)
- Grand Canyon National Park (1919)
- The Colorado River Compact-Law of the River (1922 and ongoing)
- Fish and Wildlife Coordination Act (1934)
- Bald and Golden Eagle Protection Act (1940)
- Upper Colorado River Basin Compact (1948)
- Colorado River Storage Project Act of (1956)
- Wilderness Act (1964)
- National Historic Preservation Act (1966) Sections 106 and 110
- Colorado River Basin Project Act (1968)
- National Environmental Policy Act (1969)
- Endangered Species Act (1973)
- Grand Canyon Enlargement Act (1975)
- DOE Organization Act (1977)
- Redwoods Act (1978)
- Archeological Resource Protection Act (1979)
- Native American Graves Protection and Repatriation Act (1990)
- Grand Canyon Protection Act (1992)
- Religious Freedom Restoration Act (1993)
- GCNP General Management Plan (1995)
- Record of Decision, Operation of Glen Canyon Dam Final Environmental Impact Statement (1997)
- Grand Canyon National Park Resource Management Plan (1997)
- Energy Policy Act (2005)
- Colorado River Management Plan (2006)
- NPS Management Policies (2006)
- Natural Environment Research Council NERC/WECC Standards (2007)
- NPS management statutory authorities for Glen Canyon National Recreation Area and Grand Canyon National Park
- Executive Order 11593-Protection and Enhancement of the Cultural Environment

- Executive Order 13007-Indian Sacred Sites
- Executive Order 13175-Consultation and Coordination with Indian Tribal Governments
- Secretary Order 3206-American Indian Tribal Rights, Federal-Tribal Responsibilities and the Endangered Species Act

Desired Future Condition Template for Phase 1 Report Colorado River Ecosystem (CRE)

DFC NAME: THE COLORADO RIVER ECOSYSTEM

DFC DESCRIPTION:

Ecosystem Definition: The term **ecosystem** refers to the combined physical and biological components of an environment. An ecosystem is generally an area within the natural environment in which physical (abiotic) factors and processes of the environment, such as geology, climate, and soil development, function together along with interdependent (biotic) organisms, such as plants and animals, in the same habitat to create a dynamic and interconnected system. Ecosystems usually encompass a number of food webs. An ecosystem is a functional unit consisting of living things in a given area, non-living chemical and physical factors of their environment, linked together through nutrient cycling and energy flow, and non-living chemical and physical factors in the environment, linked together through nutrient cycling and energy flow.

The Colorado River ecosystem (CRE) 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 GCDAMP activities may include limited investigations into some tributaries (e.g., the Little Colorado and Paria Rivers).

DFC Background: Glen Canyon Dam has had a profound impact on the aquatic and terrestrial domains of the CRE from lower Lake Powell downstream to Lake Mead. These impacts are summarized in Schmidt et al. (1998). This DFC is designed to meet the intent of the 1997 ROD which was implemented consistent with the 1992 Grand Canyon Protection Act, the Law of the River which is the body of law that governs the allocation of water among the seven Colorado Basin States and Mexico, and other appropriate laws and mandates, and is designed to protect, mitigate adverse impacts and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established.

REASONS WHY THIS DFC IS IMPORTANT

This DFC addresses the natural resource values for which Grand Canyon and Glen Canyon National Recreation Area were established, as stated in the laws, regulations, and agency policies section of the cover letter to Phase I of the DFC document. The human-dominated CRE described herein includes most of the native natural resources found in the Colorado River. Those resources are protected, consistent with the Law of the River, under the NPS Organic Act, the Redwoods Act, NPS 2006 Management Policies, the Wilderness Act, the Antiquities Act, the Endangered Species Act, the Grand Canyon Protection Act, the Fish and Wildlife Coordination Act and other federal legislation. The utilization of the Colorado River and the health of the river ecosystem are important to the nation, to many Native American Tribes, to the economy of the Southwest, and to most visitors to the Parks and the region.

COLORADO RIVER ECOSYSTEM DFC GOALS (FROM 22 JAN 2010 DOI Draft DFCs for the Colorado River Ecosystem, based on the Glen Canyon Dam Adaptive Management Program's Draft Strategic Plan Goals)

- DFC 1 – Protect or improve the aquatic food base so that it supports viable populations of desired species at higher trophic levels);
- DFC 2 - Maintain or attain viable populations of existing native fishes, and prevent adverse modification to their habitat (including critical habitat);
- DFC 3 - Restore viable populations of extirpated species;
- DFC 4 - Maintain a self-sustaining recreational trout fishery in the Lees Ferry reach;
- DFC 5 – Maintain or attain viable populations of the Kanab ambersnail;
- DFC 6 - Protect or improve the biotic riparian, wetland, spring and old high water zone plant communities and their associated biological processes within the Colorado River ecosystem (including threatened and endangered species and their habitat);
- DFC 7 - Maintain or attain water quality in support of ecosystem functions (dissolved oxygen, nutrient contributions and cycling, and temperature (to the extent feasible)) consistent with the life history requirements of focal aquatic species.
- DFC 8 - Maintain or attain levels of sediment storage within the main channel and along shorelines to achieve ecosystem goals;

DFC GOALS AND OBJECTIVES

Overall Policy Goal:

Achieve the balance of resource benefits envisioned by the Grand Canyon Protection Act, GCD EIS Preferred Alternative, and NPS 2006 Management Policies; maintaining, enhancing and where practical, restoring native species, natural habitats, and natural ecosystem processes. Native and non-native species are to be managed in accord with federal regulations, policies, and guidelines. Goal 3 in the AMP Strategic Plan ("*Restoring populations of extirpated species as feasible and advisable"*) is to be achieved in accord with the direction in RIN 3.1.1, which states:

> *"RIN 3.1.1 What information (including technical, legal, economic, and policy issues) should be considered in determining the feasibility and advisability of restoring pikeminnow, bonytail, roundtail chub, river otter, or other extirpated species? (Category C)"*

A Category C Information Need is defined in the Strategic Plan as: "*Information Needs that are funded and accomplished under the authority of an entity other than GCMRC*."

Restoration of extirpated species should be guided by Goal 3 of the GCD AMP strategic plan and AMWG agreements from its August 2003 meeting, and such activities are not to be funded by the Adaptive Management Program. While AMP funding may not be used for such activities, AMWG may still advise the Secretary about the feasibility of reintroduction activities, and may request monitoring and information integration about such reintroduction activities.

Sediment-related Resources

- **High elevation open riparian sediment deposits are created, maintained, or enhanced along the Colorado River in sufficient volume, area, and distribution so as to provide habitat to sustain native biota and ecosystem processes, and cultural and recreational resources (DOI DFC 8).**
    - Maintain or enhance adequate sand bars (including camping beaches) for recreation in Glen, Marble, and Grand Canyon critical reaches
    - Maintain or enhance nearshore habitats for native fish
    - Maintain or enhance marsh and riparian habitat for fish and wildlife.
    - Maintain or enhance cultural resources

Water Quality

- **Water quality(dissolved oxygen, nutrient concentrations and cycling, turbidity, temperature, etc.) is sufficient to support natural ecosystem functions, visitor safety and visitor experience to the extent feasible and consistent with the life history requirements of focal aquatic species (DOI DFC 7 - water quality).**
    - Maintain ecosystem-sustaining nutrient distribution, flux, and cycling
    - Maintain, and enhance hydro-physical conditions and characteristics of the Colorado River ecosystem necessary to sustain native aquatic biota
    - Maintain or enhance water quality for human health and visitor experience

CRE Aquatic Domain

- **The aquatic food base will sustainably support viable populations of other desired species at higher trophic levels; (DOI DFC 1).**
    - Assure that an adequate, diverse, productive aquatic foodbase exists for fish and other aquatic and terrestrial species that depend on those food resources

- **Native fish species and their habitats (including critical habitats) are sustainably maintained or enhanced through each species natural ranges in the CRE (DOI-DFC 2).**
    - Maintain or enhance self sustaining HBC population in its natural range in the CRE
    - Achieve HBC recovery in accord with ESA and agency objectives and the HBC comprehensive management plan
    - Ensure ecologically appropriate habitat is maintained or enhanced for humpback chub in the mainstream.
    - Maintain spawning habitat for humpback chub in the Lower Little Colorado
    - Establish additional spawning habitat and spawning aggregations within the CRE, where feasible.
    - Assure adequate survival of young-of-year or juvenile humpback that enter the mainstem sufficient to maintain reproductive potential of the population and achieve population sizes consistent with recovery goals.
    - Maintain or enhance healthy, self-sustaining populations of other remaining native fish with appropriate distribution (FMS, BHS, SPD).
    - Re-establish fishes extirpated from Grand Canyon, where consistent with recovery goals for humpback chub and the recovery goals for those extirpated fishes.
    - Limit recruitment and abundance of RBT and other non-native fish in Grand Canyon to meet objectives for robust native aquatic community in those reaches
    - Minimize emigration of non-native fish from the Recreation Area to downstream locations.

- **The recreational trout fishery between Glen Canyon Dam and the Paria River are healthy, self-sustaining, and of high quality of the (DOI DFC 4).**
    - Maintain a fishable population of rainbow trout in the Lees Ferry Reach from Glen Canyon Cam to the mouth of the Paria River sufficient to provide a high quality fishing opportunity and experience for anglers/visitors
    - Maintain angler and visitor satisfaction, with controlled recruitment to minimize undesired emigration from that management reach.

- **Native non-fish aquatic biota and their habitats will be maintained or enhanced, and with ecologically appropriate distributions.**
    - Maintain, enhance and , restore populations of native non-fish species (invertebrates and vertebrates)

- Assure that the the abundance and distribution of non-native species in the riparian corridor are minimized
- Protect or improve aquatic, wetland, and springs plant communities and associated biological processes, including threatened and endangered species and their habitats (DOI DFC – 6)

CRE Riparian Domain

- **Native riparian species assemblages and seral stages are diverse, healthy, productive, self-sustaining, and ecologically appropriate.**
  - Maintain or enhance native, self-sustaining riverine wetlands and riparian vegetation and habitat with appropriate mixture of seral stages
  - Maintain or enhance healthy, self-sustaining populations of native riparian fauna (both resident and migratory)
    - Maintain, enhance, and where possible restore populations of sensitive species within the zone of river influence, including Kanab Ambersnail, Northern and other Leopard Frogs, Southwestern Willow Flycatcher, Bald Eagle, Peregrine Falcon, and other listed species, consistent with the intent of the Fish and Wildlife Coordination Act
    - Encourage resolution of the taxonomic status of Kanab ambersnail (DOI DFC 5)
    - Maintain and restore populations of neotropical migratory birds, waterfowl, and other appropriate native bird species.
    - Keep common native species common within the zone of river influence
    - Consistent with federal laws and agency policies, repatriate native species or actively manage overabundant native species
  - Maintain or enhance the ecological function of tributary mouths and riverside springs, including habitat for native species

LINKAGES

The Colorado River ecosystem (CRE) consists of 13 geomorphically defined reaches between Glen Canyon Dam (15 1/2 miles upstream from Lees Ferry) and upper Lake Mead (Mile 278; Fig. 1). These reaches vary in length, width, depth, and configuration, as noted by Schmidt and Graf (1990). Physical characteristics and processes generally predominate over biological processes in the CRE, including climate, reach-based geomorphology, dam-related discharge and flow, and tributary flows (Stevens et al. 1995, 2001). Each reach (depicted as a "page" in the illustration) shapes linked aquatic and riparian domains of the river ecosystem, affecting fluvial habitat distribution, and biotic assemblage composition, structure, and population dynamics, and cumulative effects occur over distance downstream as well. "Lateral" bio-ecological processes, such as competition, and "top-down" processes, such as predation, parasitism, and decomposition, can influence some elements of assemblage composition, structure, and population dynamics over time. In addition to physical and biological interactions, the CRE contains and is linked to Native American cultural resources, such as archeological sites and cultural properties. Recreational benefits have heretofore been regarded as resulting from healthy ecosystem conditions (ROD 1997). Hydropower production and water storage and release are managed through Glen Canyon Dam under the authority of the Secretary of the Interior.

METRICS

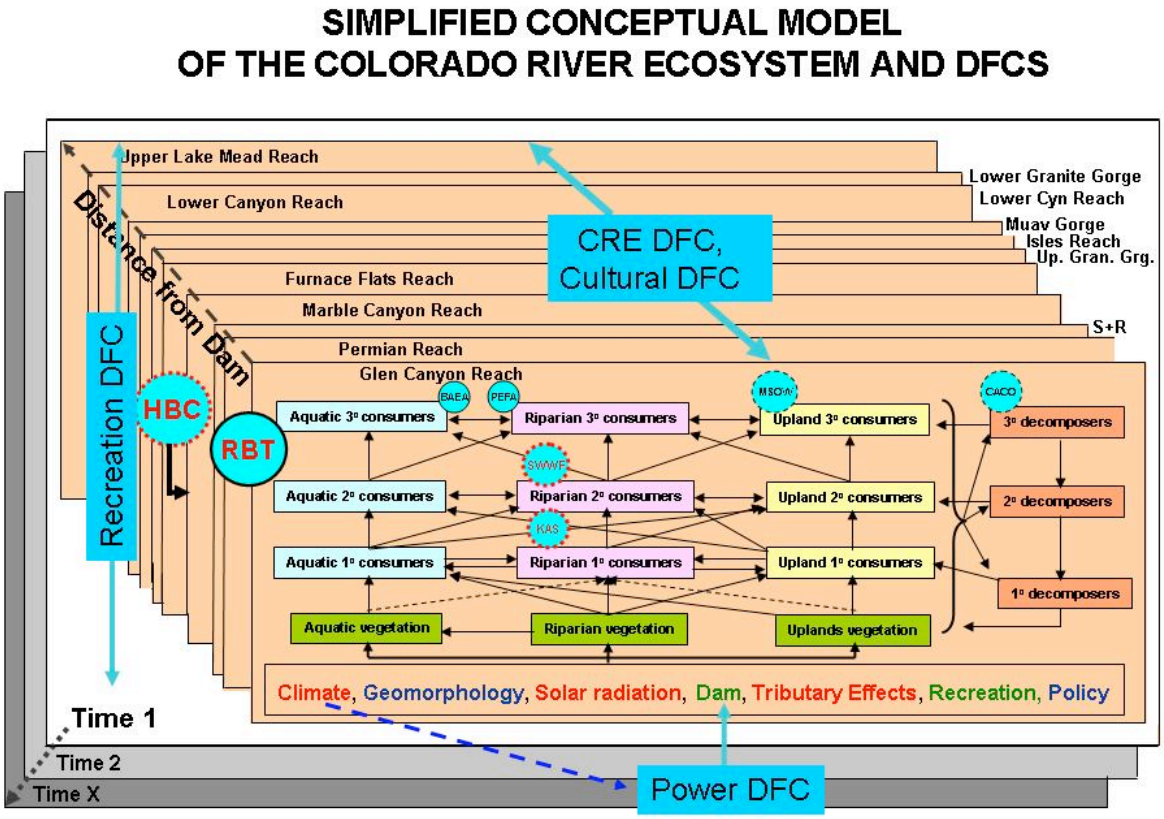
This DFC is intended to inform the gathering and analysis of the data pertinent to the CRE in Grand Canyon National Park and Glen Canyon National Recreation Area. The CRE DFCs and the related documents will be used to provide direction towards development of the core monitoring program under development by the Grand Canyon Monitoring and Research Center. Through diligent and consistent

monitoring, GCMRC may inform the Secretary as to whether and to what degree these DFCs are being achieved.

RELATIONSHIP TO DAM OPERATIONS

There are many direct and indirect, short-term and long-term ecosystem responses to dam existence and operations. Many of these are discussed in the SCORE Report (Gloss et al. 2005; Fig. 1). This and the other three proposed DFCs are directly or indirectly linked on short- and long-term bases through dam-related flows, sediment retention and distribution, hydropower production, fish and wildlife populations, recreation, and visitor experience. Figure 1 illustrates the complicated linkage among the dam operations and natural as well as socio-cultural resources in the CRE, and the extent of coverage of the proposed DFCs described in this document.

Figure 1: A schematic of the Colorado River ecosystem in relation to Glen Canyon Dam. Abbreviations: BAEA – Bald Eagle, CACO – California Condor, DFC – desired future conditions, HBC – Humpback Chub, MSO – Mexican Spotted Owl, PEFA – Peregrine Falcon, RBT – Rainbow Trout, S+R – Supai and Redwall reaches (Miles 11-39), SWWF – Southwestern Willow Flycatcher.



Desired Future Condition Phase 1 Report:
Cultural Resources

(July 22, 2010 draft)

From the January 22, 2010 DOI Draft DFC memo, the proposed Cultural Resource DFC (based on the GCDAMP Goal 10) is:

> **DFC 10** - *Preserve, protect, mange and treat cultural resources for the inspiration and benefit of past, present and future generations*

Preservation and appropriate management of cultural resources is vital at many levels. At the most basic level, cultural resources are our history; they define, reaffirm, and provide a tangible record of who we are and where we have been. Their importance can be to the Nation as a whole or locally important to a community or traditional group. Recognition of the importance of cultural resources is codified through numerous laws and orders that mandate protection, consideration, and the preservation of cultural resources. Because of the structure of the legislation, particularly the National Historic Preservation Act (NHPA), cultural resources will be considered below in two broad groupings: **DFC 10a**; those that fall within the purview of the NHPA (National Register Eligible historic properties); and **DFC 10b**, all other resources of cultural importance. This is done for purely pragmatic reasons -- there are specific requirements for cultural resources that fall under the NHPA umbrella. In reality, the dividing line between cultural resources that are covered by NHPA and those that are not is often arbitrary from the standpoint of historic and cultural importance.

DFC NAME:
NATIONAL REGISTER ELIGIBLE (OR POTENTIALLY ELIGIBLE) HISTORIC PROPERTIES (**DFC 10a**)

DFC DESCRIPTION:
These resources include the suite of resources that are eligible or potentially eligible for the National Register of Historic Places. The criteria for inclusion are defined in the National Historic Preservation Act, and are detailed in National Register Bulletins 15 and 38. Resources in the Grand Canyon include:

- Prehistoric Archaeological Sites (including trails, petroglyphs/pictographs)
- Historic Sites (Boats, Mining, European exploration, River running)
- Traditional Cultural Properties (TCPs). For the Grand Canyon, these include:
    - Archaeological sites
    - Plant collection locations
    - Sacred sites

- Landmarks/Geographic features
- Springs
- Mineral collection locations
- Significant Event locations
- The Grand Canyon itself

DFC OJECTIVES (adapted from DOI January 22, 2010 memo):

- Prehistoric Archaeological Sites and Historic Sites:

  a.) Maintain significance and integrity through preservation in place. For NPS Class I and Class II archaeological sites, there is the desire to maintain access to users of the river corridor as long as integrity is not compromised (visitor access is not an objective for Class III and IV sites).

  b.) If significance or integrity is threatened, implement preservation treatments that will reduce or eliminate threats and allow continued preservation in place. Treatments should be consistent with Park Service management policies, traditional tribal values, and cultural resource legislation (including agreement documents that incorporate CRE cultural resources).

  c.) If integrity cannot be preserved in place, measures to mitigate the loss should be implemented following the requirements of §106 of NHPA, the 1994 Programmatic Agreement (PA), or other agreement documents as appropriate. Treatments should be consistent with Park Service management policies and traditional tribal values. At 54 sites along the river corridor, the BOR has determined for the purposes of §106 of NHPA, as resolved through the 1994 PA, that integrity cannot be preserved in place and that various levels of data recovery will need to be implemented. Once finalized, this will complete the commitment of the Bureau of Reclamation to mitigate the current damage at these sites related to the operations of Glen Canyon Dam. Other activities of the AMP may require separate compliance with NHPA.

- Traditional Cultural Properties:

  a.) Maintain attributes required for National Register eligibility. These attributes will be specific to the affiliated culture and will need to be identified by that culture. Attributes may include aspects of location or physical integrity, but could also be intangible elements that link the resource to ongoing tradition cultural practices.

  b.) Maintain the ability to access and traditionally use resource by the affiliated cultural group.

  c.) Manage resource for culturally appropriate condition based on traditional ecological knowledge and integrate this desired condition into relevant monitoring and management programs. The desired condition for a TCP, especially a biological resource, may be related to values beyond simple presence or absence of the resource.

d.) Maintain ongoing consultation with group having traditional value for the resource. Because the desired condition of a TCP needs to be determined by the group that has the traditional values for the resource, ongoing consultation is necessary to assess the condition of the resource.

e.) Mitigate impacts that affect the integrity of the TCPs. How and if affects can be mitigated will need to be developed in conjunction with the cultural group that holds the traditional values for the resource.

COMPLIANCE RESPONSIBILITY:
Besides the need to comply with aspects of the laws, orders, and policies identified in the legislative section of this document, specific requirements concerning National Register Eligible Historic Properties are defined in the 1994 Programmatic Agreement on Cultural Resources and in Memorandums of Agreement for data recovery activities.

LINKAGES:
The goals for the following resources all have the potential to directly or indirectly affect the condition National Register eligible properties (includes some examples of effects):

- Flow
  - Direct inundation
  - Levels of sediment deposition
  - Fluctuation frequency and range
- Sediment
  - Distribution (laterally and vertically)
- Vegetation
  - Species composition
  - Density
- Recreation
  - Camping locations
  - Recreational visitation
  - Trailing

Additionally, Management and Research Actions have the potential to directly or indirectly impact these resources.

METRICS:

- Erosion (or deposition) rates of substrates in which the sites are contained
- Impacts at sites that will affect eligibility

WHY THIS DFC IS IMPORTANT:

- To maintain a record of human history in the Grand Canyon
- To maintain traditional cultural use and significance of the Grand Canyon
- To maintain compliance with relevant cultural resource legislation

DFC NAME:
RESOURCES OF TRADITIONAL CULTURAL SIGINIFICANCE **(DFC 10b)**

DFC DESCRIPTION:
These are resources of traditional significance to a cultural group, most likely a Native American tribe, which do not meet some aspect for eligibility to the National Register of Historic Places. A common reason that National Register eligibility may not be met is because the resource lacks a clearly defined boundary or does not remain in a fixed location. Resources that have the potential to be considered of traditional cultural significance in the Grand Canyon include:

- Plant resources
- Animal Resources
- Water
- Geologic materials
- Landscapes
- Viewscapes
- Soundscapes

DFC OJECTIVES (adapted from DOI January 22, 2010 memo):
- Maintain the ability to continue traditional use of the resource
- Maintain culturally appropriate resource condition based on traditional ecological knowledge and integrate this desired condition into monitoring and management programs
- Maintain effective consultation with group that has traditional value for the resource

COMPLIANCE RESPONSIBILITY:
Besides the need to comply with aspects of the laws, orders, and policies identified in the legislative section of this document, the Federal government needs to recognize its trust responsibility to Native American tribes.

LINKAGES:
The goals for the following resources all directly or indirectly affect the condition of the culturally significant resources:

- Flow
- Sediment
- Vegetation
- Recreation

Also, Management and Research Actions have the potential to directly impact these resources.

METRICS:
Measures for resource health and appropriate management will need to be determined individually by the culturally affiliated group. Because culture defines the roles that resources play, it can only be from within that culture that assessments regarding the status of the resources can be adequately developed.

WHY THIS DFC IS IMPORTANT:

- To maintain traditional cultural linkage with the Grand Canyon
- To maintain traditional usage of resources in the Grand Canyon

Desired Future Conditions for Recreation

Phase 1 Report

Name: Recreation

Description

The Recreation DFCs are meant to describe goals and objectives for human use of the Colorado River ecosystem through Glen Canyon and the Grand Canyon. They are intended to include not only traditional recreational activities such as whitewater rafting, camping and fishing, but also such things as educational activities, spiritual engagement, and non-use values. The Grand Canyon and Glen Canyon offer a great many ways for people to experience, appreciate and learn from them, even to people who never visit in person.

Background

Cultural use of Glen and Grand Canyons extends well into prehistory. Recreational use began before there were any dams on the Colorado River, though the exact beginnings are unknown. Due to changes in our culture, the recreational and non-use value of the Grand Canyon and Glen Canyon have increased greatly since the time of the construction of Glen Canyon Dam.

These DFCs are designed to protect, mitigate adverse impacts, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established.

Importance

The Grand Canyon is a place unique in this world. Its natural beauty, challenging environment, fascinating history, sheer size, and wilderness character offer a rare and valuable kind of experience. The river corridor is at the heart of the Grand Canyon. The river corridor and the canyon are worthy of the greatest possible respect, treatment and protection that we can afford them. They should be kept vital and intact for future generations.

The river corridor through Glen Canyon is a rare mix of outdoor beauty and easy access. It supports a valuable trout fishery and offers excellent outdoor opportunities that are more accessible and less demanding than those of the Grand Canyon. It is deserving of our respect and protection.

DOI Number

This set of desired future conditions roughly corresponds to the January 22, 2010 Department of the Interior Draft Desired Future Conditions Goal number 8: "Maintain or improve the quality of recreational experiences for users of the Colorado River ecosystem, within the framework of ecosystem goals."

Objectives

The Recreation DFCs have been divided in to four subcategories, each corresponding to a different section of the overall ecosystem or type of use.

River Recreation in Grand Canyon National Park

Maximize Grand Canyon recreation resources and their social and economic benefits while achieving a balance with other DFC resources.

- Stewardship worthy of the Grand Canyon.
- Maximum opportunity to experience the wilderness character of the canyon. Wilderness experiences and benefits available in the canyon include solitude, connection to nature, personal contemplation, joy, excitement, the natural sounds and quiet of the desert and river, and extended time periods in a unique environment outside the trappings of civilization.
- A river corridor landscape that matches natural conditions as closely as possible, including extensive beaches and abundant driftwood.
- A river corridor that ecosystem that matches the natural conditions as closely as possible, including a biotic community dominated by native species.
- A dynamic river ecosystem characterized by ecological patterns and processes within their range of natural variability.
- Numerous campable sand bars distributed throughout the canyon within a scour zone between the 8,000 to 35,000 cfs level, built and maintained by habitat maintenance and beach-habitat building flows.
- Minimal impact to recreation from research and management activities.
- River flows that continue to be within a range that is reasonably safe, given the inherent risks involved in river recreation.

River Recreation in Glen Canyon National Recreation Area

Maximize Glen Canyon recreation resources and their social and economic benefits while achieving a balance with other DFC resources

- Maintain or improve the quality of the recreation experience in Glen Canyon.
- Camping beaches suitable for recreational use.
- A setting and ecosystem that is as close to natural conditions as possible.

Trout Fishery in Glen Canyon National Recreation Area

Maximize Glen Canyon trout fishing resources and their social and economic benefits while achieving a balance with other DFC resources. Maintain a high-quality, self-sustaining trout fishery in the river corridor in GCNRA.

- Operate Glen Canyon Dam to achieve the greatest benefit to the trout fishery without causing excessive detriment to other resources.

River Corridor Stewardship

Maximize the integrity, preservation, and long-term protection of the river corridor through the Grand Canyon while achieving a balance with other DFC resources.

- Stewardship worthy of the Grand Canyon, so it can be proudly passed from generation to generation in a condition as natural and unmarred as possible.
- Management of Glen Canyon Dam that is significantly driven by concern for the cultural values and ecological integrity of the river corridor through the Grand Canyon, with preservation and protection considered over the long term (multiple generations).

Linkages

- The river corridor ecosystem. A natural, healthy and protected ecosystem is an important part of the recreation experience and wilderness character of the river corridor.
- Cultural resources within and near the river corridor. The history of human habitation and use is an important part of the recreation experience. Individual sites are valuable whether they are open for visitation or designated off-limits.
- Socio-economic values of Glen Canyon Dam.

Metrics

- Socio-economic value of river recreation in Grand Canyon National Park.
- Socio-economic value of the river corridor and the Grand Canyon itself, as a whole.
- Economic effects of Grand Canyon tourism.
- Factors that make up the "wilderness character" of the river corridor.
- Understanding of natural conditions, such as number and size of campable beaches, natural flow regimes, etc.
- Necessary factors: number, size and locations of beaches; flows that are sufficiently safe; flows for an optimal recreation experience.
- Socio-economic value of river recreation in GCNRA.
- Socio-economic value of the river corridor itself in GCNRA.
- Socio-economic value of the fishery in GCNRA.
- Effect of the trout on the rest of the ecosystem and the social and economic costs of mitigation.
- Characteristics most valued for the fishery. For example, the number and size of fish, and the ease or challenge of catching them.

July 21, 2010

DESIRED FUTURE CONDITION TEMPLATE

DFC NAME: Power – DOI DFC-09

DFC BACKGROUND: As the largest source of renewable electricity generation in the U.S., hydropower provides a wide range of benefits to the Country. Hydropower is a minimal emission, low-cost source of energy that can be relied upon for long-term, stable production of domestic energy.[1]

Glen Canyon Dam is an important component of the Colorado River Storage Project which stores water, the West's most vital resource, during wet years for use in times of drought, much like a bank account. As part of the nation's critical infrastructure, the water stored by Glen Canyon Dam is vital to the growing water needs of the Western United States. Over 30 million people depend on the water stored behind the dam for drinking, irrigation, and other municipal and industrial uses, and Glen Canyon Dam is managed in accordance with the 1997 Record of Decision to balance economic benefits while maintaining or enhancing values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. The hydropower resource produced by the release of stored water through Glen Canyon Dam is used to follow fluctuating electrical demand, or peaking power, while the larger, less-flexible coal and nuclear resources provide baseload power. Hydropower facilities are ideal for following rapid changes in electrical demand because they can be quickly adjusted to meet these changes. The dam's eight generators can produce up to 1,320 megawatts, enough electricity to serve 1.3 million residential customers. The integration of hydropower and other resources provides an efficient and flexible operation of this region's electrical resources. Releases of water from Glen Canyon Dam are adjusted in part to accommodate daily and seasonal peak power demands.[2]

DFC GOAL:
*Maximize Glen Canyon power generation and the economic and financial benefits while achieving a balance with CRE resource objectives
*Maximize the environmental benefits of hydropower generation at Glen Canyon Dam.
*Hydropower generation at Glen Canyon helps minimize coal or natural gas air emissions
*Hydropower generation can help manage water temperatures
*Mitigate impacts caused by reductions in Glen Canyon generation

DFC DESCRIPTION: Revenues from the sale of Glen Canyon hydropower generation are used to repay, with interest, the Federal investment in the CRSP, including over 95% of the costs of the federal irrigation projects. In other words, hydropower revenues ensure that the authorized purposes of the CRSP remain viable.

[1] Memorandum of Understanding For Hydropower Among The Department of Energy, The Department of the Interior And The Department of the Army, March 24, 2010.
[2] Adaptive Management Program Fact Sheets (Key Resources and Hydropower), www.gcdamp.gov

The Reclamation Project Act of 1939 provides that hydropower produced by Glen Canyon Dam be offered for sale first to public, municipal and rural electric customers (all not-for-profit entities). Customers include rural electric associations, federal facilities, state agencies, universities and 57 Native American entities.

The economic, financial and power generation-related values of Glen Canyon Dam generation are maximized when the USBR and WAPA are allowed to operate the facility with no flow restrictions to meet load requirements of wholesale power customers.

When a flow restriction such as MLFF is imposed, then other generation (generally non-renewable) is used to meet these needs. When this occurs, the economic, financial and generation-related environmental values of Glen Canyon Dam generation are reduced.

Generation-related environmental attributes that are impacted when hydropower generation is restricted include greatly increased power plant emissions (such as CO_2, SO_2 and NO_X) and increased power plant water consumption for cooling.

DFC OBJECTIVES:

*Ensure continued delivery of Glen Canyon hydropower to the existing customers who have entered into long-term firm power contracts with the Western Area Power Administration.

*Ensure sufficient and efficient production of Glen Canyon hydropower in order to provide the revenues to support the CRSP facilities and purposes.

* Maximize the amount of electric generation capacity and energy produced at Glen Canyon Dam, while seeking to achieve a balance with CRE resource objectives.

*Maximize the operational flexibility with which the USBR and WAPA can operate Glen Canyon Dam, consistent with AMP goals and objectives.

*Maintain the operational flexibility (including but not limited to load following capability, ramp rates and emergency operations allowances) that enable the USBR and WAPA to meet the system operating and other regulatory requirements of WECC, NERC and FERC, as well as emergency operating criteria for safety and human health situations.

COMPLIANCE:

Reclamation Project Act of August 4, 1939
NERC/WECC Standards: BAL-001-0.1a; BAL-002-0; BAL-005-0.1b; BAL-STD-002-0

LINKAGES:

*Operational changes, including experimentation and management actions, which include changes to volumes, release limitations (minimum and maximum), ramp rates, hourly, daily, monthly and seasonal variability, all potentially impact this resource.

*The above-identified parameters could have impacts to the CRE resources as well as recreational and cultural resources, depending on the specific operational design.

METRICS:

* Identify the average annual economic, financial and generation-related environmental values of Glen Canyon Dam generation under its original operating condition (before interim operating criteria and MLFF were imposed).

* Identify the average annual economic, financial and generation-related environmental values of Glen Canyon Dam generation under MLFF and other potential future flow regimes.

*Calculate the impacts of MLFF and other potential future flow regimes from the foregoing.

*Valuation Metrics (measurement characterization is for an average annual year):

Electric Generating Capacity (MW)
Electric Generating Energy (MWH)
Load Following Capability (units?)
Ramp Rate Capability (units?)
CO_2, SO_2 and NO_X Emissions (tons)
Power Plant Water Consumption (acre feet)
Costs ($ Millions)

RELATIONSHIP TO DAM OPERATIONS: Direct – hourly, daily patterns; monthly volumes

REASONS THIS DFC IS IMPORTANT:

* An authorized purpose of Glen Canyon Dam
* A major component of the Salt Lake City Area Integrated Projects (SLCA/IP) resource that is under long-term contract to not-for-profit entities and 57 tribal entities
* Power revenues are a significant funding source (est. $20 million/year) for the GCDAMP, Upper Colorado River and San Juan River Endangered Fish Recovery Programs, and the Colorado River Salinity Control Program
* Fluctuations can be used to disadvantage non-native fishes
* Renewable resource is an important component in the WECC and a national objective (to help meet the Nation's needs for reliable, affordable, and environmentally sustainable hydropower)[3]
* Glen Canyon generation has the ability to "ramp up" to meet system reliability obligations that are important when regional power shortages or power/transmission system disruptions occur. The generation resource can be "ramped up" to avoid massive blackouts (such as occurred in California in 2000).

[3] See footnote 1 above.