

**A REPORT OF THE SCIENCE ADVISORS ON A  
GENERAL REVIEW OF GCD AMP  
SCIENCE AND MANAGEMENT  
PLANNING DOCUMENTS**

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**INTRODUCTION**

The Grand Canyon Dam Adaptive Management Program Science Advisors (GCD AMP SAs) operate on a 12 month review cycle, with a 24 month set of reviews approved annually by the Adaptive Management Work Group (AMWG). At the AMWG summer meeting the Advisors report on the past year of reviews to AMWG, and propose a 24 Month Review Plan for approval.

In fiscal year 2004, five review activities were planned as follows:

1. GCMRC Strategic Plan
2. GCMRC Core Monitoring Plan
3. GCMRC/AMWG Long-Term Experimental Plan
4. Humpback Chub Plan
5. Glen Canyon Dam Adaptive Management Program Review

Reviews 1-4 were originally planned to be accomplished in one iteration in the order listed. Review 5 was to be planned in 2004 and conducted in 2005/2006.

Research and management planning schedules were revised by GCMRC and AMWG in Fy 2004, and resulted in a new review being added, "The Aquatic Food Base Program Review." It also resulted in reviews 1-4 being phased, so that the Science Advisors would do a general review of each first, and an in-depth review 3-5 months later. This approach permits some guidance from the SAs in actual plan development, although only of a general nature.

The Science Advisors were provided the review documents on 1-4 above on June 9, 2004. They were asked to provide comments to GCMRC and AMWG by June 23, 2004.

The GCD AMP review planning remained as proposed. However, due to information needs of AMWG, TWG and GCMRC, the review is now scheduled for 10 months instead of 24 months.

**SCIENCE ADVISOR REVIEW CHARGE**

Although no specific charge was issued by AMWG, TWG or GCMRC for the four review tasks, discussions with AMWG, GCMRC and TWG officials requesting the reviews permitted development of a review goal. The goal of the review is contained in a Science Advisor planning document (Appendix A), and provides guidance for the reviews. Reviewers are asked to determine how the planning documents address general questions as follows:

1. Are the plans complete, or are major parts missing?
2. Do the plans have an appropriate science basis?

3. Is the adaptive management process included appropriately in the process?
4. Have integration needs been addressed appropriately?
5. Are the use of research and monitoring processes in proper balance?  
Sequence?
6. Are proposed management actions/projects appropriate, given knowledge/need?

### **REVIEW PROCEDURE**

As noted above, the charge of the review is to develop assessments of the documents as relates to specific questions. The questions are structured to solicit only general assessments. However, the breadth of the questions does permit a comprehensive review of the planning documents, although with limited depth.

The review effort is designed to assist in development of the documents as well as guide revision. The procedure is selected for three reasons:

1. This type of review does permit the SAs to provide general guidance on preparation of the documents, especially as regards content and integration.
2. The development schedule for planning documents only permitted production of draft plans at this time, which lack TWG and AMWG input.
3. The GCMRC/AMWG request proposed a two level review. The second review in the fall of 2004, is proposed as the in-depth review.

Responding to the revised review request, the SAs developed a more efficient general review approach as follows.

1. Four SA teams were developed, and each was assigned a specific plan.
2. Two outside blind reviews were developed on the Humpback Chub Plan to provide added expertise on specific issues.
3. All SAs were involved in each review i.e., received all planning documents, drafts of SA report, etc.
4. Only Team Leaders and the Executive Secretary were brought together for a review workshop.
5. An explicit decision was made to capture only key issues in observations and recommendations on each plan. As such each review was held to 2-4 pages.

## **REVIEWS OF SCIENCE/MANAGEMENT PLANNING DOCUMENTS**

The four documents must eventually be linked to provide maximum support to the overall GCD AMP effort. To encourage more attention to integration of planning, science and management, we include all reviews in this section of our report.

We have elected to develop a set of observations on each planning document, followed by recommendations. We deliberately decided to focus only on key general questions in the assessments, and not engage in in-depth critique.

### **THE GCMRC STRATEGIC PLAN**

The May 2004 draft of the GCMRC Strategic Plan includes a clear statement of a vision and mission for the Center. The Plan states that the mission of the GCMRC is to provide information to the AMP on effects of Glen Canyon Dam on the downstream resources. An ecosystem-based approach is clearly stated.

The draft plan includes an evaluation of strengths and weaknesses, which are reflective. They address primarily issues of internal administration, such as workloads, staffing, contracting, permitting, morale, productivity, outreach, disciplinary integration, work environment, among others. Goals and strategies in this draft are developed in order to address these administrative issues.

The Advisors agree that this a useful document for science program management, and that the goals as stated will be helpful in addressing and improving internal management issues of the Center. However, it does not fulfill the requirements of a “Strategic Science Plan.”

### **OBSERVATIONS**

1. This is a good plan for administrative strategy and will likely have a positive effect on staff and productivity. It should be used as a strategy for managing the Center. However, as the authors note, it is not a science plan.
2. The goals are too specific to managing science, and don't address a broader suite of science programmatic issues.
3. The plan does not mention strategies for science, adaptive management, monitoring, or integration.
4. There is no executive summary or other synoptic section.

### **GENERAL RECOMMENDATIONS**

The Advisors suggest that a strategic science plan (SSP) should be a succinct document that links broad statements of programmatic science visions and mission to more specific management goals and objectives. The plan should include a linkage between the GCMRC Strategic Science Plan as a performance document, and the Adaptive Management Program goals and objectives, since GCMRC is the applied science entity for the AMP. In order to achieve this, the plan should be revisited and renewed every few years and include at least two sections.

The first section should actually capture the general AMP goals that GCMRC must fulfill from its science efforts. These should be presented succinctly, but they do need to have sufficient specificity to describe follow-up “strategies for organization structure, specifying science and monitoring strategies, resource needs and general accomplishment schedules”

The Center is encouraged to consider alternative ways of expressing these management needs, possibly as an organized collection of questions that reflects critically needed linkages and integration. Developing questions in support of the AMP goals may require one or more workshops with the AMWG/TWG groups and even researchers. These definitions of needs are the basis for the science and information goals of the Center. It is paramount that they are: a) clearly understood by both-AMWG/TWG and GCMRC, b) agreed to as the areas of performance for the Center, and c) obtainable by the Center given assigned authorities and resources.

The second proposed section of the SSP is really the most critical. This section should outline a general strategy as to how mission and goals will be attained. At least two sections need to be included: one which addresses a science strategy; and another that addresses the management strategy.

The science program strategy will require creative scientific thought. At a minimum it must address goals that require the Center to provide: a) on-demand analysis and technical information; b) new science information from research studies; and c) information from monitored resources. The three areas may have different inputs, and different types of outputs.

The last part of this section needs to address the management strategy for accomplishing the “science program strategy”. Some of the information on “administrative management” from proposed plan could be brought into this section, i.e., internal and external contracting, export of Lake Powell program, use of SAB to maintain excellence, use of adaptive management process to constantly correct direction, increased use of remote sensing technology, etc.

## **SPECIFIC RECOMMENDATIONS**

1. Keep the current version as an administrative management plan, and use it as an internal guide
2. The Vision, Mission statements should be used in Strategic Plan.
3. We suggest restructuring around the following themes:
  - a. Goals
  - b. Research/Science Strategy to meet goals
  - c. Monitoring Strategy to meet goals
  - d. Information Management strategy
  - e. Integration Strategy
  - f. Adaptive Management Strategy
4. We suggest adding an Executive Summary with a concise presentation of management goals and science strategies.

We conclude with suggestions for an outline of a revised draft.

1. Executive Summary
2. Introduction – *current version with minor revision*
3. Vision – *current version.*
4. Mission Statement – *current version*
5. Goals (examples)
  - a. Provide Research Information On Priority Resource Issues Of Fish, Hydrology And Sediment
  - b. Provide Information from Monitoring Of Resource Issues Around Vegetation, Listed Taxa (KAS And SWFC), Cultural Resources
  - c. Improve Administrative Functioning Of GCMRC To Facilitate Information Gathering, Management And Transfer (*Current Document*).
6. Research/Science Strategy to meet goals (examples)
  - a. Develop Long Term Experimental Plan
    - i. Integration of Core Elements: Predator Control, TCD, HBC, BHBF, Flow regimes,
  - b. Develop Food Base Studies
  - c. Conduct Humpback Chub Studies
  - d. Conduct Sediment/Hydrology Studies
  - e. Develop Ecosystem Studies
    - i. Model /Data Iteration
    - ii. Comparative Areas – Cataract Canyon
    - iii. The LCR ecosystem: what are potential upstream alterations that could change its status as HBC reproductive site?
7. Monitoring Strategy to meet goals
  - a. Develop Monitoring Plan
    - i. Monitoring effort based on prioritized management and research needs
    - ii. Summarize backlogs of information/data
    - iii. Produce SCORE reports
8. Information Management strategy
  - a. Implement Information Management Plan
  - b. Develop and implement Outreach Plan
    - i. Summarize and serve backlogs of information/data
9. Integration Strategy
  - a. Adaptive Management Strategy (for all key resource issues)
    - i. Articulate Alternative Hypotheses
    - ii. Develop tests actions (passive or active) to sort among explanations
    - iii. Collect information/data to assess hypotheses
    - iv. Synthesize information data-iterate between models and data
    - v. Produce and communicate learning
  - b. Other Analytic Approaches
    - i. MATA

ii. Scenario exercises

### **THE GCMRC CORE MONITORING REVIEW**

In a diverse and extensive set of experiences with monitoring programs elsewhere, there is one common result: the growth of monitoring costs eventually marginalizes resources available to research efforts. This outcome is antithetical to the adaptive management process and, ultimately to the status of and resources in support of GCMRC. We also see this as an undesirable outcome for the GCMRC staff, because both intellectual and professional rewards to scientists are reduced through time, and because it minimizes the flexibility required to respond to new challenges.

We strongly recommend a priority-setting approach that identifies key monitoring needs based on: a) relevance to management issues of today; and b) those most likely to arise in the future (e.g., continuing drought, intensified HBC “crisis”). We encourage effort directed toward highest priority for those questions, processes and variables that are most likely to change and those that are appropriate for active, experimental approaches. We cannot make those choices, but we can advise you that if you do not start this now, the consequences will be unfortunate and undesirable. Our perception is that minor modification of the current program based on the decade-old Information Needs is insufficient if not dangerous to the future of the adaptive management process. We believe this is an important time to review and “re-invent” the program.

In response to the Core Monitoring Plan document, we offer the following:

#### **OBSERVATIONS**

1. Very informative document but, unfortunately, seems targeted on maintaining the status quo.
2. What key questions drive the monitoring effort? These are not apparent, but need to guide allocation of future effort to monitoring and research.
3. Related to this, monitoring must be considered in light of the entire strategic scientific adaptive management effort, so that monitoring, research, integration, information output, and adaptive management all work toward understanding and managing Grand Canyon resources.
4. Increasing emphasis is placed on remote sensing, which could be appropriate if collected at appropriate spatial and temporal scales.
5. Fish and sediment monitoring programs appear in good shape.
6. Some confusion exists regarding “core” elements of the Core Monitoring Plan. According to Strategic Plan, Lake Powell, water quality, and socioeconomics programs are to be dropped from GCMRC monitoring efforts, yet monitoring descriptions are still included in the “core” monitoring plan. The future of food base monitoring/studies is not apparent. How important to the overall program is the vegetation monitoring effort?

7. Not enough attention is given to relative importance of issues and effort that need to be taken in order to gain the information necessary to address priority management needs.

## RECOMMENDATIONS

As a general theme, you need to identify key management questions and the vital roles for GCMRC in resolving those questions. GCMRC now has a decade of experience based on attempting to look at a broad cross section of specific Information Needs by all stakeholders, which are most important or “core” to the program. What should be done to re-align the program for the next decade? What projects should be reduced or discontinued to make room for new initiatives? Focus on those critical issues where management actions can actually change the status of key resources and provide the experimental/monitoring results needed to inform management actions. Imagine the things that are most likely to change. How can research and monitoring be used to answer those questions? How can active adaptive management efforts (i.e., experimental manipulations) be designed to resolve those? More specific recommendations are:

1. Develop the monitoring program in conjunction with an overall re-assessment of research needs. Research, monitoring, modeling, and spatial comparisons are valuable and necessary components that support each other in understanding/integrating understanding of CRE. Build these into an integrated program so that they support information transfer, and adaptive management.
2. Based on an update and re-statement of the most important management needs, develop the process for integrating research and monitoring with ongoing work of other agencies. Take advantage of and build on other agency efforts. See the example suggested in 6, below.
3. Develop evidence of trends based on evidence currently in hand. Consider discontinuing some current monitoring efforts, focus on the new questions, and create frequency of monitoring effort based on scale required for answers to those.
4. Develop new food base project based on linkage to fishes.
5. Cultural resources could benefit from guidance in selecting priorities. A workshop based on advice from outsiders is essential.
6. Ensure that the geographic scope and monitoring breadth are broad enough to capture other disturbances than dam operations that may influence fishes (e.g. changes in groundwater in LCR). An inter-disciplinary, collaborative venture that goes to Cataract Canyon may be a way to evaluate the pre-dam conditions in GCE. Consider ways to encourage university-based collaborators in this venture because they can seek extra-mural resources.
7. Once priorities are set and a plan for monitoring is in place, some of the level of detail contained in the current core monitoring document will be useful. When the time comes where it is appropriate to look at the level of detail provided, we note that few programs integrated their monitoring efforts through from why, what, how, when, to how the data will actually be stored, summarized, and disseminated. This connected progression of effort is how effective monitoring



programs contribute to understanding and management of ecosystems. A separate section on data management only reinforces that GCMRC needs to think differently than it has in the past, and in a more integrated way.

## **LONG-TERM EXPERIMENTAL PLAN**

### **EXPERIMENTAL DESIGN HISTORY**

In 2002, GCMRC proposed using an experimental approach to better understand the factors that affect the recruitment of humpback chub and influence the distribution of fine sediment. With this understanding, the Grand Canyon ecosystem could be better managed. A 16-year block design was proposed to decipher the effects of fluctuating flows, mechanical removal of fish, variable flow regimes, and variable effects of water temperature. The Science Advisors reviewed this earlier proposal and concluded that the experimental design was perhaps unduly complicated and would benefit from some level of simplification. GCMRC simplified the experimental design and has asked for a general review of the proposal.

### **PROPOSED LONG-TERM EXPERIMENTAL DESIGN**

In an attempt to achieve greater simplicity in the design, the GCMRC proposes decoupling the fisheries portion of the integrated experiment from the sediment experiment, while maintaining key elements of the original 16-year blocked design. Only 2-fixed treatment effects (streamflow treatments and mechanical removal of trout) are included, while trying to consider the effects of water temperature as random. Beach habitat building flow would be considered independently on an event-driven basis. The scheduled arrangement of the individual treatments is to allow for an analytical evaluation of the effects of each factor independently and in combination with one another on humpback chub recruitment and sediment response. For this design to be effective, treatment factors (including the stated random factors such as water temperature) must be applied consistently among and within scheduled blocks. This is important because the effect of each treatment on the response of the experimental unit must be approximately the same from block to block. As stated by GCMRC, a departure from this consistency in the implementation of the approach invariably makes it more difficult to detect differences or to be able to separate out treatment effects among other alternate treatments.

### **OBSERVATIONS/COMMENTS**

Through rigorous studies on sediment dynamics in the Grand Canyon, the GCMRC and its cooperators are able to develop models to describe the transport of sand down the canyon. The studies not only provide information to better understand the dynamics in fine sediment but also provide information to possibly refine the existing sediment models and provide information to help manage flows, sediment, and beaches in the Grand Canyon.

We feel that decoupling the effects of sediment studies from the humpback chub

studies is valid and may enable both efforts to be examined more quickly and easier. We do feel that the effects of the sediment studies on river recreation, archeology, and vegetation should also be examined and included in the proposal.

We do, however, feel that there are several weaknesses in the overall design of the Long Term Experimental Program for examining the effects of streamflow, mechanical removal of non-native fish, and water temperature:

1. Water temperature is a very important uncontrollable factor/covariate that cannot be totally manipulated or randomized and must be considered just like the other two experimental factors. Just by stating that it will not be controlled does not make it a random variable. With a two-year base period of design, it is very difficult for a variable like dam release temperatures to be randomized. If humpback chubs do have a strong year class in WY05 and WY06, can one conclude that it was caused by stable flow and not trout removal? Was it actually caused by warmer water being released in those years or was it caused by finally removing a critical amount of trout?

Any long-term design must specifically consider water temperatures, even if it requires adapting the design every few years. Because a TCD is not available at the present time, GCMRC will have to take an opportunistic approach to trying to examine the effects of water temperature in combination with the other independent factors.

2. The effects of mechanical removal of fish cannot be toggled off and on with a two-year base design and a four-year block design on trout removal. Mechanical removal of fish has an accumulative effect with smallest effect in the first year and largest effect in the fourth year. In other words, the population of trout in the first year of removal could be much higher than in the first year of when trout are not removed. Therefore the overall design (with flow treatments) will not be valid. As stated by GCMRC, a departure from similar effects during each block, makes it more difficult to detect differences or to be able to separate out treatment effects among other alternate treatments. In addition, the timing of extensive non-native fish removal should be conducted just prior to when small humpback chubs encounter predator fish.

3. Interannual differences in fish year class strength may not be independent. The likelihood of a strong year class of many fish is often dependent on its own population. A species may only produce a strong year class once every several years. Therefore, although conditions may be right for a strong year class, its own population may reduce the possibility of such an occurrence. Therefore, conditions that may be adequate for producing a strong year class may be overlooked if they follow conditions that were also adequate for producing a strong year class. Because humpback chub are a relatively rare species, this may not be extremely important.

4. Other factors affecting the recruitment of humpback chub should be considered or at least not overlooked. As it is stated in the proposal, for this design to be effective, treatment factors must be applied consistently among and within scheduled blocks. This is also true for other factors not considered in the experimental design but which may affect the recruitment of humpback chub. For example if portable dams are installed on the LCR in some years and not in others, assigning the effects of the

specified combination of factors may not be valid. Other factors affecting the recruitment of humpback chub should not be altered during testing of the block design.

### **RECOMMENDATIONS/ALTERNATIVE STUDY DESIGNS:**

1. GCMRC should consider trying to do everything possible to promote the recruitment of humpback chub, especially while water levels in Lake Powell are low. Over the past few years, humpback chub populations appear to have significantly decreased as trout populations have dramatically increased and water temperatures have remained cool. Because chubs are at high risk of local extinction, concern exists that insufficient time exists to conduct a block-design experimental approach or to determine exactly what is causing the decrease in humpback chub populations. One alternative to the proposed design would be to do everything possible to promote the recruitment of humpback chub, at least until the block design can be truly implemented. This recommendation is consistent with that suggested by the LTEP Ad Hoc group

In response to the design in table 2 and the critically low populations of the humpback chub, a Long-term Experimental Plan Ad Hoc group was assembled and proposed a Combined Management Action (CMA). In the CMA all of the treatments that scientists generally agree, based on evidence available, will promote the recruitment of humpback chub would be implemented as soon as possible (“kitchen-sink approach”). The CMA experiment should last at least six to ten years. After approximately six years, and hopefully a larger humpback chub population, a modified blocked-design study could be implemented. A risk assessment is important to evaluate the alternative designs, since significant risk and high penalty is currently associated with the HBC issue.

2. A longer term length of the basic block design or buffer years should be considered. Because of the inability to turn on and off the effects of non-native fish removal and the other factors affecting the recruitment of humpback chub, a basic block duration of 3 or 4 years or buffer years between blocks in the design should be considered. This would, however, increase the overall length of the study. One way to minimize the increase in the length of the study (minimize the number of buffer years) is to try to have blocks with low populations of non-native fish following one another and blocks with high populations of non-native fish following one another.

3. Opportunistic approach. Because water temperature may not be completely controllable, even with a TCD, the experiment should adapt every few years to try to obtain all of the possible combinations in the matrix in table 2. Some combinations of factors may not be attainable in certain years. Therefore, to obtain all of the combinations in table 2, an opportunistic approach should be considered. This type of approach would take advantage of environmental conditions when they are available. This would, however, possibly extend the length of the study to obtain all of the combinations in the overall study design.

4. Modeling approach. Because of the inability to control the hydrological conditions of the Colorado River and the complicating effects of other variables, it is difficult to conduct the block design proposed in tables 1 and 2 with sequential treatments of one management action

at a time. Another approach to consider is the use a modeling approach similar to that used to understand the factors affecting the distribution of fine sediment. The Walters/Korman ecological model has been developed for the Grand Canyon ecosystem. At present, this model is not refined as much as the sediment model. By incorporating the results of the variable flows, fish populations, and water temperatures, not only can the ecological model be refined but also the effects of the various factors can be better understood.

5. Statistical expertise. We feel the proposed experimental design was developed without sufficient input of ecological statisticians. We strongly encourage GCMRC to bring this ecological experience into the research group to help develop the experimental design and understand the capabilities of such a study. The BRD or universities have experienced statisticians at other locations that could spend a limited time each per year helping design and evaluate the LTEP.

One way to incorporate all of the recommendations is to:

1. For the next few years (until a TCD is install and the water level of Lake Powell has returned to a more normal level) use a Combined Management Action (kitchen-sink approach) with appropriate risk analysis and input from statisticians.
2. When water levels return back to more normal levels and a TCD is in operation, start the experimental block design to determine the factors affecting the recruitment of humpback chub. However, the application of the design should be opportunistic to determine which blocks will be examined and take advantage of the changes in hydrology of the Colorado River.
3. When applying the block design, use a longer period for each block and /or include buffer years between changes in non-native fish populations, so that each combination of factors is more independent and represents the combinations that they were intended to represent.
4. In combination with the statistical approach, use the results of the CMA and the block design studies to help advance further development of the Walter/Korman ecological model for the Grand Canyon, and possibly use the model to decipher the interacting effects of the various factors.

# THE HUMPBACK CHUB COMPREHENSIVE PLAN

## INTRODUCTION

This review represents the consensus of members of the GCDAMP Science Advisors. Two external reviewers provided input. Their views are combined with those of the Science Advisors and organized as a set of Observations in response to the document and a set of Recommendations with regard to revisions. Quotes from reviewers are inserted where appropriate to the specific concerns.

## OBSERVATIONS

1. The document provides an appropriate review of goals set in the context of the Adaptive Management Program.

2. As currently presented, the document offers a loose aggregation of management and research ideas rather than development of background for prioritization of key research needs and their management applications, relative to the importance to the goals and estimates of practicality. One quote from the reviews summarizes this point:

“I would have preferred and I recommend that the authors list items in order of importance and perhaps in a second ordered list in terms of their difficulty of implementation.”

3. External reviewers challenge some of the assertions and assumptions of cause and effect. While members of the SA are familiar with current and previous work, “outsiders” found the documentation of background insufficient. Quotes from reviewers capture that view:

*“I must reiterate that which I found most troubling in this plan was the lack of extensive literature citation and documentation of the facts as presented. Do we really know this little or should the plan be re-written to include all of the published and gray literature that we have?”*

*“What has come out of the manipulations of flow that have occurred over the years? Does turbidity increase recruitment; does increased flow enhance success of the HBC?”*

*“I wondered how valuable disease/parasite work within the lab might be. Does it tell you anything about the impact of these mortality factors in the field?”*

*“These are all important elements to include, but the multiple ways the issues are presented doesn’t provide a cohesive picture. The list of projects looks retrospective – i.e., this lists everything that is underway or proposed, but not necessarily everything that is needed. Are there gaps? The document indicates*

*that the recommended projects are those that the Ad Hoc Committee believes are necessary to achieve recovery of HBC in the Lower Basin (p. 10). Is this collection of projects also sufficient? I would like to see the plan indicate not only what is being done, but also whether or not all the key issues are being adequately addressed”.*

4. In general, the plan lacks sufficient evidence of inter-agency coordination and budget planning reflecting that coordination.

*“Critical features of the restoration plan must include the description of an organizational structure that will energize cooperation and joint projects (one may need incentives for this sort of interaction).”*

*“The summary of programs contributing to HBC conservation (section 2.3) suggests there are a lot of “cooks in the kitchen.” I’m sure much of that derives from political and jurisdictional realities, but from the information given I can’t tell if the combined effort results in any wasteful redundancies in efforts or gaps in coverage. Hopefully the final version of this document will help address such issues.”*

## **RECOMMENDATIONS**

In response to the reviews and discussion of the issues raised therein, we offer a series of suggestions for revision and improvement of the document.

1. Develop a more extensive and complete documentation of background literature and resultant rationale for the proposed projects. Include therein some background on minimum viable populations and distinction of primary and secondary impacts on the chub population (i.e., a prioritization of causes for decline and their remedies). This is important as this document proceeds to readers not directly involved in agency-sponsored work on the HBC issues. The matrix presented as Table 1 herein offers some guidance in defining the relationship between Threats and Projects. In addition, consider the suggestion below:

*“It would be most helpful if future drafts of this and other related documents were accompanied by an acronym glossary that readers could use to keep things straight. For programs, organizations, committees, etc. it would also be helpful if the list briefly indicated which agencies they are associated with and how they are related to each other. Likewise, it would be very helpful if a map of the system was included denoting all the landmarks referred to in the document. These documents need to be more transparent to folks not totally immersed in the subject (applies to decision-makers as well as reviewers and the public)”.*

3. Pursue an “art of the possible” approach to developing priorities. In other words, organize projects by priority based on consideration of strength of rationale, budget constraints, current status, and practical estimates of likely benefit. Arrange them around the three principal strategies for improving conditions for the humpback chub, i.e.: 1.) Expanding the range of rearing and spawning in Grand Canyon for HBC, 2.) Increasing survival and recruitment for HBC; and 3.) Reducing the threat of catastrophic events. Identify each project as ongoing, initiated or intended; the agency(ies) involved and sources of budget/personnel resources. Comments from reviewers represent those of many:

*“I think it is a good idea to have an integrated research-management plan beyond what is specified in the recovery goals in order to coordinate and synthesize the diverse efforts directed toward HBC recovery. It also makes good sense to organize the plan around a prioritized list of the key threats to HBC, or at least use such a list as a touchstone to make sure all the right issues are being addressed”.*

3. As a guide to considerations of “strength of rationale” and priority setting, consider developing a formal decision analysis workshop and/or modeling workshop that can create a ranking of research needs and management prospects in an ecosystem context. In general, reviewers encourage projects that focus on historical habitat and mimic those at a scale similar to that of the pre-dam conditions. Examples are the proposal for inflatable dams to create ponding in the LCR and the prospect that current water levels in Lake Powell are producing a preview of river warming such as that intended through use of the TCD.

*“Essentially all the main issues are identified as immediate priorities. That isn’t too surprising given that we’re talking about an endangered species, but on the other hand it isn’t very useful in making decisions regarding allocation of effort and resources. It might be useful to sort these reflecting how immediate the concern is, and our likelihood of being able to do something about it in the near term”.*

4. Distinguish between HBC recovery planning by USFWS and research planning recommendations for GCMRC. Although linked in many ways, the priority-setting process differs for these two agencies. In fact, the document should present a strategy and its title would be more appropriate if stated as: “Research and Management Strategy for Humpback Chub in Grand Canyon “.

5. Develop a more explicit strategy for inter-agency cooperation, coordination and allocation of budget resources.

6. As a means toward coordination and information exchange, develop a more explicit plan for increased outreach efforts and regular (annual? biennial?) workshops on HBC project progress and plans. All reviewers encourage a more timely and effective communication of accomplishments and plans.

Table

- Matrix indicating association between projects in Appendix B and threats to HBC identified in Section 3.0. X indicated direct association, ? Indicates tangential association. Blue rows indicate projects that are as yet unfunded. Yellow columns indicate threats of immediate concern.

Project	Threat												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1													
2													
3													
4													
5													
6													
7	X	X	X					X	X				
8			X					X	X				
9	?							X	X				
10	X	X											
11							X	X	X				
12								X	X				
13						X							
14	?						X						
15													
16											?	X	
17													
18											?	X	X
19						X	X	X	X				
20							X	X					
21				X	X								
22													



**APPENDIX A  
REVIEW CHARGE**

TO: GCD AMP Science Advisors  
FROM: M3 Research; LD & PJ Garrett  
DATE: June 9, 2004  
SUBJECT: Science Review Meeting, Ft. Collins, CO  
June 17-18, 2004

I have the four documents in hand that we will review for the GCD AMP. All are in draft form, some more complete than others. The four documents are attached:

1. The Long Term Experimental Plan (LTEP)
2. The GCMRC Core Monitoring Plan (CMP)
3. The GCMRC Strategic Plan (SP)
4. The AMWG Ad Hoc Committee HBC Comprehensive Plan (HBC Plan)

I forwarded the LTEP last week, and Dale and the team leader are already working on that review.

Remember, we have agreed to only do a general review of these draft documents now, with in depth reviews in August-October when they are complete. For these reviews lets look at a general questions such as the following. We will agree to specific questions in our meeting.

1. Are the plans complete, or are major parts missing?
2. Do the plans have an appropriate science basis?
3. Is the adaptive management process included appropriately in the process?
4. Have integration needs been addressed appropriately?
5. Are the use of research and monitoring processes in proper balance? Sequence?
6. Are proposed management actions/projects appropriate, given knowledge/need?

Again, our selected review teams and team leaders are as follows. Reviewers should arrive at the meeting with your concerns and recommendations written down.

Strategic Plan Lance (Team Leader), Dave, Doug, Joe  
Long Term Experimental Plan: Dale (Team Leader) Virginia, Dave  
Core Monitoring Plan: Jill (Team Leader) Alan, Virginia, Margaret  
Humpback Chub Comprehensive Plan: Jim (Team Leader) Dale,  
Margaret, Dave

You will recall that we have contracted for external reviewers on the HBC from Dr. Stein and Dr. Rice. These reviews may be available at the meeting.

And, finally, our brief revised agenda is as follows:

### **JUNE 17**

8:00 AM Revise review as appropriate and decide of writing assignments; Dave  
8:30 AM Review of Strategic Plan; Lance

11:00 AM Agreement on review observation and  
recommendations on Strategic Plan; Dave  
11:30 AM Review of LTEP; Dale  
12:30 PM Working lunch- continue LTEP; Dale  
2:30 PM Agreement on observations and recommendations  
on LTEP; Dave  
3:00 PM Review of Core Monitoring Plan; Jill  
5:00 PM Adjourn

### **JUNE 18**

8:00 AM Continue review of CMP; Jill  
10:00 AM Agreement on observations and recommendations  
on CMP; Dave  
10:30 AM Review of Humpback Chub Comprehensive Plan;  
Jim  
12:00 Noon Working lunch  
2:00 PM Agreement on observation and recommendation on  
HBC Plan; Dave  
2:30 PM Agreement on final review schedules and  
approaches on HBC Plan, LTEP, CMP and SP.  
Agreement on schedule and approaches on GCD  
AMP review  
4:00 PM Adjourn

### **JUNE 21**

All SA final review comments to Dale, Jill, Jim, Lance and  
Dave

### **JUNE 23**

Garrett drafts letters of transmittal and provide SA reviews to  
AMWG/TWG/Gabalton, with new proposed final review schedules