Budget Ad Hoc Group
Report to Technical Work Group
June 26, 2007

The Budget Ad Hoc Group has met by conference call five times to discuss the FY 08 budget and workplan. The draft budget is largely a continuation of projects initiated in FY 07. Several new projects have been developed, however, and they are provided for TWG consideration. Only one of the projects received consensus by BAHG members, and there were only 5 BAHG members present at the final conference call. Without a majority of BAHG members present for this deliberation, and thus failing the quorum required of TWG meetings (BAHG being an ad hoc of the TWG), these projects are provided without a clear recommendation from the BAHG.

Project 1: Sponsor—Mike Berry, Reclamation

PROJECT TITLE AND ID: D.4. Glen and Grand Canyon Treatment Plan Implementation

General Project Description: In consultation with Grand Canyon NPS, the Arizona SHPO and the remainder of the PA signatories, Reclamation completed a scope-of-work for the development of a treatment plan for the cultural resources of Grand Canyon. This work was completed in 2007 under a Cooperative Ecosystem Studies Unit agreement with Utah State University. An analogous set of treatment plan recommendations was completed in FY06 (based on FY04 and FY05 funding) by the Navajo Nation Archaeological Department. Treatment of individual properties may include in situ preservation measures, nature and extent testing, full data recovery or additional documentation/recordation. The determination of appropriate treatment will be based on consultation with NPS, the Arizona SHPO, the Hualapai THPO, the Navajo THPO, the tribal PA signatories and other Southwestern tribal. This consultation will take place during FY07 with treatment plan implementation scheduled to begin in FY08 under an MOA among Reclamation, NPS, the Arizona SHPO, the Hualapai THPO, and the Navajo THPO.

Project Goals and Objectives:

- Implementation of the first year of the treatment plan under an MOA to achieve Reclamation's compliance with section 106 of the National Historic Preservation Act.
- Continued Government-to-Government consultation with tribal councils regarding the treatment plan.

Expected Results: It is estimated that data recovery or other mitigation measures will be accomplished at four to six sites in FY08 following the Secretary of the Interior Standards and Guidelines for Historic Preservation and guidance of the Advisory Council on Historic Preservation. Detailed and comprehensive reports will be prepared on consultant activities, results and recommendations.

Budget: FY08 = $500,000

FUNDING HISTORY					
	2004	**2005**	**2006**	**2007**	**2008**
Outside USBR Science/Labor	**99,000**	**250,000**	**250,000**	**70,000**	**500,000**
Logistics Field **Support**	--	--	--	--	--
Project Related **Travel/Training**	--	--	--	--	--
Operations/Supplies	--	--	--	--	--
USBR Salaries	--	--	--	--	--
Subtotal	**99,000**	**250,000**	**250,000**	**70,000**	**500,000**
DOI Customer Burden (29%)	--	--	--	--	--
Project Total	***99,000**	****250,000**	****250,000**	*****70,000**	******500,000**
% Total Outsourced	--	--	--	--	--

*Funds obligated to Navajo Nation Archaeological Department for Glen Canyon treatment plan preparation.
**Funds obligated to Utah State University for Grand Canyon treatment plan preparation.
***IA for NPS support of emergency mitigation project.
****If the NPS cost-share proposal (Project D.5) is accepted, the treatment plan cost will be reduced to $405,000 as a consequence of financial and in-kind NPS contributions.

Project 2: Sponsor—Mike Berry, Reclamation and Lisa Leap, NPS GRCA

PROJECT TITLE AND ID: D.5. Grand Canyon National Park Service Cost-Share Proposal

General Project Description: Grand Canyon National Park Service (GRCA) archaeologists have been an integral part of the GCDAMP compliance program from its inception. Their continued participation and support is critical to the success of compliance and research efforts. This proposal is intended to clarify and stabilize the role of the National Park Service within the context of the GCDAMP.

Project Goals and Objectives: GRCA archaeologists will 1) assist in and provided necessary continuity to Reclamation's multi-year treatment plan implementation, 2) assist GCMRC in the development of cultural monitoring protocols and 3) coordinate efforts 1) and 2) with the Colorado River Management Plan (CRMP).

Expected Results: The development of a meaningful and replicable protocol for the long-term monitoring requirements of the Grand Canyon Protection Act (GRPA). Active participation in excavation of endangered historic properties in conjunction with Reclamation's treatment plan.

Budget: FY08 = $142,000

FUNDING HISTORY					
	2004	**2005**	**2006**	**2007**	**2008**
Outside USBR Science/Labor	--	--	--	**137,500**	**142,000**
Logistics Field **Support**	--	--	--	--	--
Project Related **Travel/Training**	--	--	--	--	--
Operations/Supplies	--	--	--	--	--
USBR Salaries	--	--	--	--	--
Subtotal	--	--	--	**137,500**	**142,000**
DOI Customer Burden (29%)	--	--	--	--	--
Project Total	--	--	--	**137,500**	***142,000**
% Total Outsourced	--	--	--	**100%**	**100%**

* In exchange for this funding, GRCA will provide two river trips (one each for monitoring and treatment plan support), 1520 hours toward the Reclamation treatment plan, 1360 hours toward GCMRC monitoring protocol development/implementation, $86,000 in related monitoring activities, $5000 toward completion of the Historic Preservation Plan and $261,180 per annum (through 2011) for excavation of ten sites in Grand Canyon. This funding will include the $70,000 presently included under the GCMRC budget as Task 2. Implement Pilot Monitoring Protocols for Geomorphic Change Detection and Erosion Control Effectiveness Monitoring in Project CUL 11.R1.08.

Project 3: Sponsors—Mary Barger, WAPA and Ted Kennedy, GCMRC

PROJECT TITLE and ID: BIO 1.R4.08: Impacts of Various Flow Regimes on the Aquatic Food Base

GCDAMP Goal 1: Protect or improve the aquatic food base so that it will support viable populations of desired species at higher trophic levels.

Start Date
2008

End Date
2010

Principal Investigator(s)
Theodore Kennedy, Ph.D., Aquatic Biologist, Grand Canyon Monitoring and Research Center

Geographic Scope
Three sites (Glen Canyon ~river mile (RM) -15–0, Diamond Creek ~RM 225, and Little Colorado River confluence ~RM61).

Project Goals/Tasks
This project will be done in close association with research project BIO 1.R1.08, which will quantify, on a monthly basis, the density and production of basal resources (i.e., algae, terrestrial leaf litter, etc.) and

invertebrates, and will determine the amount of energy that is available to support production of fishes (e.g., monitoring). In addition, short-term experiments should be conducted to obtain a greater understanding of the responses of the aquatic food base to specific aspects of different flow regimes. The primary goal of such experiments would be to verify the range of flow magnitudes and flow fluctuations that could occur without significantly impacting the long-term sustainability of the aquatic food base. This would, in turn, help identify ways to accommodate power generation and water storage purposes at Glen Canyon Dam while protecting downstream aquatic resources.

Short-term experiments would be conducted over the course of several years in order to capitalize on the availability of specific hydrological conditions. During experiments, measurements would be made of algal and invertebrate standing crop, together with levels of invertebrate drift. To the extent possible, data collection methods should be consistent with the methods described in BIO 1.R1.08. Aspects of hydrographs that should be examined include fluctuation levels, ramp rates, and minimum flow levels. In addition, it may be desirable to evaluate effects of the proposed flow regime on fish (especially trout) activity levels, foraging success, and survival as related to fluctuation patterns and food conditions (e.g., concentrations and composition of the drift).

Benthic production is the source for food base items in the drift, so it is important to assess both how the source of drifting material and the quantity of drifting material is affected by dam operations. These measurements should be made in three locations, Glen Canyon, Diamond Creek, and the confluence with the Little Colorado River. The effects of dam operations on benthic production and drift are likely very different in the tailwater relative to downstream reaches. The food base program (BIO 1.R1.08) will continue to make monthly measurements of benthic production and drift at Glen Canyon and Diamond Creek which will provide an excellent set of baseline data that can be used to compare results from experimental dam operations. The Little Colorado River confluence should be included in addition to the sampling at Glen Canyon and Diamond Creek because of its relevance to the availability of food for humpback chub. Adding sampling at the Little Colorado River confluence will significantly increase the cost of this research because it will require three full sets of sampling equipment and a downstream river trip.

The objectives that are addressed by this project are:

- Quantify the abundance of the aquatic food base on substrates in response to changes in the flow regime
- Identify composition and quantity of drifting organic matter and invertebrates in response to changes in the flow regime
- Determine the effects of ramp rates on invertebrate productivity, standing crop, and drift
- Determine the effects on drift of short-term 5,000-cfs flow fluctuations during a fall steady flow experiment
- Determine effects of short-term flow reductions and subsequent (e.g., 2 hours later) increase in flow on drift rates

Need for Project

The food base in any aquatic system is an important factor that directly affects fish community dynamics including abundance, reproduction and recruitment, condition, and even distribution. Much of the diet of trout and humpback chub consists of food items that have been suspended and are drifting in the water column (Valdez and Ryel 1995). The drifting food base in the Colorado River ecosystem is generally composed of freely floating aquatic invertebrates and *Cladophora glomerata* (a long filamentous green algae) that are available to fish for consumption. Primary production at Lees Ferry is dominated by *Cladophora* which acts as a substrate for various types of epiphytic diatoms which provide a food source

for chironomids and simuliids (aquatic insect larvae) and for the shrimp-like amphipod, *Gammarus lacustris* (Pinney 1991). The nutritional value of *Cladophora* to fish is enhanced by the presence of lipid-rich epiphytic diatoms, and diatoms have been shown to provide an important source of energy for rainbow trout (Leibfried 1988). Studies indicate that the abundance of invertebrates used as food by trout and other fishes in the Colorado River ecosystem is generally proportional to the abundance of *Cladophora*.

In order to understand the current condition of the aquatic food base, measurements of epiphytic diatoms, aquatic invertebrates, and algal abundance in the Colorado River downstream of Glen Canyon Dam should be conducted. GCMRC's food base monitoring program (BIO 1.R1.08) would largely fill this need on a monthly basis. However, the response of these benthic and drifting resources to various flow management regimes remains uncertain. Thus, this research project should be conducted to identify the responses of the benthic and drifting food base to various aspects of the proposed flow regime. This adds an important component to the food base research program under BIO 1.R1.08 which may help to identify flow regimes likely to contribute to the recovery of humpback chub populations in Grand Canyon.

Strategic Science Questions

Primary SSQ addressed:

> **SSQ 1-5.** What are the important pathways, and the rate of flux among them, that link lower trophic levels with fish and how will they link to dam operations?

Additional SSQs addressed:

> **SSQ 3-5.** How is invertebrate flux affected by water quality (e.g., temperature, nutrient concentrations, turbity) and dam operations?
>
> **SSQ 1-6.** Are trends in the abundance of fish populations, or indicators from fish such as growth, condition, and body composition (e.g., lipids), correlated with patterns in invertebrate flux?

Links/Relationships to Other Projects

Under Research Project BIO 1.R1.08—Aquatic Food Base, four broad tasks would be performed: (1) quantify basal resources using a carbon budget framework, (2) determine important trophic pathways linking basal resources to fish, (3) estimate fish density and production, and (4) model bioenergetics and the trophic basis of production calculations. We will work closely with this project, relying on much of their infrastructure and capabilities, to estimate primary and secondary biomass, productivity, and drift. This project builds upon the aquatic food base program by carrying more intensive observations during various experimental flow regimes with the intent of distinguishing the effects of various flow changes compared to "base" conditions.

Information Needs Addressed

This project focuses on quantifying food availability (drift) in the Colorado River ecosystem in Glen and Grand Canyons due to experimental changes in flow from Glen Canyon Dam. The distribution of multiple sampling sites over multiple years will allow a number of research information and core monitoring information needs to be directly addressed, as enumerated below:

Primary information needs addressed:

RIN: 1.1. What are the fundamental trophic interactions in the aquatic ecosystem?

RIN: 2.1.2. Quantify sources of mortality for humpback chub < 51 mm in rearing habitats in the LCR and mainstem and how these sources of mortality are related to dam operations.

RIN 12.9.2. What is the best combination of dam operations and other management actions to achieve the vision, mission, goals, and objectives of the GCDAMP management objectives?

Other information needs addressed:

RIN 1.4. What is the current carbon budget for the Colorado River ecosystem?

CMIN 1.2.1. Determine and track the composition and biomass of benthic organisms between Glen Canyon Dam and the Paria River in conjunction with measurements of flow, nutrients, water temperature, and light regime.

CMIN 1.3.1. Determine and track the composition and biomass of primary producers below the Paria River.

General Methods

Quantify algae production

The food base project has been successful in verifying that algae/macrophyte production in the Colorado River can be measured using open-system measurements. This technique involves constructing an oxygen budget for a reach of river, where all inputs (algae production, air-water gas exchange) and outputs (respiration) of oxygen are accounted for.

- Primary production and ecosystem respiration will be quantified using whole stream metabolism calculations: Use diel changes in dissolved oxygen concentration, a byproduct of algal photosynthesis, to determine rates of algae production for mile long reaches of the river. Use nighttime sags in dissolved oxygen concentration to determine ecosystem respiration, a measure of basal resource (both leaf litter and algae) consumption. If quantity of carbon consumed during respiration exceeds quantity of carbon produced by algal photosynthesis, this indicates allochthonous inputs may be an important basal resource fueling the aquatic food web. Data collected monthly at Glen Canyon and Diamond Creek and four times per year along the river corridor.

Quantify benthic biomass/drift

- Standing stocks: the standing stock of algae and organic matter will be quantified using a Hess sampler and by scraping algae off rocks. These data will provide a measure of basal resource availability within each reach. Collections will occur monthly at Glen Canyon and Diamond Creek and four times per year at the confluence with the Little Colorado River.

- Invertebrate density, production, and growth measurements. Sample all benthic habitats (i.e., cobble bars, cliff faces, boulders, talus slopes, sandy bottom, etc.) to quantify density of invertebrates. Habitat specific density estimates will be made using shoreline and bed classification data from the Physical Science and Modeling Program. Growth measurements for

the most common invertebrates (e.g., New Zealand mudsnails, Gammarus, chironomids, simuliids) in controlled chambers. Production of invertebrates will be calculated using density estimates coupled with growth measurements. Invertebrate density will be estimated monthly at Glen Canyon and Diamond Creek and four times per year at downstream locations. Growth measurements will be taken four times per year at Glen Canyon and Diamond Creek.

- Transported organic matter and invertebrates: The amount of organic matter and invertebrates transported into and out of each reach will determine the extent to which downstream reaches are linked to upstream processes. Depth integrated water samples will be used to quantify transported organic matter and invertebrates.

Products/Reports

Publications
Tentative subjects for publications include:

- Response of primary production and secondary production of invertebrates in the Colorado River to various flow regimes from Glen Canyon Dam.

- Affect of various flow regimes from Glen Canyon Dam on the availability of drifting food base for humpback chub and trout.

Reports

A final report summarizing major results and recommendations will be submitted at the close of the project.

Monitoring Protocols

A report describing potential monitoring protocols will be submitted at the close of the project. Some potential monitoring tools that will be evaluated during the course of the project include:

- Measurement of primary production and ecosystem respiration using whole stream metabolism methods

- Organic and invertebrate drift measurements

Budget

We already have four sondes equipped with dissolved oxygen sensors, but would need to purchase two additional sondes in order for these measurements to be made simultaneously at Glen Canyon and Diamond Creek. The Clark-type dissolved oxygen sensors that we currently using for making these measurements can be calibrated with a good degree of precision and accuracy, but the calibration of those sensors is only reliable for 5-7 days because the sensors tend to ‘drift’. Optical Dissolved Oxygen sensors are a relatively new technology that can be calibrated more accurately and precisely than Clark-type sensors, and they hold their calibration for over a month. With the purchase of optical dissolved oxygen sensors we will be able to make continuous measurements of algae production, which are more accurate and precise, for the duration of any flow experiments.

We already have all of the equipment needed to make measurements of benthic biomass (i.e., algae, invertebrates, terrestrial leaf litter), but we only have one set of this equipment. We will need to purchase an additional set of equipment so that these measurements can be simultaneously at both Glen Canyon and Diamond Creek. We already have enough wet suits and winches (needed for ponar dredge) to accommodate simultaneous sampling at two or three locations.

BIO 1.R4.08				
Impacts of Various Flow Regimes on the Aquatic Food Base (FY08-09)				
Item	Purpose	Unit Cost	Quantity	Total
YSI 6920 Sondes	Open-system measurements of algae production	$4500	4	$18,000
YSI ROX Optical Dissolved Oxygen Probe	Open-system measurements of algae production	$1500	8	$12,000
Wildco Standard Ponar Dredge	Benthic Biomass	$1249	2	$2500
Benthic Suction Sampler	Benthic Biomass	$300	2	$600
Wildco plankton/drift nets 20 in diameter mouth, 5:1 mouth-length ratio, 250 µm-mesh	Algae/Leaf litter/Invertebrate Drift	$500	2	$1000
Misc. Supplies	Bottles, preservative grade alcohol, etc.	$2000		$2000
Full-time technician (GS 7)	Field and lab work	$40,000 (salary + benefits)	1	$40,000
River Trip	Little Colorado River sampling for up to 2 months	$35,000		$35,000
Subtotal				$111,100
Overhead (19.091%)				$21,210
Total				**$132,310**

Sites: Glen Canyon, Diamond Creek, and Little Colorado River confluence

Project 4: Sponsors—Bill Persons, AGFD and Larry Stevens, GCWC

PROJECT TITLE AND ID: B.x Facilitation Contract

General Project Description

This project represents the work assigned to one individual under contract to the Bureau of Reclamation to facilitate at Technical Work Group meetings. This person may also assist TWG ad hoc groups in completing TWG assignments if the budget allows.

Project Goals and Objectives
The facilitator's primary responsibility is to keep the TWG meetings organized and effective, and help the members reach consensus on important issues. The facilitator creates a setting in which all members and the public are able to express their views.

The TWG chair elected from the group will continue to serve, but at no cost. Funds used previously to pay the TWG chair will be used to hire an outside facilitator.

Results
The facilitator will create an atmosphere in which the members and other participants at TWG meetings feel comfortable expressing their individual viewpoints. The facilitator will bring the TWG members to consensus on pertinent issues affecting the GCDAMP, help develop meeting agendas and calendars.

Budget
FY08 = $23,521 (This funding would be transferred from Project B.4: TWG Chair Reimbursement.

	2008	
USBR Salaries	-	
USBR Project Related Travel / Training	-	
USBR Operations/ Supplies	-	
Outside USBR Science / Labor	23,521	
Project Sub-total	**23,521**	
DOI Customer Burden (29%)	-	
Project Total (Gross)	**23,521**	
Percent Outsourced	100%	

Technical Work Group Facilitator Project

I would like the Glen Canyon Dam Adaptive Management Program Technical Work Group Budget Ad Hoc Group (BAHG) to recommend that the Technical Work Group (TWG) include a project in the FY08 Workplan and Budget to hire a facilitator to help the TWG run meetings, as recommended by the Roles ad hoc report (2007).

I think recent TWG meetings have been less productive than they might have been. I'm not sure what all of the causes are; we could clearly have lengthy discussions about this topic, and I believe we have. I think we should enlist a trained facilitator to help us work more effectively together and achieve resolution on the issues we face. Running meetings like the TWG is a difficult task by its nature, conflict resolution usually is. However, I think we could make a lot more progress if we had help, especially planning agendas and running our meetings.

I think it would be difficult at this time to replace the TWG chair with a facilitator, so I think it would be better to hire a facilitator to work with the TWG chair, much as we do at the AMWG, at least through FY08.

The value of a facilitator to the program would be evaluated by the TWG and GCMRC as part of a meeting evaluation process that facilitators are taught to use.

The Roles ad hoc recommended the TWG use a facilitator. (See "Report and Recommendations from the Roles Ad Hoc Group to the Secretary's Designee". April 13, 2007, p. 6) (http://www.usbr.gov/uc/rm/amp/amwg/mtgs/07may22CC/AIF_RolesRpt.pdf)

> "Utilize facilitation and mediation expertise more broadly throughout the AMP. Sophisticated process design, facilitation, and mediation expertise is needed for a collaborative process to effectively address complex controversial issues involving the many diverse interests represented on the AMP and that have a long history of conflict. Currently the AMWG utilizes a professional facilitator for all of its meetings; **a professional facilitator should be similarly utilized for all TWG meetings**. In addition, river trips, team building exercises, common goal setting, and social interactions should all be used to build trust and foster more effective collaboration."

Some of the things facilitators do to assist a meeting (see:

(http://en.wikipedia.org/wiki/Facilitator#Some_of_the_things_facilitators_do_to_assist_a_meeting:)

(I have bolded some of the things I think the TWG needs help with)

Helping participants show up prepared to contribute

Codifying the purpose, scope, and deliverables of the meeting or workshop

Coming prepared with a variety of group facilitation and dialogue tools that the facilitator is skilled in and can employ in difficult moments

Keeping the group on track to achieve its goals in the time allotted

Either providing the group or helping the group decide what ground rules it should follow and **reminding them of these when they are not followed**

Reminding the group of the objectives or deliverables of the meeting or session

Setting up a safe environment where members feel comfortable contributing ideas

Guiding the group through processes designed to help them listen to each other and create solutions together

Asking open-ended questions that stimulate thinking

Tentatively paraphrasing or repeating verbatim individual contributions to confirm understanding and ensure they are heard by the whole group

Tentatively summarizing a recent part of the discussion

Recording agreements reached in large script on the wall so all can see and accept the wording

Recording the current issues within the group in large script on the wall using phrases agreed by the group

Offering a possible wording for an unspoken question that may currently beset the group

Ensuring the group doesn't settle for the first thing that they can agree on because they find it painful to go on disagreeing with each other

Offering opportunities for less forceful members to come forward with contributions

Ensuring that actions agreed by the group to carry out its decisions are written up in a large script on the wall for all to see and are assigned to individuals

Evaluating the performance of the meeting to assist in continuous improvement.

The only negatives that I can think of with hiring a facilitator are the costs. I will not do a cost/benefit analysis, but think a facilitator will pay for itself by improved meetings and less time spent unproductively. If we can be more productive and cut one meeting a year, I think the $25,000 spent would be well worth it.

It will take some time to get a new facilitator up to speed on the issues within the program, but again I think it will be time well spent. We need to ensure that the facilitator does not back particular opinions voiced in the group, but if they are properly trained that should not be a problem.