**REVISED PROJECT STATEMENTS FOR CULTURAL PROJECTS C2. and C3. (TO COMPLY WITH BAHG BUDGET RECOMMENDATION OF MAY, 2005)**

**Project C.2. Synthesize Tribal Monitoring Programs Results (1995-2005)**

| FUNDING HISTORY | Fiscal year | | | | |
|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | 2007 |
| Outside GCMRC Science/labor | — | — | — | 50,000 | — |
| Logistics Field Support | — | — | — | — | — |
| Project Related Travel/Training | — | — | — | — | — |
| Operations/Supplies | — | — | — | — | — |
| GCMRC Salary (student intern) | — | — | — | 25,000 | — |
| Project Subtotal | — | — | — | 75,000 | — |
| DOI Customer Burden (6 to 17%) | — | — | — | 7,250 | — |
| Project Total | — | — | — | 82,250 | — |
| % Total Outsourced | — | — | — | 61% | — |

Principal Investigators: TBD

**Statement of Problem**: The five tribal groups participating in the Glen Canyon Dam Adaptive Management Program have cultural traditions associated with Grand Canyon that extend back many hundreds of years. Many of the same resources are valued by multiple tribes for different reasons. Resources valued by the tribes include many of the same prehistoric and historic sites that are also valued by the National Park Service and the general public for their informational and potential interpretive values. In addition to archaeological sites, the Tribes value specific locations (geologic landmarks, springs, shrines), biological resources (specific plants and animals), and minerals in the Colorado River Ecosystem that are important to their traditional cultures. Many of the sites and landmarks qualify as traditional cultural properties under the National Historic Preservation Act, although formal determinations of eligibility have not been completed. Numerous native plant and animal species in the CRE have been identified by the Southern Paiute, Navajo, Hualapai and Hopi people as having significant cultural value

because they were traditionally used or are currently used in ceremonies, as medicines, and in daily living. (Jackson, 1993; Lomaomvaya, 1999; Southern Paiute Consortium and Bureau of Applied Research, 1997). Above and beyond these individual resources, however, the Tribes value Grand Canyon as a whole for its uniquely important role in their Nations' histories and spiritual lives.

Since the mid 1990s, three of the five tribal entities participating in the GCD-AMP (Southern Paiute Consortium, Hualapai, and Hopi) have monitored some of their traditionally-valued resources at selected locations in the river corridor in conjunction with annual tribal river trips funded by the DOI agencies through the GCD-AMP. Methods are highly variable between the various programs, as one would expect given the diverse cultural backgrounds and interests of the Tribes involved in the AMP.

In 2001, GCMRC attempted to engage the Tribes in the development of a long-term terrestrial ecosystem monitoring program (TEM) to incorporate tribal needs for information about non-Register eligible plant and animal resources of cultural importance. This attempt met with only limited success. Although representatives from Southern Paiute, Hualapai, and Hopi attended most TEM meetings, and representatives from Hopi and the Southern Paiute Consortium participated on TEM river trips, only the Hopi Tribe provided specific input to GCMRC about how current data collection strategies could be modified or supplemented to meet their specific needs for information. Hualapai and Southern Paiute representatives indicated that their needs could not be met through the TEM program as currently designed, because the resources of interest to them are tied to specific, culturally important locations in the river corridor, while the TEM program relies on a randomly selected sample of study sites, none of which overlap with specific locations of interest to the Tribes.

Currently, three of five tribal entities engaged in the GCD-AMP are conducting monitoring programs of one kind or another in the CRE. Most of these programs monitor one or more tribally-identified TCPs, plus archaeological sites, plant and mineral resources. In April, 2005, representatives from these three tribes met with staff from GCMRC and NAU's Center for Sustainable Environments over the course of a three day workshop to articulate the goals and objectives of current tribal monitoring programs and receive feedback on how to align tribal monitoring objectives more closely with those the

GCD-AMP. One outcome of the workshop was a recounting of the history of tribal monitoring within the GCD-AMP, and the processes and internal deliberations that led to the current configuration of the various tribal monitoring programs. In FY06, GCMRC will continue to work with the Tribes to implement workshop results and modifying current protocols necessary to meet the specific needs of the GCD-AMP. As a step in this direction, the following proposed project will result in three synthetic reports, one from each of the tribes (Hopi, Hualapai, and Southern Paiute) currently engaged in actively monitoring resources in the CRE. The reports will summarize the results of tribal monitoring conducted since completion of the GCD-EIS and provide the GCD-AMP with a formal assessment of resource conditions from individual tribes' perspectives, based on the past ten years of tribal monitoring work in the CRE.

**Management Objectives Re: Monitoring TCPs and other Tribally Valued Resources**

| MO # | Objective |
|---|---|
| 11.1 | Preserve historic properties in the area of potential effect via protection, management, and/or treatment (e.g. data recovery) for the purpose of federal agency compliance with NHPA and GCD-AMP compliance with GCPA. |
| 11.2 | Preserve resource integrity and cultural values of traditionally important resources within the Colorado River Ecosystem. |

| CMIN # | Question |
|---|---|
| 11.1.1 | Determine the status of historic properties under Record of Decision operations. (11.1.1a. Determine periodically whether the essential physical features are visible enough to convey their integrity or retain their information potential) |
| 11.1.3 | What are the thresholds for impacts that threaten the integrity and eligibility of historic properties? (11.1.3a. Are the current monitoring programs collecting the necessary information to assess resource integrity?) |
| 11.1.4 | How effective is monitoring, and what are the appropriate strategies to capture change at an archaeological site – qualitative, quantitative? |
| 11.2.1 | Are the traditionally important resources and locations for each tribe and other groups being affected? |

**Proposed Program:** At a workshop sponsored by GCMRC in April 2005, tribal representatives from Hopi, Hualapai and the Southern Paiute Consortium collaborated with facilitators from Northern Arizona University's Center for Sustainable Environments to assess their current monitoring programs in terms of their relevance to

GCPA and the GCD-AMP goals, as well as their relevance for meeting tribal information needs. (Representatives from the Navajo Nation and Pueblo of Zuni were asked to participate in this workshop also but were unable to do so.) The participating Tribes were asked to articulate rationales for using specific approaches and methodologies, as well as define the resource values that they consider important to monitor and preserve. The tribes did so by describing their chosen approaches to monitoring in terms of both traditional cultural perspectives, as well as in relation to the perceived changing needs and directions received from the BOR, PA, and GCD-AMP over the past ten years.

In FY06, as a foundational step towards developing a long term plan for monitoring tribal interests in the CRE, the tribes that are actively monitoring resources in the CRE will produce synthetic reports describing the history of their respective monitoring programs, the methodologies employed, information needs satisfied (both Tribal needs for information, as well as information needs identified in the AMP Strategic Plan) and summarizing the results of their monitoring work over the past ten years. These synthetic reports will serve a function similar to the SCORE Report, but will reflect the values and issues of principal concern to each individual Tribe. These synthetic reports will summarize baseline condition information and current trends in tribally valued resources to serve as the foundation for future tribal monitoring programs.

**Expected Products:**

1) Comprehensive synthesis of monitoring work conducted by each tribe since 1995 (one report from each of the three tribal entities actively engaged in monitoring CRE resources), including a complete history of monitoring work conducted by each tribe in the CRE, methods used, results obtained, and recommendations for future management of Glen Canyon Dam and the CRE based on the past ten years of monitoring work.

2) Formal presentations to TWG and AMWG in the summer of 2006, presenting a synopsis of the final synthetic report, summarizing monitoring results, and providing recommendations to TWG and AMWG based on those monitoring results.

**Project C.3. Integrated Campsite Monitoring and Research (Pilot Study)**

| FUNDING HISTORY | Fiscal year | | | | | |
|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Outside GCMRC Science/Labor | — | — | — | — | 50,000 | — |
| Logistics Field Support & MPS | — | — | — | — | 15,000 | — |
| Project Related Travel/Training | — | — | — | — | 0 | — |
| Operations/Supplies | — | — | — | — | 6,000 | — |
| GCMRC Salaries | — | — | — | — | 7,450 | — |
| Project Subtotal | — | — | — | — | 78,450 | — |
| DOI Customer Burden (6 to 17%) | — | — | — | — | 7,837 | — |
| Project Total | — | — | — | — | 86,287 | — |
| % Total Outsourced | — | — | — | — | 67% | ?% |

**Principal Investigators:** Rod Parnell and associates, Northern Arizona University and Jack Schmidt and associates, Utah State University

**Statement of Problem:** Camp sites in the CRE are diminishing in size, quality and overall number under current dam operations (Kaplinski et al., 2003, 2005; NPS, 2004.) In the early 1980s, growing public concern over diminishing size and quality of camping opportunities in the CRE and the impact of proposed changes in dam operations on "camping beaches" was one of the critical issues that prompted the Bureau of Reclamation to initiate the Glen Canyon Environmental Studies program.

The loss of campable area in the CRE impacts visitor use values in a variety of ways. The number, size classes, and distribution of campsites are critical for maintaining the types and quality of recreational opportunities consistent with National Park Management objectives (NPS, 2004). These three critical factors--number, size, and distribution--constrain the upper limits of the Colorado River corridor's visitor carrying capacity (NPS, 2005). A diminishing quantity and range of camping opportunities may negatively impact visitor experience through increasing crowding, increasing numbers of contacts between groups, and increasing human use-related impacts (an end result of

large numbers and large groups of recreational users being forced to camp in increasingly smaller areas.) Moreover, some specifically-valued campsite qualities such as amount and spatial distribution of open sand area, boat mooring attributes, and amount of shade-producing vegetation (Stewart et al., 2000) are directly influenced by dam operations.

The relationship between operations of Glen Canyon Dam and camping opportunities in the river corridor has been studied sporadically over the course of the last three decades, using a variety of assumptions and approaches (Borden, 1976; Brian and Thomas, 1984; Brown and Hahn-O'Neill, 1987; Kearsley and Warren, 1993; Kearsley et al., 1994, 1995, 1994; Shelby et al., 1976, 1992; Stewart et al., 2000; Kaplinski et al., 2004; see also Behan, 2000 and Kaplinski et al., 2003 for a summary of past recreation monitoring and research approaches pertaining to the Colorado River in Grand Canyon.) Recent monitoring shows that sand bar camp size and opportunities have decreased through time, at a rate of approximately 15% per year since 1998. Reductions in camp site area and numbers are due to a combination of factors, including sediment being removed from the system by dam operations, sediment being removed by tributary floods (and not subsequently replaced by flood flows), and vegetation encroachment (Kaplinski et al., 2005.)

The lack of periodic scouring floods under current dam operations has allowed vegetation to become established on many formerly open sand areas. Vegetation encroachment is believed to be an important factor contributing to the reduction in size and abundance of campable areas in the CRE, yet actual rates and amount of campsite loss due to vegetation encroachment remain unmeasured and unknown (Kaplinski et al., 2003, 2005).

The National Park Service currently monitors approximately 100 campsites for visitor use impacts such as social trailing, vegetation damage, fire scars and litter. NPS recently initiated a new pilot campsite impact monitoring program to meet Park-specific management needs related to the Colorado River Recreation Management planning process. The current NPS recreation monitoring programs are primarily concerned with tracking human impacts at campsites, rather than focusing on physical changes linked to dam operations. The current NPS monitoring program will continue into the foreseeable future as a separate but complementary program to the one presented here.

The GCD-AMP currently does not have a well conceived, integrated GCD-AMP campsite monitoring program that is fully responsive to stakeholder needs. Despite more than 30 years of research on Grand Canyon river corridor campsite issues, an up-to-date, comprehensive inventory of camping areas in the river corridor is currently lacking (Kaplinski, 2003). Such an inventory is needed to provide a comprehensive baseline record of campsite number, distribution, and size in the CRE from which changes and trends in physical conditions can be objectively compared and tracked over time. In addition to a comprehensive list of available camps, there is need for a ground-truthed record of current camp areas, so that changes in campable area, vegetation growth, and related-social impacts can be tracked and measured remotely over time.

**Summary Project Description:** The FY06 campsite monitoring program is designed to continue tracking and quantifying trends in the size, distribution, and physical qualities of selected campsites in the CRE (camps associated with the existing NAU sand bar series), while transitioning towards the use of remotely sensed imagery in evaluating changes to campable area and other important campsite attributes over time. The project proposed for FY06 will build on the current (FIST) campsite area survey program and integrate it with complementary data derived from remotely sensed vegetation and sediment (digital imagery) data. The comparability of the two data sets will be systematically evaluated using GIS analytical techniques. In addition, if additional funding becomes available, the long-term photographic record produced by the Grand Canyon River Guides Adopt-a-beach program will be continued in order to provide a long term, site specific visual record of campsite changes, to complement the more generic assessments accomplished through analysis of remotely sensed imagery. In addition, if funding permits, we will begin the process of developing a comprehensive inventory (geo-referenced maps) of current camping areas and transferring these maps to a GIS, to serve as the foundation for future monitoring of system-wide changes in campsite size, distribution and quality through time. GCMRC and NPS recreation management staff will collaborate in the proposed inventory effort, with NPS staff defining the campsite boundaries from a management perspective (i.e., NPS staff will define what they consider to be the acceptable boundaries of each camp).

The project includes the following interrelated components, which are listed in the order they will be implemented, subject to available funding. At the current level of funding proposed by the BAHG, only Items 1 and 2 will be fully funded in FY06.

1) The current program of repeat mapping of campable area at a judgmental sample of sand bar camps will continue, while we transition to using more remotely sensed data. In addition, we will evaluate campable area changes in relation to overall changes in sand bar topography to assist in determining the specific factors responsible for campable area decline.
2) We will compare campable area at currently used camp sites with campable area polygons derived from GIS analysis of remotely sensed data (Breedlove, 2003). As part of this effort, we will also thoroughly evaluate the limitations and benefits of using remotely sensed data to track changes in various camp attributes at a variety of camp types through time.
3) To supplement the campsite area change detection data, we will continue to support the Grand Canyon River Guides in gathering and archiving a long-term visual record of campsite changes using volunteer labor provided through the Grand Canyon River Guides' Adopt-A-Beach program.
4) If sufficient funding is available in FY06, aerial photo-based inventories by Weeden et al. (1975), Brian and Thomas (1984), and Kearsley and Warren (1993) will be compiled into a single GIS. The quality and collection methods of this pre-existing aerial photo data will be evaluated, then transferred to one set of orthorectified digital imagery in a spatially referenced GIS.
5) If sufficient funding is available in FY06, begin the process of comprehensively inventorying all campsites currently used by river runners in the river corridor. Supplement the existing camp site inventory data (now somewhat out of date) with information derived from recent commercial guidebooks (e.g. Martin and Whitis, 2004) and by interviewing commercial guides and science outfitters to identify all actively used locations. Combine the geographic information with past and current NPS assessments of the maximum group size considered appropriate for each identified campsite.

6) With NPS collaboration, outline all current camp sites areas on orthorectified images in the field using the pen tablet approach pioneered by Kaplinski et al. (2003). Important attributes of camp sites will be coded in linked data fields (e.g., type of camp, percentage of campable area, total area covered by sand vs. vegetation, boat mooring characteristics, etc).
7) Compare currently used camp sites with formerly identified sites to determine changes in type, distribution, and (where possible) size and capacity of camp sites over the past thirty years.
8) Track and quantify amounts and rates of vegetation encroachment within the designated campsite boundaries. Vegetation encroachment will be measured at camps currently being monitored by NAU, as well as at key Adopt-A-Beach sites, plus at a random sample of all CRE camp sites (selected from the total population of camp sites identified through the inventory). Vegetation encroachment will be measured via repeat comparisons of remotely sensed, digital imagery.

**MO's and IN's ADDRESSED:** Goal 9. This project directly addresses MO 9.3 and CMINs 9.3.1 and 9.3.2, plus EIN 9.3.1. The project indirectly addresses MOs 9.1 and 9.4 and CMINs 9.1.1, 9.1.2, 9.1.3 and 9.4.1 (because diminishing size, quality and number of camps influences the quality of visitor experience through affecting perceptions of crowding, numbers of group encounters, and by increasing camp competition.)

**Consequences of FY06 Funding Recommendations:** The funding level currently proposed by the BAGH for FY06 is only sufficient to continue the existing campable area monitoring effort and conduct an evaluation of the current approach in relation to an alternative approach using remotely sensed imagery subject to GIS analysis. The proposed funding level is not sufficient to compile a comprehensive inventory of campsites, as has been recommended in by previous studies, continue funding the Adopt-A-Beach effort, or incorporate legacy data into a GIS to provide a more comprehensive and longer-term record of campsite area change over time. If additional funding is made available, additional components of the campsite monitoring program will be implemented.

**Status/Schedule: FY06-09: FY06 represents the start up year of a** multi-year effort to evaluate changes in campable area and other attributes that are important to the maintaining a high quality recreational experience in the CRE. The first year will emphasize continuation of existing campable area measurements while simultaneously evaluating the appropriateness of using remotely sensed data as a proxy measure of campable area change and refining methods for calculating sand area and vegetation change. If sufficient funding is approved, we will also embark on inventorying current campsites and compiling baseline campsite data. Collection of system-wide digital imagery will occur in May 2005 as a follow up to the November 2004 experimental high flow; analysis of this digital data set will continue through FY09. This project builds upon and integrates the previous work of Kaplinski et al. (2003), Kaplinski et al. (2005) Breedlove (2003), and the ongoing Adopt-A-Beach effort.

**Expected Products/Deliverables:** In FY06, surveyors will continue the current program of mapping campable areas at selected campsites throughout the CRE, and these data will be analyzed and compared with polygons generated through remotely sensed data and GIS technology to systematically evaluate the comparability and reliability of these two different approaches. Two reports will be generated, one comparing changes in the surveyed campable area from October 2003 to May 2005, and evaluating campable area change in relation to sand bar topographic changes; a second report will evaluate the surveyed data in relation to campable area polygons produced via remote sensing and GIS analysis.

If sufficient funding is available in FY06, in addition to the above products, a series of GIS layers composed of 1) previously inventoried camp sites tied to spatially-referenced digital imagery, 2) current campsites with NPS management boundaries and actual use areas delineated; 3) a comprehensive inventory of potentially campable sand areas (based on remote sensing analysis); and 4) vegetation change within delineated camp sites will be produced. A thorough GIS-based analysis of these data will be conducted to 1) document changes in type, distribution and size of camp sites over time, and 2) document encroachment of vegetation on campable areas. The GIS data will be

complemented by the long-term visual (photographic) record of campsite changes derived from the ongoing Adopt-A-Beach Program.

**Integration:** This project proposes to integrate the monitoring of sand bar area and topography, vegetation, and the long-term visual record of repeat photographs to create foundational elements of a long-term integrated campsite monitoring program. This project will also (eventually) integrate remotely sensed data with legacy campsite data derived from conventional aerial photos into a GIS. The project lays a foundation and builds capacity to link the changing physical attributes of camp sites currently affected by dam operations to the experiential parameters of visitor use values.