

## Memorandum

**To: Glen Canyon Dam Adaptive Management Technical Work Group**

**From: GCMRC Sociocultural Program Manager**

**Subject: Progress Report on Cultural R& D project**

**Date: March 29, 2007**

**Introduction/Overview:** Glen Canyon Dam and the manner in which it is operated have altered the hydrological regime, sediment budget, and sediment flux of the Colorado River downstream in Grand Canyon. Because these factors directly and indirectly influence terrestrial geomorphological processes, including rates of landscape erosion, there are ongoing concerns about the effects of these processes on the physical condition of archaeological sites embedded within the river corridor landscape. To effectively evaluate and address these concerns requires tracking and evaluating the potential effects of dam operations and other factors, such as climate and visitor use, on the long-term integrity of cultural resources in the river corridor. Accordingly, in FY06, the AMWG approved a research and development project for archaeological site monitoring that involves the development, testing and evaluation of a variety of methods for objectively monitoring and quantifying factors contributing to archaeological site stability and/or degradation. In FY06 and FY07, this project is focused on researching and testing potential approaches and techniques for monitoring and quantifying impacts to cultural sites using a variety of methods, including library research, legacy data review, direct observation and documentation of relevant site attributes, and field testing of various instruments and methods for tracking and quantifying physical changes. In FY08-10, a set of protocols will be piloted on a trial basis. The results of the pilot program will be subject to a formal PEP evaluation in late FY10 or early FY11, prior to being implemented as the final core monitoring approach.

**FY06:** FY06 was the first year of a five-year research and development project for core monitoring of archaeological resources in the CRE. The project got under way in March, 2006 with the first of three geo-archaeological assessment research river trips in FY06. In order to improve efficiency and reduce AMP costs, this work was conducted concurrently and in close collaboration with treatment planning efforts sponsored by Reclamation. In addition to conducting geo-archaeological assessments (as the first step towards grouping sites for future monitoring), we began the process of testing and evaluating different survey methods (total station surveys vs. ground-based LIDAR) for quantifying rates of erosion at a sample of sites during these trips.

A draft report on the first phase of archaeological assessment work (151 sites) was completed by NPS in January, 2007; a separate report on the geomorphic characterization of these same sites is due to be completed by USU cooperators in April, 2007. Both reports will undergo independent peer review in spring, 2007. Processing of the total station and LiDAR survey data has been completed, and an interim report on the first year of work is in preparation. Preliminary analysis of the existing site data in relation to modeled river stage (flow lines) has been completed and was presented to the CRAHG in July, 2006; additional analyses of existing monitoring data are planned for FY07.

**FY07:** The FY07 work plan divided the annual work load for this project into three general tasks: 1) site assessments to establish the foundation for long-term monitoring; 2) legacy data evaluations; and 3) testing and evaluating monitoring protocols for quantifying geomorphic change and tracking effectiveness of treatments. Progress in each of these three areas has occurred during the first half of FY07, as described below:

**Task 1, Site Assessments:**

The CRAHG had requested at their meeting in July 2006 that the results of the treatment assessment work be factored into the site assessment review prior to the start of the FY07 field season. According, the Sociocultural Program manager made several requests to Reclamation's cooperators to obtain these data. However, neither USU nor ZCRE felt comfortable releasing their data until the draft treatment plan had been submitted to and reviewed by Reclamation. Since this has not occurred (as of March 22, 2007), it was not possible to incorporate these data into our review process. However, it is unlikely that data collected in FY06 would materially alter the need for conducting additional field assessments in FY07, given that additional field data is needed for the same reasons that treatment planning required them, i.e., because existing geomorphic data and archaeological integrity data are not sufficiently detailed nor robust enough to determine which sites will require specific types of treatment (or monitoring) in the future.

In keeping with our agreement with the CRAHG, GCMRC worked with NPS to refine and reduce the list of sites requiring additional field assessments in FY07. As requested by CRAHG, we established a set of criteria and then reviewed the existing site information to determine which sites did or did not meet these criteria. Principle criteria included whether there was sufficient geomorphic data in existing site records to preclude the need for field re-assessment, whether existing data indicated that a site no longer retained sufficient integrity to warrant future monitoring or management, and whether sufficient monitoring of a given site had occurred within the past few years to ascertain its current status without needing to revisit it. Based on this review, we determined that approximately 80 sites will be reassessed through field visits in FY07. USU, NPS and GCMRC have planned our field work logistics for FY07 based on this refined list.

**Task 2, Legacy Data Evaluations:** As described above, legacy site data and monitoring data were reviewed in the context of applying the criteria for future site assessments. In addition, GCMRC is currently in the process of identifying an independent panel of subject experts to review and provide recommendations on the existing archaeological site monitoring data in terms of its utility and applicability for the future monitoring program. This independent review of the data will occur in summer, 2007.

Also, at the request of the CRAHG, GCMRC will be conducting an evaluation of the existing monitoring data in relation to recent historical flow data to determine whether any correlations occur between the two data sets. Dr. David Topping will initiate this analysis in summer, FY07.

Finally, the FY07 work plan proposed to evaluate historical aerial imagery to determine its accuracy, precision and potential utility for future monitoring purposes. This component of the R&D project is temporarily on hold due to ongoing unresolved mechanical issues with the existing scanner at GCMRC.

Task 3, Testing and Evaluating Monitoring Protocols: To date, the bulk of GCMRC's time and effort on this project in FY07 has focused on researching, selecting, ordering, testing and then installing a series of new weather monitoring stations at selected sites within the river corridor. With approval and on-site supervision by NPS, 10 out of a total of 12 planned stations were installed along the river during late February, 2007. The weather stations were placed at three of five locations previously monitored by Drs. Amy Draut and David Rubin in 2003-2006, plus at four of six study sites selected by USU geomorphologists for tracking rates of gully incision and erosion control effectiveness. (This is a continuation of work started by USU during the treatment planning project.) We are awaiting approval from the Hualapai Tribe to install another set of weather stations in the vicinity of Granite Park. These stations are collecting data on precipitation, wind direction and intensity, temperature, humidity and barometric pressure. In addition to serving the interests of the cultural monitoring R&D project, the weather data will be useful for the temperature modeling work that GCMRC is currently conducting, and potentially to other ongoing AMP ecosystem studies as well.

In FY06, USGS surveyors collected ground-based LiDAR and total station survey data at nine archaeological sites, and during the first half of FY07, they focused on processing these data. In addition to collecting the data, the survey team collected information on the amount of time required to collect the data in the field, process the data in the lab, and other efficiency and data quality parameters. A report comparing the trade-offs of ground-based LiDAR vs. total station surveys in terms of field and lab time, financial costs, efficiency, quality of data, and resource impacts is currently in preparation. In FY07, testing of survey protocols will continue, with a focus on evaluating the change detection capability of these two methods.

GCMRC has established formal agreements with USU and USGS Western Coastal Marine Team to continue geomorphic evaluations and topographic surveys at selected sites and to assist with analyzing the weather data collected in 2007, and we are in the process of finalizing our agreement with NPS to complete the assessment work and the polygon delineation tasks outlined in the FY07 work plan. Two river trips (one prior to and one following the summer monsoon season) are planned for FY07 to accomplish the site assessment, polygon delineation, topographic survey comparison, and gully monitoring/check dam effectiveness work. In addition, one GCMRC staff member will accompany other GCMRC research trips throughout FY07 to maintain and download data from the weather stations.

