GRAND CANYON MONITORING AND RESERCH CENTER'S

FISCAL YEAR 2006 PROJECT REPORT FOR THE GLEN CNAYON DAM ADAPTIVE MANAGEMENT PROGRAM

EXECUTIVE SUMMARY

MARCH 22, 2007

Preface

Following is the Executive Summary for the Grand Canyon Monitoring and Research Center's (GCMRC) Fiscal Year 2006 Annual Accomplishment Report. This is a new product to provide the Technical Work Group (TWG) with a summary of accomplishments, shortcomings and recommendations related to projects included in GCMRC's FY 06 work plan for the Glen Canyon Dam Adaptive Management Program. The report is intended to inform the TWG's decisions and recommendations related to the development of the FY 08 work plan. Since this is a new product that GCMRC intends to produce annually, comments on the usefulness of this report are welcome.

EXECUTIVE SUMMARY

A. PHYSICAL SCIENCE, MODELING, AND DASA PROGRAM

Project A.1 Ongoing Provisional Monitoring – Lake Powell Quality-of-Water (note: funded under agreement no. 05-AA-40-2385, Support of Integrated Water Quality Program Studies for Lake Powell)

PROGRESS STATEMENT:

Recent drought conditions at Lake Powell have resulted in lower reservoir elevations, increased release temperatures, and decreased dissolved concentrations in Glen Canyon Dam releases. The telemetry system below Glen Canyon Dam has provided valuable real-time information during this period.

The relational water quality database is complete and current. An USGS data report is in development for publication in 2007, describing the 42-year history of Lake Powell water-quality monitoring.

RECOMMENDATIONS:

The biological monitoring plan will provide useful information to develop a budget and appropriate levels of analysis for the current backlog of plankton samples. The analysis of these samples and other existing data will provide an important baseline of plankton community structure, on which to evaluate effects of a potential selective withdrawal device or possible exotic species invasion. Further evaluation of the 42-year historical data set could lead to a restructuring of the existing sampling program to maximize efficiency and cost-effectiveness.

Project A.2 Ongoing Provisional Monitoring – Downstream Quality-of-Water for Physical, Biological and Chemical Sampling (includes R&D (modeling)) (Report 1 of 2)

PROGRESS STATEMENT:

During FY2006, all stage equipment and quality-of-water (QW) probes operated normally. Sediment-transport data collected during FY2006 on the tributaries to the CRE have been processed, finalized, and delivered to the GCMRC. Sediment-transport data collected during FY2006 on the mainstem Colorado River are now in the final stages of being processed and will be delivered to the GCMRC by March 2007. Other QW data collected during FY2006 are now in the final stages of being processed and will be delivered to the GCMRC by March 2007. Much of the National Canyon data were compiled and a draft report was written. The report was completed in early FY2007 and will be made available on-line. When available, the final report will be e-mailed to GCMRC. Substantial progress has been made on (1) posting the real-time sediment-transport data collected under this project to the World-Wide-Web, and (2) serving these data through Oracle; these two tasks will be completed during mid-2007. The two-way

satellite telemetry system is now considered operational. Updates of the mass-balance sediment budgets have been computed and delivered to the GCMRC, TWG, and AMWG. The final reports from the sediment-transport modeling component of this project have been delivered to the GCMRC. During FY2006, results from the downstream IQW project were presented at (1) the 2005 Fall Meeting of the American Geophysical Union, San Francisco, California, December 5-9, 2005; and (2) 8th Federal Inter-Agency Sedimentation Conference, Reno, Nevada, April 2-6, 2006. The basic 1D Colorado River sand-transport model was completed, and a journal article submitted for publication in FY2006. Testing and calibration of the model has continued. The model we developed fits the model described in our proposal that was reviewed, selected, and funded by the GCMRC. The model is a reach-averaged, event-driven sand-transport model intended primarily to route sand inputs from the main tributaries over weeks to a few months. The root model in its uncalibrated state generally shows good agreement with data in an application that is long (7 months) and covers a wide range of flow and sand supply. Model predictions of cumulative sand volume at Phantom Ranch are close to or within measurement error estimated by the GCMRC. The uncalibrated model shows excessive sensitivity to sand inputs from the Paria, however, which affects transport rates and predicted grain sizes in transport. Calibration by Scott Wright has improved the model predictions.

RECOMMENDATIONS:

This project has been externally peer reviewed (SEDS-PEP, August 2006) and is being proposed as core monitoring in 2007 as part of the recommendation report on long-term sediment monitoring to TWG. It will also be reviewed internally by the USGS Office of Surface Water during spring/summer 2007.

Project A.2 Ongoing Provisional Monitoring – Downstream Quality-of-Water for Physical, Biological and Chemical Sampling (includes R&D (modeling)) (Report 2 of 2)

PROGRESS STATEMENT:

- Stage equipment working fine on the mainstem and tributary gages. Water-quality probe at Lees Ferry is also working fine. Sediment samples were collected during storms and given to GCMRC for processing.
- Much of the National Canyon data were compiled and a draft report was written. The report was completed in early FY07 and will be made available on-line. When available, the final report will be e-mailed to GCMRC.
- The basic 1D sand transport model, funded under a separate agreement, was completed, and a journal article submitted for publication in FY06. Testing and calibration of the model has continued. The model we developed fits the model described in our proposal that was reviewed, selected, and funded by the GCMRC. The model is a reach-averaged, event-driven sand-transport model intended primarily to route sand inputs from the main tributaries over weeks to a few months. The root model in its uncalibrated state generally shows good agreement with data in an application that is long (7 months) and covers a wide range of flow and sand supply. Model predictions of cumulative sand volume at Phantom Ranch are close to or within measurement error estimated by the GCMRC. The uncalibrated model shows excessive sensitivity to sand inputs from the Paria, however, which affects transport rates and predicted grain sizes in transport. Calibration by Scott Wright has improved the model predictions.

RECOMMENDATIONS:

- Streamflow/Sediment – continue operation of gages and collection of sediment samples.

- Modeling - Scott Wright, formerly the GCMRC Physical Resources modeling program manager, now with the CA WSC, and Peter Wilcock, Johns Hopkins University, have been running the model to further test and calibrate it. Wright and Wilcock have the necessary expertise and should continue to be supported in applying the model.

Project A.3 Completion of Research & Development in Support of Monitoring Changes in Fine- Sediment Storage along the Main Channel & Shorelines of the CRE

PROGRESS STATEMENT:

Topographic, bathymetric, and remote-sensing data from reach-based fieldwork in 2002, 2004, and before and after the November 2004 BHBF test were processed, finalized, and delivered to GCMRC-DASA. Aeolian sand-transport data collected during 2005 were delivered to the GCMRC; final report on this work was completed. Sandbar topographic and campsite-area data from fieldwork in 2001, 2002, 2003, 2004, and 2005 were also delivered to the GCMRC. During FY2006 and early FY2007, results from the FIST project were presented at (1) the 2005 Annual Meeting of the Geological Society of America, Salt Lake City, Utah, October 16-19, 2005; (2) the 2005 Fall Meeting of the American Geophysical Union, San Francisco, California, December 5-9, 2005; (3) 8th Federal Inter-Agency Sedimentation Conference, Reno, Nevada, April 2-6, 2006, and (4) the 2006 Fall Meeting of the American Geophysical Union, San Francisco, California, December 11-15, 2006. The project is now in its final stages with articles being prepared for publication. The project is now in its final stages with articles being prepared for publication.

RECOMMENDATIONS:

Final presentations, with recommendations for future monitoring, will be made to the TWG and AMWG during summer 2007. Findings of the project will be included in the recommendations report to the TWG in 2007 on long-term sediment monitoring.

Project A.4 Ongoing Support of Provisional Monitoring Remote Sensing Data Acquisition

PROGRESS STATEMENT:

Due to unforeseeable and uncontrollable climatic events (Hurricanes Katrina and Rita), the New Orleans-based contractors (3001, Inc.) were severely disadvantaged to carry on normal company operations and were unable to meet delivery deadlines of the May 2005 remote sensing data sets. Every effort was given on the part of GCMRC to accommodate those affected while continuing to assist the contractor in seeing the project through to the data delivery phase. By the close of FY2006, 18 months after data collection, approximately 95% of data for the May 2005 overflight had been delivered to GCMRC. These data were expected by the close of FY2005, and so the full assessment of the remote sensing mission was impossible to complete prior to the end of FY2006. An initial accuracy assessment was performed in July 2006 for some of the available data; however, due to the late delivery of the full data set, a final accuracy assessment will now be completed in FY2007.

Several servers, including the Oracle database server, were upgraded to allow for more data storage for GIS and remote sensing work, including more storage space for the May 2005 imagery and elevation data sets.

RECOMMENDATIONS:

It is recommended that future core monitoring remote sensing activities include travel for GCMRC on-site visits of contractors both before and after the data collection process to ensure that data standards and delivery requirements are followed from the onset through to completion of the contract. Additionally, 1-2 GCMRC personnel should attend appropriate training relating to the writing and handling of large remote sensing contracts. Post-processing of raw data into GIS usable formats by GCMRC staff may potentially provide products with higher accuracy standards then those typically returned by contractors. A new term position is recommended to process Remote Sensing Data.

Project A.5a Science Support of All Data Storage within Grand Canyon Integrated (Oracle) Database Management System (DASA)

PROGRESS STATEMENT:

Access to the Oracle database has been greatly increased within GCMRC during FY2006, allowing staff scientists to work more closely with their data as it is stored in the database. A new Aquatic Food Base schema was developed and hands-on training was provided to GCMRC staff and associated contractors to streamline data entry and analysis. Existing database tables were updated in the sediment and water schemas, including a reload of legacy data from sediment and LCR gages appended to the database. The water access page was revamped in FY2006 and is once again providing water data from several gages throughout the Grand Canyon basin.

Additionally, a significant effort was made to eliminate errors from existing databases and new field submissions, especially the native and nonnative fish data, which in turn has improved upon the response time for generating the Humpback Chub Assessment. Historical tag linking was achieved that extended the time line beyond any previous efforts; this allows an unprecedented view into the life history of endangered fish.

RECOMMENDATIONS:

The Grand Canyon Integrated Databases is currently understaffed owing to the DBMS position being vacated in January 2007, This position is necessary for basic database maintenance as well as the development of new procedures that will allow increased access to the database for scientists, resources managers, and the public alike.

Project A5b Ongoing Data Conversion & Library Operations (DASA)

PROGRESS STATEMENT:

Numerous new holdings have been added to the library in FY2006, ranging from hard copy texts to digital versions of research reports and peer-reviewed journal articles produced from GCMRC science and the Adaptive Management process. The GCMRC librarian also coordinates review activities for Protocol Evaluation Panels (PEPs) and research proposals and reports funded by the Center. In FY2006 this included 1PEP (sediment), 4 research proposals and 26 research reports. In the second half of FY2006,

DASA library staff responded to a BOR data call, producing an inventory of all information collected in conjunction with adaptive management process since 1995.

RECOMMENDATIONS:

In addition to coordinating GCMRC's peer review process and normal library operations, continue conversion of hardcopy reports for web access, conversion of aerial photography for scientific analysis and change detection.

Project A.6 Ongoing Support GIS General Support for Integrated Analyses and Projects (DASA)

PROGRESS STATEMENT:

Great strides in the realm of field map development were achieved in FY2006, allowing for the automation of customized river atlases to support specific projects in the field. Examples of projects benefiting from this improved support include the Aquatic Food Base project and the Campsite Mapping project. This new development is also applicable to any GCMRC project in need of field maps for river trips.

Improvements in the IMS system were also made during FY2006, including the development of a new research-based internet map service for the Fine-grained Integrated Sediment Team (FIST). This site was made available to FIST members and added features previously not possible, such as the integration of text documents, spreadsheets, and charts with the spatial data served through the website. This allowed team members stationed at different locations to view and query spatial and tabular data related to the project simultaneously.

RECOMMENDATIONS:

In FY2007, the GIS general support will work on upgrading the GIS software to a new version (9.2) and begin testing the applicability of a newly available module called ArcGIS Server. This module is expected to greatly improve on GMCRC's ability to serve not only large spatial datasets, but also linked tabular data from Oracle, spatial analyses developed by GCMRC staff and various usable outputs including maps, charts and graphs related to project-specific data in the Oracle database.

Project A.7 Completion of Channel-Mapping Project (DASA)

PROGRESS STATEMENT:

These data have been processed and this project closed with FY2006. All data developed from this project will be handled by the GIS general support and Integrated Analysis and Modeling projects in FY2007.

RECOMMENDATIONS:

Single and Multi-beam sonar hydrographic data have proven useful for Sediment and Flow modeling, and have a potential to help Foodbase studies. If this project was funded and wrapped into the recommended internal Overflight processing position, a continuum of institutional processing knowledge could be created in one staff position.

B. BIOSCIENCES

Project B.1 Ongoing Provisional Monitoring – Terrestrial Activities (KAS and SWWF)

PROGRESS STATEMENT:

Surveys of habitat were completed in spring and fall of 2006. Survey data are being reduced and mapping of area is in progress. Annual report pending completion of survey data. Attended Kanab Ambersnail Working Group meeting in Spring 06.

RECOMMENDATIONS:

Maintain biannual monitoring of Kanab ambersnail in Grand Canyon

Project B.2 Continued Research and Development – Aquatic Productivity, Organic Mass Balance, and Food Web Linkage Studies (Linking whole-system carbon cycling to quantitative food webs in the Colorado River) 1 of 2

PROGRESS STATEMENT:

Site selection and sampling methodology was finalized in April 2006. All of the field sampling tasks were completed as planned in FY 06. Initial findings are: 1) open-system metabolism measurements are feasible in the CRE, 2) algae production is always high in Glen Canyon and considerably lower along downstream reaches, 3) tributary inputs of organic matter dominate the carbon budget for downstream reaches, and 4) invertebrate biomass and production is extremely high in Glen Canyon and extremely low in downstream reaches. Samples are currently being processed and analyzed for stable isotope ratios of carbon, nitrogen, and hydrogen.

RECOMMENDATIONS:

Continue project to determine carbon flow and trophic linkages in CRE. If hydrogen stable isotope analysis proves to be a useful tracer of trophic linkages it is recommended that the budget for this project be increased by $10,000 annually to cover the additional cost of analyzing samples for hydrogen stable isotopes.

Project B.2 Continued Research and Development – Aquatic Productivity, Organic Mass Balance, and Food Web Linkage Studies (Elucidating Aquatic and Terrestrial Contributions of Organic Carbon to the Colorado River Ecosystem Using Stable Hydrogen Isotopes) 2 of 2

PROGRESS STATEMENT:

Site selection and sampling methodology was finalized in April 2006. All of the field sampling tasks were completed as planned in FY 06. Initial findings are: 1) open-system metabolism measurements are feasible in the CRE, 2) algae production is always high in Glen Canyon and considerably lower along downstream reaches, 3) tributary inputs of organic matter dominate the carbon budget for downstream reaches, and 4) invertebrate biomass and production is extremely high in Glen Canyon and extremely low in

downstream reaches. Samples are currently being processed and analyzed for stable isotope ratios of carbon, nitrogen, and hydrogen.

RECOMMENDATIONS:

Continue project to determine carbon flow and trophic linkages in CRE. If hydrogen stable isotope analysis proves to be a useful tracer of trophic linkages it is recommended that the budget for this project be increased by $10,000 annually to cover the additional cost of analyzing samples for hydrogen stable isotopes.

Project B.3 Ongoing Provisional Monitoring – Status and Trends of Downstream Fish Community

PROGRESS STATEMENT:

All sampling trips occurred as scheduled and data have been incorporated into the GCMRC long-term fish monitoring database. Results continue to suggest depressed relative abundance of rainbow trout and increased abundance of flannelmouth sucker and bluehead sucker relative to previous years.

RECOMMENDATIONS:

Downstream monitoring will be modified during 2007 to allow for sampling in association with a concurrent abundance estimator of the LCR population of humpback chub.

Project B.4 Ongoing Provisional Monitoring – Status & Trends of Lees Ferry Trout

PROGRESS STATEMENT:

All sampling trips occurred as scheduled and data have been incorporated into the GCMRC long-term fish monitoring database. Results continue to show depressed relative abundance of rainbow trout and increased condition factor.

RECOMMENDATIONS:

Continue long-term monitoring, conduct Protocol Evaluation Panel in 2007.

Project B.5 Completion of Habitat Map and Inventory in Support of Monitoring

PROGRESS STATEMENT:

Digital map is complete except for metadata. Written report in draft form waiting for co-author comments. Mapping effort identified six vegetation classes for the river corridor. Total vegetated area varies by reach. Tamarisk covered 494 ha., wetland covered 227 ha., and Baccharis/coyote willow covered 94 ha. Reach based effects appear to override patterns observed previously, which showed distance from dam affected vegetated area, at least with respect to marsh communities. The long-term loss of sediment in the system may have reduced this previously reported downstream pattern.

RECOMMENDATIONS:

Use 2005 imagery to determine feasibility of change detection as a monitoring tool for woody riparian vegetation.

Project B.6 Completion of Experimental Treatment - Spawning Redds and Suppression Mechanisms

PROGRESS STATEMENT:

All sampling trips were conducted as planned. Ageing estimates were delayed because we investigated using another ageing lab. Age estimates will be completed by Mar. 2007. Analysis of available data is underway.

RECOMMENDATIONS:

Recommend continuing this work in 2007.

Project B.7 Mechanical Removal of Nonnative Fish

PROGRESS STATEMENT:

The mechanical removal project was an experimental effort scheduled for implementation for 4 years in the mainstem Colorado River above and below the mouth of the Little Colorado River. The year 2006 was the 4th year of the project. The project was initiated because rainbow trout in this reach were thought to pose a significant threat to native fishes, especially humpback chub. While all nonnative fishes captured during this project were removed, the majority of fish captured and removed were rainbow trout. Hoop nets were also deployed in the reach in order to monitor small bodied fishes not usually captured by electrofishing, the primary method employed. In 2006, the numbers of rainbow trout captured dropped dramatically as compared to previous years. For example, by August 2005, 2,171 rainbow trout had been captured and removed by this project. A total of 2,422 rainbow trout were removed in 2005. By comparison, by August 2006, only 945 rainbow trout had been captured and removed. Therefore, the decision was made to not conduct electrofishing on the final trip of the year in September 2006, although hoop nets were deployed to continue the small bodied fish monitoring. The total number of rainbow trout removed over the 4 years of the project was 20,636

RECOMMENDATIONS:

Continuation of project only as dictated by long-term experimental planning.

Project B.8 Ongoing Humpback Chub Action – Translocation of Humpback Chub

PROGRESS STATEMENT:

The U.S. Geological Survey's Grand Canyon Monitoring and Research Center (GCMRC) contracted the U.S. Fish and Wildlife Service (USFWS) to conduct a May (May 23-26, 2006) and a June (June 28–July 3, 2006) monitoring trip from above Lower Atomizer Falls (13.57 river kilometers) to 18.1 rkm within the Little Colorado River.

The two Chute Falls trips were primarily used to conduct mark-recapture efforts to estimate the abundance of HBC ≥ 125 mm between the top of Lower Atomizer Falls and

the base of Chute Falls (13.57 to 14.1 rkm), and from the top of Chute Falls to 18.1 rkm in the LCR, where sampling activities ended. The results of the effort from Lower Atomizer Falls to Chute Falls (lower reach) indicated that there were 707 (SE = 42) HBC ≥ 125 mm during the late May to early July of 2006. Of these fish, it is estimated that there were 328 (SE = 25) HBC ≥ 150 mm, and 206 (SE= 18) HBC ≥ 200 mm. The results of the effort from above Chute Falls (14.1 rkm) to 18.1 rkm (upper reach) indicated that there were 440 (SE = 35) HBC ≥ 125 mm during the late May to early July of 2006. Of these fish, it is estimated that there were 255 (SE = 11) HBC ≥ 150 mm, and 125 (SE= 15) HBC ≥ 200 mm.

During both trips combined, a total of 299 hoop net sets were deployed, yielding 6,993 hours of fishing effort. A total of 13,954 fish were captured, of which 1,430 were HBC, and 12,263 were speckled dace (*Rhinichthys osculus).* Catch per unit effort (CPE) for HBC was 0.179 fish/net-hour. Nonnative fishes comprised 1.9% of the catch. Sixty-two ripe male HBC and one ripe female HBC were captured. Three black bullhead had fish remains in their stomachs (speckled dace or unidentifiable fish). Percent occurrence of the external anchorworm (*Lernaea cyprinacea*) on HBC was 0.5%.
The management plan for this area is now being drafted by Dexter National Fish Hatchery and will be included in their genetics management plan for HBC. This plan will help determine when additional translocations are necessary.

RECOMMENDATIONS:

Continue with mark recapture efforts in spring to estimate population size above Chute Falls. Perform additional translocations when deemed necessary via the genetics management planning effort underway by Dexter National Fish Hatchery.

Project B.9 Warm Water Fish Monitoring Workshop (Previously Completion of Humpback Chub Action – Dam Operations)

PROGRESS STATEMENT:

The workshop was conducted in December 2005 in Flagstaff, AZ.

RECOMMENDATIONS:

Develop a research program and long-term nonnative control plan to address threats from warm water nonnative aquatic species.

Project B.10 Completion of Humpback Chub Action - Monitoring Fish Disease and Parasites in the Colorado River Ecosystem

PROGRESS STATEMENT:

Fish were collected and field necropsies conducted during the June-July field trip. Laboratory work is underway to complete sample processing

RECOMMENDATIONS:

There are no recommendations at this time.

Project B.11 Completion of Humpback Chub Action – Temperature Control Device (Water Temperature Model Development (note: funded under agreement no. 02-aa-40-6750, environmental resources and compliance)

PROGRESS STATEMENT:

The first three tasks (Write routines to reformat UNSTEADY output for BLTM, Develop BLTM input files, and Calibrate and validate model using years 2000 and 2005) were completed in FY06. Documentation of the model was delayed by the experimental options analyses, which were extensive. The model was briefly documented in the experimental options report. More extensive documentation of the model is currently underway as a conference paper for this years' American Institute of Hydrology meeting. The final task above was made possible by publication of the long-term mainstem water temperature dataset as part of the Integrated Quality-of-Water project.

RECOMMENDATIONS:

Continue work on development of a nearshore water temperature model (ongoing in FY07)

Project B.11 Completion of Humpback Chub Action – Temperature Control Device (Organic and invertebrate Drift Exchange between Mainstem and Backwaters; funded under agreement no. 02-aa-40-6750, environmental resources and compliance)

PROGRESS STATEMENT:

Most samples/data were collected and analyzed as planned. Deviations from the proposed sampling include:

- A single backwater was instrumented with hydroacoustics for the entire 2-month study. We had proposed instrumenting a backwater for the 1st treatment block and then moving the instruments to a different backwater for the 2nd treatment block. We elected not to do this because we could only find one backwater in Glen Canyon with geometry that was suitable for an acoustic instrument.

- Only three backwaters were sampled, not the five we had planned.

There are only three backwaters in Glen Canyon.

All samples have been processed for organic matter and invertebrate density and biomass, as planned. Mainstem drift data have been analyzed and we have found that there is a relationship between acoustic backscatter and organic matter concentrations. Analysis of benthic organic matter and invertebrate data from backwaters is ongoing.

RECOMMENDATIONS:

Using hydroacoustics to continuously monitor organic drift in the Lees Ferry reach looks very promising. We recommend future studies focus solely on calibrating the acoustic-organic relationship.

Project B.11 Completion of Humpback Chub Action – Temperature Control Device (Compare Near-Shore Native Fish Habitats Under Steady/Fluctuating Flows; funded under agreement no. 02-aa-40-6750, environmental resources and compliance)

PROGRESS STATEMENT:

Data were collected between September 3 and October 22, 2005. Data and report were analyzed and written in 2006. Draft report submitted to GCMRC for internal review in September 2006. Results indicate that of the variables measured, there were no significant differences between the flows. But antecedent conditions and inherent variability of organisms sampled and system as whole results in recommendation that results are viewed cautiously.

RECOMMENDATIONS:

Recommend that laboratory studies be used to address these types of questions in the future.

Project B.12 Ongoing Provisional Monitoring – Status and Trends of the Fish Community From Below Diamond Creek

PROGRESS STATEMENT:

All sampling trips occurred as scheduled and data have been incorporated into the GCMRC long-term fish monitoring database. Preliminary results suggest an increased abundance for flannelmouth sucker, common carp, channel catfish, and striped bass relative to previous years.

RECOMMENDATIONS:

In 2007, fish sampling from Diamond Creek to Lake Mead will occur in late summer as opposed to spring in previous years. This change in sampling protocol is being enacted to improve ability to detect warm-water adapted nonnative fish.

C. CULTURAL RESOURCES

Project C.1 Ongoing Provisional Monitoring of Integrated Archaeological Sites

PROGRESS STATEMENT:

FY06 was the first year of a multi-year research and development project for core monitoring of archaeological resources. Implementation of the first year's work was delayed several months due to disagreement among a subset of AMP stakeholders about how to proceed with project implementation. The project finally got under way in March, 2006 with the first of three geo-archaeological assessment research river trips in FY06. This work was conducted concurrently with treatment planning efforts sponsored

by BOR. In addition to conducting geo-archaeological assessments (as the first step towards grouping sites for future monitoring), testing and evaluating total station vs. LiDAR surveys to quantify rates of erosion was conducted 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 spring, 2007. Both reports will undergo 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.

RECOMMENDATIONS:

Continue R&D project as planned (ongoing in FY07)

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

PROGRESS STATEMENT:

Preliminary results of GIS analysis of archaeological site distributions in relation to projected flow lines were presented to the CRAHG in July, 2006; processing of recently acquired vegetation data (from 2005 overflight mission) is underway and ongoing.

RECOMMENDATIONS:

The tribes did not receive FY06 funding until late in FY06; consequently, they are still in the process of developing proposal for future monitoring approaches. It is anticipated that these projects will entail additional support requirements from GCMRC in the form of GIS data requests, as well as data archiving and peer review. Additional funding may be required to support these programs, but until such time as the projects have been fully defined and accepted by TWG, accurate predictions about additional costs can not be accurately projected.

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

PROGRESS STATEMENT:

FY06 monitoring field work was conducted and completed in October, 2006 at 45 sand bar sites; most of the data have been processed and preparation of a report is currently (January, 2007) underway.

RECOMMENDATIONS:

No changes in monitoring protocols are recommended at this time. We recommend continued tracking of changes in sand bar area, volume and campable area using established protocols in FY07 and FY08, or until such time as alternative sediment storage monitoring protocols are developed. Note: the FY06 budget included costs for collecting sand bar survey data in addition to campable area measurements, but not for processing or analysis of the sand bar survey data, pending final outcome and recommendations of the FY06 sediment PEP. Subsequently, at the request of the Physical Science program manager, these data were processed and analyzed for

inclusion in the 2004 Experimental summary and final Fine-grained Sediment Team (FIST) report. Additional funding to cover the discrepancy between planned and actual FY06 data analysis costs is therefore needed.

D. LOGISTICS OR SUPPORT SERVICES PROGRAM

Project D.1 Ongoing Coordination and Support Program-Logistics Operations

PROGRESS STATEMENT:

The GCMRC provided complete logistical support for approximately 30 research and monitoring river trips through the Grand Canyon in FY06. These trips range in length from 7 to 21 days and from 4 to 36 people in size. Trips were comprised of a variety of motor and oar powered boats operated by contracted boat operators. Projects operating in the Glen Canyon reach of the Colorado River (Glen Canyon Dam to Lees Ferry) were supported by a variety of motor powered boats operated by GCMRC researchers and contracted boat operators. Additionally, research activities on the Little Colorado River and at other locations outside of the Grand Canyon National Park boundaries were supported by helicopter services contracted with the Bureau of Reclamation. Ground based support for other research activities outside of the river corridor were also coordinated with the use of GCMRC leased vehicles.

RECOMMENDATIONS:

Continue providing logistics support for field activities

Project D.2 Ongoing Survey Operations

PROGRESS STATEMENT:

- Completed – Equipment, survey support, or establishing control were provided to the following projects: IASM, KAS, Campsite, NAU/FIST, Sediment Modeling, Control Network, Fish (rangefinder), and foodbase (rod and level).
- Completed – Provide control point information or establish control in support of data collection for cultural project (Pederson, NPS/MNA Arch Excavation) and for the sediment modeling project (Bright Angel Creek).
- Completed – Survey Department houses two control point atlases available for check out. Additional control point maps were mad for IASM/NPS Archaeology, KAS, Control Point Database (GCY), foodbase, and Sediment Modeling.
- Collection of photos and descriptions to populate the control point database is nearly complete. From a total of approximately 850 control points, 299 points concentrated between Lees Ferry and Phantom Ranch need site descriptions (less than 10 points need site descriptions between Phantom and Diamond Creek).
- Progress toward updating historical data for inclusion into a GIS database continues. Updated control point coordinates supplied to NPS facilitated the NPS-funded project to update most of the legacy archaeology survey data. NPS shared a copy of the dataset with GCMRC. The updated data requires verification.

- The procedure for updating FIST historical data was established.
- Several historical datasets are ready for analysis in a GIS platform, but a formal structure for a survey database has yet to be defined.
- Task is ongoing - survey expertise is provided to PIs for georeferencing collected project data, as well as best/appropriate technique for collecting survey data to best meet research goals and project objectives.
- Complete and Ongoing – Evaluation of ground-based LiDAR as a less intrusive mapping technology for monitoring cultural sites is in progress; this includes a comparison between survey techniques and ground-base LiDAR techniques as well as, evaluation of ground based LiDAR as a monitoring tool.
- Evaluation of Oblique Photogrammetry is in the preliminary stages.

RECOMMENDATIONS:

Continue providing survey support as described above.

Explore the use, effectiveness, costliness of the following mapping techniques: ground-based LiDAR, oblique photogrammetry, and improved GPS systems.

Continue historical data integration to updated coordinates.

Define structure of a survey database.

Project D.3 Ongoing Development of Geodetic Control Network

PROGRESS STATEMENT:

As of December, 2006, the GPS network within Grand Canyon has been expanded to include 159 traverse points referencing 39 GPS stations. Additionally, 217 Photo-identifiable hard points have been referenced throughout 18 sites from RM0 to RM225. These stations, combined with the 20 rim control stations, 25 primary river stations, and 170 secondary river stations now total 374 survey monuments and 217 photo-identifiable stations that are referenced to the National Spatial Reference System.

RECOMMENDATIONS:

The final deliverable (2008) will be a comprehensive geodetic control network report for the CRE. The report will include use and analysis of many costly data sets collected between 1990 and 2006 that directly aid modeling and ecosystem change detection capabilities. One major outcome of the report will be the determination of realistic and achievable accuracies for supporting GCDAMP scientific investigations.

E. INFORMATION TECHNOLOGY SUPPORT

Project E.1 Information Technology Support

PROGRESS STATEMENT:

There were no significant deviations from the AWP. Support was provided in the following areas:

- Provided necessary computer hardware and software required by the GCMRC
- Provide computer networking infrastructure
- Met DOI/USGS security requirements
- Maintained computer systems as necessary
- Provide website support

RECOMMENDATIONS:

None

F. ADMINISTRATIVE AND MANAGEMENT

Project F.1 Administrative Operations

PROGRESS STATEMENT:

There were no significant deviations from the AWP. Administrative activities involved oversight and management of facilities, burden and overhead; addressing personnel needs/issues; expenditure tracking; processing of and financial management of cooperative and interagency agreements; processing of contracts; timekeeping; bank card tracking and reconciliation; travel plan and voucher processing; and liaison activities between the USGS administrative groups.

RECOMMENDATIONS:

GCMRC administrative personnel have met with BOR personnel in FY 2007 and will be providing detailed billing information for agreements. In addition, GCMRC and BOR worked together to determine a perceived discrepancy of $1.7 million dollars under the closed agreement (No. 01-AA-40-4640). When the books were compared, the difference in the books came to approximately $400 over the course of the 5-year agreement and $36,296,000. GCMRC and BOR administrative personnel agreed to meet on a consistent basis to maintain an open working relationship and discuss and resolve issues before they become problems.

Project F.2 Program Planning and Management

PROGRESS STATEMENT:

GCMRC program managers actively participated in and provided staff support to AMWG, TWG, SPG, and CRAHG activities. Program managers also coordinated/facilitated implementation of FY06 projects and supervised GCMRC staff. All key GCMRC program manager positions were filled in FY06 including a Chief and Biology Program Manager. A Deputy Chief position was established to oversee internal operations and facilitate integrated multidisciplinary science.

RECOMMENDATIONS:

Fill the recently vacated Physical Program Manager position.

Project F.3 AMWG/TWG Participation

PROGRESS STATEMENT:

GCMRC managers and appropriate staff attended all AMWG and TWG meetings in FY06.

RECOMMENDATIONS:

Recommend renaming this project to represent its actual purpose which is to fund travel costs only to/from TWG/AMWG meetings for USGS employees.

Project F.4 Independent Review Panels

PROGRESS STATEMENT:

Two Science Advisors positions were open from 2005, and three SAs resigned in 2006 at the end of their appointment period. A proposal by GCMRC to AMWG to reduce the Science Advisor group from 10 to 8 was accepted, and three of the five open positions were refilled. Dr. Harold Tyus, fish/aquatic ecologist from UC Boulder; Dr. Don Fowler, anthropologist from UN Reno, and Dr. Ellen Wohl, geomorphologist from CSU, were appointed by the GCMRC Chief as Science Advisor replacements. All three specialists are currently working with existing SAs on review projects.

Continuing SA Appointments are:
Jill Baron, Plant Ecologist, USGS/CSU
Virginia Dale, Systems Specialist, TVA
Lance Gunderson, Adaptive Management Specialist, Emory College
Jim Kitchell, Fish Ecologist, Univ of Wisconsin
Dale Robertson, Limnologist, USGS

The SAs produced the following reviews of documents in 2006:

- Knowledge Assessment Report (KAR)
- Section of SCORE Report
- Draft HBCC
- Strategic Science Plan (2)
- Monitoring and Research Plan (2)
- FY 2007 Annual Work Plan and Budget
- Hydropower Economic Statement of Work Review
- Biophysical/Socio-Cultural Statement of Work Review

Science Advisory Services of SAs:
The SAs, and specifically the SA Executive Secretary, agreed to significantly increased contributions of advisory services to the AMP in 2006 to ensure support to planning process needs in science and management. This has involved contributions in the following areas.

- A Science Planning Group to develop AMP science plans; i.e., SSP, MRP, AWP and Budget
- SPG to develop experimental options
- Review and advisory service to TWG and GCMRC
- Advisory service to Task Team for Experimental Options Assessment Resource Requirements

RECOMMENDATIONS:

Selected recommendations of the Science Advisors from various reviews are as follows:

- Incorporate ecosystem paradigm into more elements of research, monitoring, and management actions
- Focus on most critical management resource concerns
- Implement aggressive HBC program of research, monitoring, and management actions
- Redirect aquatic food base program
- Focus new food base program toward key higher trophic resources
- Direct science program with strategic and operational science questions
- Determine how to integrate management actions into ongoing science/monitoring programs

The FY 2007 and FY 2008 budget for Science Advisor programs should be reduced to previous levels of between $170,000 and $190,000.

Project F.5 Support for Strategic Science Implementation Planning

PROGRESS STATEMENT:

The SPG has documented their process and performance in "A Report on Activities and on Accomplishments of the GCD AMP Science Planning Group: 2005-2006." In brief, the SPG:

- Developed and followed a 12-month plan of specific objectives, and proposed schedules, costs, and outcomes.
- Utilized an open process of all AMP parties' involvement in multiple workshop meetings to develop all plans.
- Produced and evaluated in 12 months and within budget:
    - Three 5-year experimental plan alternatives
    - A 5-year Strategic Science Plan (SSP)
    - A 5-year Monitoring and Research Plan (MRP)
    - A 2007 Annual Work Plan and Budget (AWP)

In conducting its activities, the SPG found the lack of full development in several aspects of the GCD AMP structure and processes that created weaknesses in the science planning process, and will likely affect other future management and science activities in a similar nature. These findings prompted a set of recommendations from the SPG.

RECOMMENDATIONS:

The SPG felt its size, composition, and task orientation contributed strongly to its performance. However, it also determined that its performance and the performance of future task groups could be greatly improved if resolve could be gained in several critical aspects of the structure and processes of the AMP. The SPG identified 10 issues for continued efforts in FY 2007 and 2008. To this end the SPG recommends that the SPG be followed in 2007 by another similar task group that is charged in the 12-month period to provide resolve to one or more of five critical issues.

- Develop improved methods and/or procedures for managers to establish and articulate priorities for specific 3-5 year time intervals.
- Develop improved methods for managers and scientists that permit more effective tradeoff assessments.
- Develop more effective scientist/managers collaborative working procedures.
- Implement methods to monitor and improve the adaptive management process.
- Implement methods to define future conditions (DFCS) for the Colorado River Ecosystem resources of concern.

Project F.6 GCMRC's FY 2006 Biennial Science Symposium

PROGRESS STATEMENT:

Symposium completed; SCORE Report written and published; see the following link for abstracts, etc.
http://www.gcmrc.gov/news_info/outreach/symposiums/2005/sym_2005.htm

RECOMMENDATIONS:

Conduct the next science symposium in FY08 in coordination with the Upper Basin Recovery Implementation Program and the Lower Basin Multi-species Conservation Plan.

Project F.8 AMWG, TWG Requests During FY 2006

PROGRESS STATEMENT:

Minimal funds were used to help with the costs of publishing the SCORE report.

RECOMMENDATIONS:

None at this time.