Supplement
GCMRC FY04 Work Plan (Revised Final, dated May 5, 2003)
(reflects TWG Budget Recommendations passed 7/1/03)

A. Terrestrial Ecosystem Activities

A.1. Monitoring & Inventory of Terrestrial Resources & Tribal Participation: Integrated biological monitoring of vegetation linking birds, mammals, arthropods, herptofauna, and vegetative structure on reach and river-wide scale, using bird patch size as minimum sampling unit. Also linking hydrology to vegetation composition change and implementing statistically based sampling scheme for long-term monitoring of status and trends. New RFP in FY04. ***The Principal Investigators on the Terrestrial Ecosystem Monitoring project propose to use FY 2004 for synthesis and completion of existing data sets, writing synthesis reports, papers for submission to peer-reviewed journals, and performing field work at a level which, although reduced, will provide continuity with the first three years of this project.***

-- Tribal Participation: One-year continuation of work begun in FY 2001 and continued in FY 2002-03. Participating tribes will work with biologists to incorporate tribal perspectives within long-term terrestrial ecosystem monitoring plan. ***Additional funding represents transfer of river trip funds from PA budget to partially cover logistical costs of monitoring work conducted by the three participating tribes.***

A.2. Monitoring Kanab Ambersnail: Sampling and estimating population status of snails at Vaseys Paradise. Includes measurement of habitat. Logistics support for supplemental population surveys included. ***Eliminate estimation of habitat and snails above 100,000 cfs.***

A.3. New Terrestrial Research: Research dependent on information needs and strategic planning. ***Funding and project eliminated in FY04.*** (*Note:* in FY04 work plan, project A.3 is the Cultural Data Base Plan):

A.4. Mapping Holocene Deposits: Purpose of this project was two-fold: (1) to document spatial extent of Holocene deposits within the Canyon to define the area potentially affected by dam operations relative to sediment deposits, cultural and recreational resources, and (2) refine our knowledge of the temporal age and depositional environment of various Holocene deposits to improve understanding of buried cultural site distributions. This project would have implemented a cultural PEP recommendation. ***Project eliminated.*** (*Note:* in FY04 work plan, Project A.4 is the terrestrial habitat map; this A.4 project description corresponds to the A.4 title on budget sheet):

Note: ***Italicized boldface type*** indicates the changes to the project that will be made as a result of the FY04 budget recommendation by the GCD AMP Technical Work Group.

A.5. Terrestrial Habitat Mapping and Inventory: Project involving remote sensing approach using digital color infrared imagery to create comprehensive canyon wide vegetation map for river corridor. ***Originally scheduled for completion in FY03-has been extended in FY04 for ground truthing and correction of maps and production of final base map product.*** (*Note:* in the FY04 work plan, this project is numbered A.4 and A.5 is Kanab Ambersnail Taxonomy Project.)

A.6. Cultural Resource Data Base Plan: Cultural PEP recommended development of a database plan to identify types and current locations of existing cultural data, compile existing data into a relational data base, identify future data base needs, and address data access and confidentiality issues related to compilation, use, and dissemination of sensitive cultural data. ***Project eliminated. Funding transferred to A.1 Terrestrial Ecosystem monitoring project. Elimination of project funding means that development of a cultural database plan will become an unfunded component of the IT work load.*** (*Note:* in the FY04 work plan, this project was numbered A.3.)

A.7. Kanab Ambersnail Taxonomy (Year 1): First year of multi-year project to resolve taxonomic issues associated with *Oxyloma* complex. Funding of $100,000 additional per year from USGS appropriated funds. ***New RFP probable to obtain best available science.***

B. Aquatic Ecosystem Activities

B.1. Foodbase Monitoring: Data collection and analysis of algae, benthos, drift and organic carbon flux to measure response to operations. ***Increased emphasis will be in Glen Canyon and in association with gauging stations in Grand Canyon. Program is responsive to aquatic PEP report and retains status and trends sampling sites implemented in FY02. Project Activities to be conducted by GCMRC and NAU/CESU. This project will involve an RFP process beginning in FY05 or 06.***

B.2. Monitoring Downstream Fish: New RFP to be issued in FY04. Data collection and analysis of fish populations in the mainstem and Little Colorado River likely involving 4 LCR trips and mainstem trips that include 2 trips for estimates of trout (rainbow, brown), carp, and other non-nativefishes distribution and relative abundance. 3 trips to develop native fish abundance estimates and for synoptic surveys to detect distribution changes. ***Increase will be used to support increased level of GCMRC staff and contractor interaction with Upper Colorado River Endangered Fishes Recovery Program, participation in workshops, as well as increased articulation with Lower Colorado River RIPSWIG.***

B.3. Monitoring Lees Ferry Trout: New RFP in FY04 involving population estimates for Lees Ferry trout fishery including proportional stock density and condition factor of fish. ***No Changes.***

B.4. IWQP Downstream Activities: Water quality monitoring downstream within the intention of expansion of parameters measured as per PEP recommendations. Monitoring plan is under development. ***Elimination of WRD contract and increased temperature monitoring in anticipation of TCD.***

B.5. Native and Non-native Fish Interactions Research: Projects will include predator-prey interactions, competition, and bioenergetics model development. Design and technical assistance with non-native fish control. ***Project eliminated-subsumed in experimental flow program and non-native fish control.***

B.6. Captive Breeding Program: Originally proposed as a feasibility analysis of factors needing to be addressed in the potential development of a captive breeding program for HBC or other native fishes for the Grand Canyon. ***Project was eliminated from FY04 Workplan and funds reprogrammed from FY03 to address this need at the request of the AMWG. Draft Final Report Submitted to AMWG for August 2003 mtg.***

B.7. IWQP Lake Powell: Monthly and quarterly monitoring program for Lake Powell. Sampling for major ions and nutrients, temperature, conductivity and dissolved oxygen, transition to CEQUAL model based predictive capability ongoing. Project forms basis for most predictive capability for downstream water quality parameters, including temperature. ***Decreased funding reflects a combination of reduced field sampling frequency and parameters as increasing use of CEQUAL model ensues as well as USBR paying directly for support personnel and laboratory analyses.***

C. Integrated Terrestrial and Aquatic Ecosystem Activities

C.1. Fine-Sediment Storage Monitoring & Research: This project's main objective is to measure changes in the area, volume and grain-size characteristics of sand bars above and below the 8,000 cfs flow elevation, supports Goal 8, MO's 8.1 through 8.5. This is an ongoing project in 2001-2005, with review and revision of monitoring protocols for fine-sediment storage in FY05 and implementation of long-term monitoring in FY06. ***Although the budget decrease appears small, considerable funding has been redirected towards aeolian transport research in relation to cultural sites. Also, cultural program salary from eliminated projects D.6 and D.7.is now tied to this project. Budget reduction and reprogramming means that only 8 of the 11 reaches will be monitored in FY04.***

C.2 Stream flow & Fine-Sediment Transport (System-Wide Mass Balance): The main objective of this project is to measure high-resolution changes in mass flux of sand and fines under range of dam operations and tributary inputs, supports Goal 8, MO's 8.1 through 8.5. The project is ongoing in 2001-2005, with review and revision of monitoring protocols for fine-sediment storage in FY05 and implementation of long-term monitoring in FY06. ***Budget reductions mean that operation of the Glen Canyon gage is eliminated in FY04, and uncertainties in sand export (owing to unmeasured inputs from Havasu and Kanab Creeks) below Phantom remain unresolved. However, key measurements for suspended-sediment transport continue at both the Grand Canyon and Diamond Creek stations as a means of calculating sand-export loads. Evaluation of sediment-surrogate technologies for monitoring suspended-sediment transport shall be continued, but without an expanded scope system-wide.***

C.3. Coarse-Sediment Inputs & Impacts Monitoring & Research: The objective of this project is to measure area, volume and grain-size characteristics of coarse sediment inputs from tributary debris flows and stream floods, along with changes in physical habitats under range of dam operations, supports Goal 8, MO's 8.6 through 8.7. The project is ongoing in 2001-2005, with review and revision of monitoring protocols for coarse-sediment storage in FY05 and implementation of long-term monitoring in FY06. ***Budget reductions mean less emphasis on physical habitats and integration in FY04.***

C.4. Fine-Sediment Transport Modeling and Sand-Bar Evolution: The objective of this research project is to develop a predictive capability for estimating the fate of fine-sediment inputs from Paria River, as well as simulation of multidimensional sand-bar evolution under range of dam operations and sand-supply conditions, supports Goal 8, MO's 8.1 through 8.5. The project is ongoing in 2002-2004, with project completion and review in FY04, followed by model verification in FY05 and FY06. ***The budget remains nearly whole in FY04, so that research project can be completed as proposed. Some field efforts are eliminated in the third and final year.***

C.5. Development of Colorado River Ecosystem Control Network: Spatial positioning of natural and cultural resource data collected in the CRE is fundamental to performing spatial analysis and change detection and integrating data from multiple disciplines. Integrating and analyzing data on a regional scale requires that spatial data be referenced to a real world coordinate system. Currently, only about half of the CRE has geographic control. However, this control is of insufficient accuracy for most GCMRC monitoring and research activities and is not tied into a real world coordinate system. The remainder of the CRE either does not have control at all or has control established in a local coordinate system. To fully implement the long term monitoring and research plan adopted by the AMWG, existing control needs to be updated and tied into the a real world coordinate system and additional control needs to be established in the portion of the CRE that has none. The objective of this project is to develop a high-precision control network throughout the CRE that meets the current and projected needs of natural and cultural resource monitoring and research projects. Control monuments will be established at a line-of-sight interval depending upon terrain. ***Reduced funding during 2004 will delay the completion of CRE control network.***

C.6. Development of Colorado River Ecosystem Hydrographic Mapping Program: Channel geometry and morphology is currently unknown below a water elevation of 8,000 cfs in the Colorado River Ecosystem (CRE). This information is critical for modeling stage/discharge relationships and sediment transport in the CRE as well as sub-aqueous topographic change detection. The objective of the project is to develop a hydrographic basemap of the CRE below a water elevation of 8,000 cfs in the mainstem Colorado River between Glen Canyon dam and lake Diamond Creek. ***Reduced funding during 2004 will delay the completion of CRE hydrographic base map by one year.***

D. Other Science Activities

D.1. Unsolicited Proposals: This budget category funded diverse and relatively small-scale unsolicited projects such as the Kaibab Band of Paiute Indian's tribal education/outreach initiative and Grand Canyon River Guides' Adopt-a-Beach Program. Budget eliminated. ***Budget elimination means these previously funded projects will not continue in FY04 and no new unsolicited projects will be funded.***

D.4. Tribal Outreach: This project proposes to develop additional mechanisms for integrating tribal perspectives in GCMRC and AMP activities through sponsoring a series of workshops and recruiting a student intern. ***Budget increase restores funding to the original proposed level, but the restored funding only partially recaptures cultural program salary losses resulting from elimination of cultural projects A.6, D.1, and D.5. Thus, there is a net reduction in project funding for the workshops and internship, as more of the budget is reprogrammed to cover cultural program salary.***

D.5. Public Outreach: This project was originally intended to implement a public outreach plan approved in FY03 for the dissemination of information relating specifically to the cultural program. The original project implemented a recommendation of the cultural PEP. AMWG recommended redefining the project scope to include outreach for all AMP activities, including outreach for the HBC action plan initiative. ***Increase funding reflects shift in project scope to include outreach for all AMP-related activities. Outreach will be accomplished through contracts with a professional public relations firm and through collaboration with NAU's School of Communication.***

D.6. Cultural Resource Synthesis and Status Report: The objective of this project was to synthesize and evaluate the previous five years of sociocultural research and monitoring studies, evaluate the status of current knowledge from an integrated interdisciplinary perspective, incorporate this information in the SCORE Report, and identify future research and monitoring needs. This project addresses M0s 11.1 and 11.2. ***Project eliminated; funds moved to C.1.***

D.7. Cultural Affiliation Study: This project proposed to evaluate existing information relating to tribal affiliation and identify data gaps requiring future research for the purposes of meeting the requirements of the Native American Graves Repatriation Act. ***Project eliminated; funds moved to C.1.***

E. Administrative and Management

No changes.

F. Technical Support Services - Information Technology Activities

F.1. Geographic Information Systems: The GIS is a core information technology used by the GCMRC. Its purpose is to provide spatial analysis capabilities to GCMRC staff and stakeholders and maintain a library of GIS thematic coverages of the study area. The GIS is an important analytical tool for change detection of biological, cultural, and physical data relating to the operations of Glen Canyon Dam. ***Reduced funding in FY 2004 will result in delayed implementation of the spatial data engine and internet map server due to delays in purchasing necessary hardware and software to implement the system. Additionally, student positions utilized to transpose, import, and populate the data systems may need to be abolished.***

F.2. Data Base Management: The purpose of the DBMS is to store and deliver tabular and other electronic data pertaining to the CRE. The need for a comprehensive database for maintaining this information was recognized by the National Academy of Sciences in their initial review of the GCES Program in 1987, and reinforced during a second review in 1990. Extensive data and information currently exists in the GCMRC collections relating to resource conditions, quality, and relationships to other resources. Potentially equal amounts of data and information exist within museums, universities, agencies, etc. However, much of this information has not been organized, managed or integrated into an analysis of the interrelationship among various resources and dam operations. The GCMRC data base management systems will, to the extent possible, integrate these vast and disparate data sets into a single ecologically integrated database that can be accessed by stakeholders, scientists, and the public interested in analyzing data pertaining to the Colorado River Ecosystem. ***Reduced funding in FY 2004 will result in delayed implementation of the Oracle database system due to delays in purchasing necessary hardware and software to implement the system. Additionally, student positions utilized to transpose, import, and populate the data systems may need to be abolished.***

F.3. Library Operations: Library operations are a core information technology used by the GCMRC ITP. Its purpose is to facilitate research by providing a centralized repository for hard copy information such as books, reports, maps, photography, and videos. The scope and purpose of the library is to collect, archive and deliver those materials that assist the center in its efforts to administer long-term monitoring and research. The library has additionally embarked upon a project to digitize historical library content so that this information can be accessible through the Internet. ***Reduced funding in FY 2004 will result in delayed delivery of digitized historical library content over the Internet due to delays in purchasing necessary hardware and software to implement the system. Additionally, student positions utilized to digitize and format historical library content may need to be abolished.***

F.4. Survey Operations: The Survey department's mission is to provide survey support for spatial measurement and referencing of scientific data collected in the Colorado River ecosystem by GCMRC programs. This support may be in the form of precise measurement of geographic coordinates of a sample collected in the Canyon or in the generation of topographic maps used for erosion monitoring of terraces adjacent to the Colorado River. The Survey department is also responsible for establishing and maintaining accurate geographic control in the Canyon that is essential for accurate geo-referencing of remotely sensed data and change

detection of resource data using modern image processing and GIS technologies. The survey department has additionally embarked upon inventorying historical survey data sets for the last 15 years so that these may be integrated into the DBMS and IMS for the purpose of analysis relative to modern data in their respective scientific areas. ***Reduced funding in FY 2004 will result in delayed implementation of the canyon-wide control network and hydrographic basemap as described in C.5 and C.6 above.***

F.5. Systems Administration: The GCMRC computing environment is a complex system of servers, workstations, laptops, printers, plotters, modems, routers, hubs, switches, copy machines, FAX's, and telecommunications equipment networked together using 100baseT networking media. Most of the computers are of the PC type running the Windows NT/2000 operating system. In addition, over 50 applications are utilized by GCMRC scientists and support personnel in carrying out the collective mission of the GCMRC. Applications are primarily off-the-shelf products but in many cases are highly specialized. The system administrator develops, implements, and troubleshoots the infrastructure necessary to support the complex computer environment at GCMRC. ***Reduced funding in FY 2004 will result in delayed implementation of the data delivery systems used for database management, geographic information, library, and web services due to delays in purchasing due to delays in purchasing servers, disk arrays, and software necessary to implement the system.***

F.6. Aerial Photography: Natural and cultural resource monitoring in the Colorado River Ecosystem is logistically difficult, expensive, and invasive. Depending upon accuracy requirements, remotely sensed data sets can provide data useful to Glen Canyon Dam Adaptive Management Program monitoring activities that have one or more of the following benefits: (1) cost less, (2) cover larger geographic areas, and (3) have less impact on the ecosystem. In addition, single acquisitions can serve the needs of multiple monitoring programs. ***Reduced funding in FY 2004 will result in the collection of traditional hardcopy print aerial photos. These will neither be digital or orthorectified. Automated image analysis and area calculations will not be possible without further (expensive) processing. Hardcopy prints deteriorate with age and will require digitizing in the future to preserve their integrity.***