APPENDIX E

Glen Canyon Dam Adaptive Management Program
Bottom Line Funding Needs – Fiscal Year 2003

I. PROGRAM ADMINISTRATION

A. ADAPTIVE MANAGEMENT WORK GROUP[1]

1.	Personnel Costs	173,000
2.	AMWG Member Travel Reimbursement	10,000
3.	Reclamation Travel	17,000
4.	Facilitation Contract	25,000
5.	Other	11,000
	Subtotal	236,000

B. TECHNICAL WORK GROUP[2]

1.	Personnel Costs	81,000
2.	TWG Member Travel Reimbursement	10,000
3.	Reclamation Travel	18,000
4.	TWG Chair Reimbursement	25,000
5.	Other	2,000
	Subtotal	136,000

C. SCIENCE ADVISORS

	Program Manager	0
	Subtotal	0

D. COMPLIANCE DOCUMENTS[3]

1.	Biologist (0.25 fte)	26,000
	Subtotal	26,000

E. TEMPERATURE CONTROL DEVICE

F. CONTRACT ADMINISTRATION[4]

1.	Contract Specialist (0.25 fte)	25,000
	Subtotal	25,000

II. TRIBAL CONSULTATION

A. Cooperative Agreements with Tribes[5]

1.	Hopi Tribe	80,000
2.	Hualapai Tribe	80,000
3.	Navajo Nation	80,000
4.	Pueblo of Zuni	80,000
5.	Southern Paiute	80,000
	Subtotal	400,000

B. River Trip Logistical Costs to GCMRC[6]

1.	Hopi Tribe	15,000
2.	Hualapai Tribe	15,000
3.	Navajo Nation	15,000
4.	Pueblo of Zuni	15,000
5.	Southern Paiute	15,000
	Subtotal	75,000

Glen Canyon Dam Adaptive Management Program
Bottom Line Funding Needs (continued) – Fiscal Year 2003

III. PROGRAMMATIC AGREEMENT FOR CULTURAL RESOURCES

A. WORK PLAN ACTIVITIES

1. Reclamation Administrative Costs[7]	50,000
2. Geomorphological Effect Study with GCRMC[8]	200,000
3. NPS Monitoring Costs[9]	228,500
4. Contract for Treatment Plan & Monitoring Plan[10]	200,000
Subtotal	678,500

IV. EXPERIMENTAL FLOW FUND[11] 450,500

V. GCMRC SCIENTIFIC ACTIVITIES[12, 13]

A. TERRESTRIAL ECOSYSTEM ACTIVITIES

1. Monitoring & Inventory of Terrestrial Resources[14]	445,000
a. Tribal Participation	125,000
2. Monitoring Kanab Ambersnail[15]	81,000
3. Kanab Ambersnail Taxonomy (Year 1)[16]	100,000
4. New Research in Terrestrial Ecosystems[17]	7,000
5. Mapping Holocene Deposits[18]	112,000
6. Implementation of GCMRC HPP & PEP Activities[19]	0
7. Terrestrial Habitat Mapping and Inventory	251,000
8. Cultural Resource Monitoring & Mitigation	22,000
Subtotal	1,143,000

B. AQUATIC ECOSYSTEM ACTIVITIES

1. Phyto-benthic Monitoring[20]	256,000
2. Monitoring Downstream Fish[21]	929,000
3. Monitoring Lees Ferry Trout[22]	155,000
4. Native and Non-native Fish Interactions Research[23]	91,000
5. Ongoing Population Genetics of Humpback Chub[24]	7,000
6. IWQP Downstream Activities[25]	150,000
7. IWQP Lake Powell (O&M Funding)[26]	300,000
Subtotal	1,888,000

C. INTEGRATED TERRESTRIAL & AQUATIC ECOSYSTEM ACTIVITIES

1. Monitoring Fine-grained Sediment Storage[27]	366,000
a. Beach Monitoring (continuation of NAU work)	75,000
2. Monitoring Streamflow & Fine Sediment Transport[28]	575,000
a. One-year Evaluation of In-Situ Continuous Monitoring of Suspended-Sediment Transport[29]	80,000
b. Installation of Automated Pump Samplers[30]	50,000
c.Advance Warning for Paria River Sediment Inputs[31]	30,000
3. Monitoring of Coarse-grained Sediment[32]	138,000
4. One-dimensional Fine Sediment Routing Model[33]	231,000
5. Conceptual Modeling of Coarse-grained Sediment[34]	100,000
6. Control Network[35]	86,000
7. Channel Mapping[36]	118,000
8. Recreational Effects to Cultural & Biological Resources[37]	47,000
Subtotal	1,896,000

Glen Canyon Dam Adaptive Management Program
Bottom Line Funding Needs (continued) – Fiscal Year 2003

D. REMOTE SENSING ACTIVITIES
1. Digital Imagery and LIDAR 523,000

E. OTHER SCIENCE ACTIVITIES
1. Unsolicited Proposals 53,000
   i. Adopt-a-Beach with Integration Report 10,000
2. AMWG/TWG Requests 76,000
3. In-house Research 26,000
4. Tribal Training, Science/Tribal Perspectives Integration/ Tribal Interns[38] 44,000
5. PEP/PA stipulated public outreach/involvement plan[39] 35,000
6. Cultural Resources Synthesis and Status Report[40] 15,000

Subtotal 259,000

VI. GCMRC ADMINISTRATIVE & TECHNICAL SUPPORT

A. ADMINISTRATIVE & MANAGEMENT[41]
1. Administrative Operations 755,000
2. Program Planning & Management 302,000
3. AMWG/TWG Participation 52,000
4. Independent Review Panels 212,000

Subtotal 1,321,000

B. TECHNICAL SUPPORT SERVICES[42]
1. Geographic Information Systems 150,000
2. Data Base Management 113,000
3. Library Operations 62,000
4. Survey Operations 122,000
5. Decision Support System[43] 150,000
6. Systems Administration 250,000
7. Aerial Photography (see budget under V.B.1.)
8. Logistics (costs distributed to projects)

Subtotal 847,000

TOTAL FY 2003 BUDGET 9,904,000

FY 2003 FUNDING REQUESTS

AVAILABLE FUNDS	AMOUNT
CRSP Power Revenues	$ 8,325,000
DOI Tribal Funding Appropriations	$ 475,000
O&M – IWQP Lake Powell Studies	$ 300,000
USGS Appropriations	$ 774,000
Other Funding Sources	$ 30,000
TOTAL	$ 9,904,000

GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM
Project Descriptions for Fiscal Year 2003

[1] Adaptive Management Work Group (AMWG). This includes personnel costs required to administer the Adaptive Management Program (AMP), travel funds to reimburse members/alternates for attendance at AMWG, ad hoc, and other meetings, and a facilitation contract for meeting management and/or special ad hoc assignments.

[2] Technical Work Group (TWG). This includes personnel costs needed to administer the TWG, travel funds to reimburse members/alternates for attendance at TWG, ad hoc, and other meetings required in the completion of AMWG/TWG assignments, as well as reimbursement for the TWG Chairperson.

[3] Compliance Documents. This covers funding for preparation of compliance documents for AMP-proposed actions in order to comply with ESA, NEPA, and NHPA.

[4] Contract Administration. These are Reclamation personnel costs needed to administer the AMWG facilitation, TWG Chairperson, and Programmatic Agreement contracts.

[5] Cooperative Agreements with Tribes. Each of the five tribes with demonstrated interests in the effects of Glen Canyon Dam operations on resources of tribal concern will continue to be funded through cooperative agreements. These agreements are for $80,000 per tribe (or consortium of tribes) annually. Funds are designed to cover salary, benefits, travel, and indirect costs to enable an official tribal representative to attend meetings wherein government-to-government consultation occurs on AMP activities, issues, and proposals. Funds also ensure the tribal representative maintain communication within their tribes regarding the AMP.

[6] River Trip Logistical Costs to GCMRC. Each of the five tribes is allocated $15,000 to monitor resources of tribal concern and to report back to the AMP and the Secretary regarding the observed effects of dam operations or other management actions. The funds are transferred from the federal agencies within the AMP to Reclamation to the GCMRC to pay for river guides, boats, fuel, food, etc.

[8] Reclamation Administrative Costs. A total of $50,000 has been projected to cover salary, benefits, travel, and indirect costs of administering the PA program.

[8] Geomorphological Effect Study with GCMRC. Depending upon the results of the geomorphology workshop (FY02), it may be reasonable and feasible to conduct geomorphological investigations into mapping or modeling exactly where and how dam operations affect historic properties. This project is contingent upon the workshop,. Costs are estimates based on some preliminary input from geomorphologists.

[9] NPS Monitoring Costs. Existing monitoring programs of the NPS will remain unchanged until the new plan is implemented in FY04 (contract for treatment and monitoring plan is FY02).

[10] Contract for Treatment and Monitoring Plan. When the research design is complete and there is an evaluation of the relative values of the historic properties, and once the direct and indirect effects of dam operations are more precisely mapped or identified, it is necessary to resolve adverse effects of dam operations on properties eligible to the National Register. This resolution and the proposed mitigation measures will be described in a treatment and monitoring plan that will be contracted.

[11] Experimental Flow Fund. Experimental Flows are a key part of the Adaptive Management Program. These funds cover monitoring and research activities required for doing experimental flows in an effort to improve our understanding of ecosystem processes. It's anticipated these funds could be carried over from year-to-year and accumulate to such a level that an experimental test flow could occur.

[12] Scientific Activities. Project descriptions and budget estimates have been built using information from current and draft information needs, recommendations contained in PEP reports, and existing monitoring and research activities that have been funded as multi-year projects. It is expected that as the revision to existing information needs and the AMP Strategic Plan is completed, the details for a given project may be revised. We believe the bottom-line budget figure presented here is a reasonable estimate of the funds needed for FY 2003 given existing information.

[13] Project costs include contract costs, salaries for GCMRC staff, logistics, GIS and survey support, and other operational costs.

[14] Monitoring & Inventory of Terrestrial Resources & Tribal Participation: Integrated biological monitoring linking birds, foodbase and vegetative structure on reach and river-wide scale, using bird patch as minimum unit. Also linking hydrology to vegetation composition change and developing minimum sampling scheme for long-term monitoring.

-- Tribal Participation: One year continuation of work begun in FY 2001 and continued in FY 2002. All five participating tribes to work with biologists on terrestrial monitoring to incorporate tribal perspectives within biological monitoring project.

[15] Monitoring Kanab Ambersnail: Measuring and estimating population status of snails at Vaseys Paradise. Includes measurement of habitat. Logistics support for supplemental population surveys included.

[16] Kanab Ambersnail Taxonomy (Year 1): First year of multi-year project to resolve taxonomic issues associated with *Oxyloma* complex.

[17] Terrestrial Interactions Research: Unidentified research depending on information needs and strategic planning.

[18] Holocene Mapping: Continuation of approved work for FY 2002 to document Holocene deposits within the Canyon. Project purpose is to define the area potentially affected by dam operations relative to sediment deposits, cultural and recreational resources. Implements a

cultural PEP recommendation. Scale of project defined by existing information and feasibility based on scoping meeting held early in FY 2002.

[19] Cultural Resource Monitoring Plan: Implementation of GCMRC portion of HPP and PEP specified integrated Monitoring Plan that was developed during FY 2002 by BOR and GCMRC. Monitoring Plan specifies articulation between AMP cultural programs.

[20] Phyto-benthic Fast-response Monitoring: Data collection and analysis of algae, benthos and drift to measure response to operations. Emphasis may be in Glen Canyon and in association with gauging stations in Grand Canyon. Program is under review and development.

[21] Monitoring Downstream Fish: Data collection and analysis of fish populations in the mainstem and Little Colorado River. Request is for 4 LCR trips and 6 mainstem trips that include 2 trips for estimates of trout (rainbow, brown) and 3 trips to develop native fish abundance estimates and for synoptic surveys to detect distribution changes.

[22] Monitoring Lees Ferry Trout: Population estimates for Less Ferry trout fishery including proportion stock density and condition factor of fish.

[23] Native and Non-native Fish Interactions Research: Projects are not currently defined, but may include predator – prey interactions, competition, and bioenergetics model development. Dependent on information needs.

[24] Ongoing Population Genetics of Humpback chub: The third year of project to examine the relationships of mainstem and LCR humpback chub. Results will be incorporated into monitoring efforts and compliance issues associated with HBC.

[25] IWQP Downstream Activities: Water quality monitoring downstream within the intention of expansion of parameters measured as per PEP recommendations. Monitoring plan is under development.

[26] IWQP Lake Powell: Water quality monitoring of reservoir, includes monthly and quarterly sampling and incorporation of modeling effort into monitoring program. Monitoring plan is under development consistent with PEP recommendations as indicated in "Response to Comments" document

[27] Monitoring of Fine-Grained Sediment Storage: This project is designed to annually assess the spatial distribution of sand- and finer-sized material stored within the main channel of the Colorado River ecosystem; specifically related to storage in eddy complexes and main-channel pools. Monitoring data shall reflect the relative changes in total volume of sediment and grain-size distribution within a subset of representative reaches throughout the ecosystem, with emphasis on the first 100 miles below the dam. These data support information needs on the state of the available fine-sediment supply in the system subject to influence of dam operations. Related elements of this project include documenting changes in high-elevation sand storage (above 25,000 cfs) related to available campable areas, evolution of sand bar grain-size distribution, changes in the spatial distribution of channel-bed substrates, changes in the number

and size of return-current channels within eddy complexes (backwater habitats) and changes in the size of pre-dam river terraces.

[28] Monitoring Streamflow and Fine-Sediment: This project provides data on streamflow and suspended-sediment transport on the gaged tributaries that provide fine-sediment to ecosystem (influx), and on suspended-sediment transport through critical reaches of the main channel of the Colorado River ecosystem (efflux). It has one research component related to advancing development of a protocol for tracking the fine-sediment budget in real time through a variety of integrated and remotely sensed input data.

[29] One-year Evaluation of In-Situ Continuous Monitoring Of Suspended-Sediment Transport: One-year evaluation of in-situ instrumentation aimed at tracking continuous suspended-sediment transport (reach-scale export) between Glen Canyon Dam and Diamond Creek using laser-diffraction technologies (LISST). Initial evaluation will be conducted using installation of LISST-25 instrument at the Grand Canyon stream gage. Grain-size and concentration data for suspended sediment conditions derived from LISST will be verified using the daily-to-weekly samples collected as part of long-term monitoring. This evaluation will be conducted in collaboration between the GCMRC and the WRD of USGS. (Includes purchase of customized LISST-25 instrumentation).

[30] Installation of Automated Pump Samplers: Installation of Automated Pump Samplers at Moenkopi Wash, Lower Marble Canyon, Grand Canyon and Diamond Creek Stream gages intended to obtain additional needed suspended-sediment data at key main channel sites for use in tracking monthly fine-sediment mass balance by geomorphic reach. This strategy also requires additional funding needed to support stage/discharge monitoring at the Lower Marble Canyon stream gage. These samplers are needed owing to the very remote nature of main channel locations where insufficient sediment samples are currently obtained to track monthly sediment export. These devices could eventually be used to verify additional LISST instruments if that technology proves to be successful.

[31] Advance Warning for Anticipating Paria River Sediment Inputs: This consists mostly of hardware required for instrumentation of the Upper Paria River watershed so that sediment inputs to the main channel of the Colorado River can be better anticipated. The need for this system relates to a desire by managers to have sufficient lead time to allow high flows from Glen Canyon Dam to be released during or immediately following large sand inputs. This network would likely provide from 12-18 hours of advance notice before large Paria River floods reach the main channel.

[32] Monitoring Coarse-Grained Sediment: This project provides data on tributary inputs of coarse sediment introduced by debris flows annually, and information about how these inputs change the geomorphology of the main channel settings where sand storage, recreational, food base and fisheries resources exist.

[33] One-dimensional Fine Sediment Routing Model: This project results in a numerical simulation for routing sand inputs from the Paria and Little Colorado Rivers, downstream through main channel storage settings below Glen Canyon Dam, including eddy complexes and

main channel pools. The simulation uses modeled information on sand inputs, in combination with predictions of travel time and historical and model-derived local conditions of sand bar deposition and erosion.

[34] Conceptual Modeling of Coarse-Grained Sediment Inputs: This project relates ongoing impacts of coarse-sediment inputs to the evolution of the geomorphic framework of the Colorado River ecosystem, under current dam operations, over periods ranging from decadal to centennial time scales. The project specifically examines simulation related to local and system-wide changes to the main channel thought to influence fine-sediment storage, related physical habitats and food base dynamics.

[35] Control Network. The objective of this project is to develop a high precision survey control network throughout the CRE that can be used to georeference and geographically integrate field and remotely sensed monitoring and research data. The project will provide a suitable rim control network and line-of-site floor control network throughout the CRE with accuracies suitable for existing and projected GCMRC natural and cultural resource projects.

[36] Channel Mapping. The objective of this project is to develop a sub-aqueous topographic basemap of the Colorado River channel throughout the CRE at a resolution suitable for habitat mapping and monitoring of sediment load transported on the channel bottom.

[37] Recreational Effects to Cultural and Biological Resources (New Work): New project that identifies and assesses recreational impacts to significant cultural and biological resources in Glen and Grand Canyons. Responds to concerns about commercial boats in Glen Canyon and tribal concerns within Grand Canyon.
Estimated Cost: $ 20,000.

[38] Tribal Training, Science/Tribal Perspectives Integration/Tribal Interns: Follow-on workshops for tribal training, science/tribal perspective integration workshop implementation, and use of tribal student interns. Purpose of work is to increase tribal participation within AMP for project development and implementation.

[39] PEP/PA stipulated public outreach/involvement plan: Development of public outreach and involvement plan as stipulated in the PA agreement and recommended by the cultural PEP. New work that will be jointly funded by the BOR and GCMRC.

[40] Cultural Resources Synthesis and Status Report: Incorporates data and reports developed by AMP cultural representatives to provide a general synthetic knowledge gained from projects and integrated across resource areas. Developed in-house by GCMRC with collaboration with AMP cultural representatives. Project provides current information within SCORE report.

[41] Includes salaries for GCMRC staff not otherwise assigned to project costs.

[42] Includes contract costs, salaries for GCMRC staff, logistics support, and other operational costs not otherwise assigned to project costs or administrative operations and support.

[43] Decision Support System Development: GCMRC provides objective, scientific information to the AMWG for use in making recommendations to the Secretary of the Interior regarding the effects of dam operations on the Colorado River ecosystem (CRE). In support of this effort, GCMRC is developing: (1) a conceptual (i.e., computer) model of the CRE, (2) a detailed map of the CRE, (3) GIS overlays for the CRE, and (3) an integrated Oracle database of research on the CRE. Missing from this equation is the decision-support system (DSS) overlay that can act to integrate these various efforts and support the AMWG in examining various management actions/policy changes that they may wish to recommend to the Secretary.