

## Memorandum

**Date:** May 3, 2011

**To:** Anne Castle, Assistant Secretary for Water and Science, Department of the Interior

**Through:** Mark Sogge, Associate Regional Executive, USGS Pacific Southwest Area

**From:** Ted Melis, Acting Chief, Grand Canyon Monitoring and Research Center  
Glen Knowles, Chief, Adaptive Management Group, Bureau of Reclamation

**SUBJECT:** Summary of Proposed Revisions to FY 2012 GCDAMP Workplan and Budget

In January 2011, the USGS was directed to review and revise the provisional FY 2012 Glen Canyon Dam Adaptive Management Program (GCDAMP) work plan and budget (hereafter “workplan”) to focus on the following Department of the Interior (DOI) priorities:

1. Compliance with the Endangered Species Act, focusing on the native fish, particularly the humpback chub (*Gila cypha*)
2. Sediment, which was an instigating factor for the Grand Canyon Protection Act
3. Nonnative fish control downstream of the dam
4. Recreational trout fishery immediately downstream of the dam

In revising the workplan, the USGS Grand Canyon Monitoring and Research Center (GCMRC) evaluated each activity in the provisional workplan to determine if it met core DOI priorities. Adaptive management program operational activities (e.g., Reclamation and USGS administrative programs, independent science reviews, etc.) were also evaluated. In addition, the workplan was modified to include socio-economic analysis activities. The resulting proposed FY 2012 workplan is described in the following pages. Activities other than support for a quality adaptive management program are organized around the four Phase I Desired Future Condition (DFC) categories:

- DFC #1 Colorado River Ecosystem - food base/food web, native and nonnative fish, spring habitats and riparian vegetation, quality-of-water and sediment
- DFC #2 Cultural Resources - traditional cultural properties, archaeological and historical sites
- DFC #3 Recreation - rafting, camping, fishing, educational activities, spiritual engagement
- DFC #4 Hydropower - maintaining or increasing the dam’s power-generating capacity

The revised workplan also considers or assumes the following:

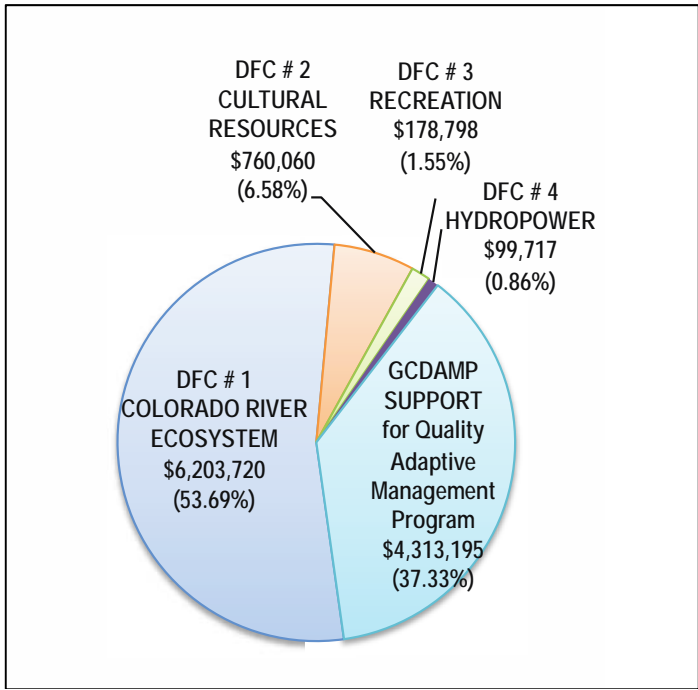
1. The 24 recommendations provided by the Technical Work Group from its March 2011 meeting
2. Anticipated support needs for proposed experimental management and compliance efforts, including monitoring and research activities for the proposed High-Flow Experiment (HFE) Protocol and Non-Native Fish Control (NNFC) experiments proposed to begin in 2011–2012
3. Monitoring of priority resources during the proposed experimental treatments will continue for at least a decade
4. Monitoring and research in support of ongoing humpback chub translocations within the Little Colorado River will continue
5. Completion of nearshore ecology study (tied to 2008–2012 fall steady-flow testing)
6. Provision of science activities to support the Long-Term Experimental Management Plan (LTEMP) Environmental Impact Statement (EIS) efforts in 2012

## Summary of Overall Efforts

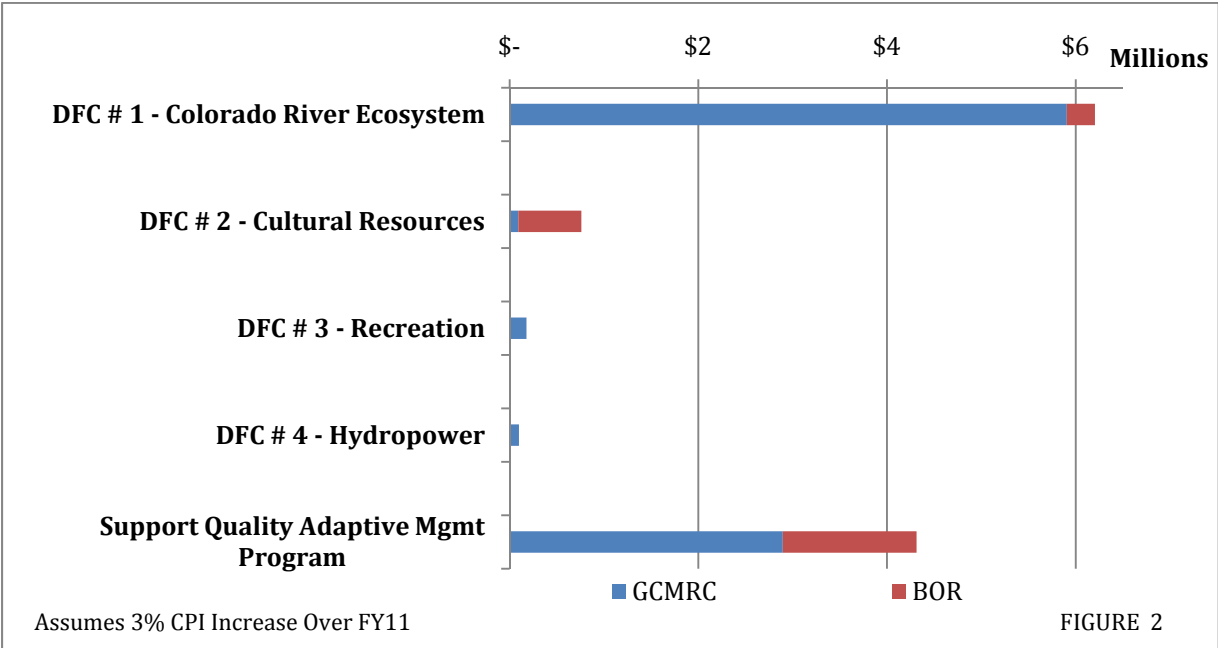
The summary below includes both the GCMRC and Reclamation components of the GCDAMP. Under the revised workplan, (table1, fig. 1) the majority of activities and funds are directed to DFC #1 (Colorado River Ecosystem) and to supporting a quality adaptive management program. Projects related to Cultural Resource, Recreation and Hydropower account for approximately 9% of funding. Most funding for the Colorado River Ecosystem, Recreation, and Hydropower DFCs comes from the GCMRC budget, while most for the Cultural Resources DFC is from Reclamation (fig. 2). Two thirds of the funding for the GCDAMP support activities is associated with GCMRC.

**Table 1.** Funds distribution by each of the four Desired Future Conditions (DFCs) and the adaptive management program under the proposed FY 2012 workplan. The total FY 2012 budget was estimated assuming a 3% Consumer Price Index increase over FY 2011.

<b>Desired Future Condition</b>		<b>Budget</b>	<b>% of Total Budget</b>
1 - Colorado River Ecosystem	GCMRC	5,906,223	51.11%
	BOR	297,497	2.57%
	<b>Total DFC 1</b>	<b>6,203,720</b>	<b>53.69%</b>
2 - Cultural Resources	GCMRC	92,191	0.80%
	BOR	667,869	5.78%
	<b>Total DFC 2</b>	<b>760,060</b>	<b>6.58%</b>
3 - Recreation	GCMRC	178,798	1.55%
	BOR		0.00%
	<b>Total DFC 3</b>	<b>178,798</b>	<b>1.55%</b>
4 - Hydropower	GCMRC	99,717	0.86%
	BOR		0.00%
	<b>Total DFC 4</b>	<b>99,717</b>	<b>0.86%</b>
Support for Quality Adaptive Management Program	GCMRC	2,895,301	25.06%
	BOR	1,417,894	12.27%
	<b>Total AMP Support</b>	<b>4,313,195</b>	<b>37.33%</b>
<b>Summary by Agency</b>	GCMRC	9,172,230	79.38%
	BOR	2,383,260	20.62%
<b>Total GCDAMP FY 2012 Funding</b>		<b>\$11,555,490</b>	<b>100.00%</b>



**Figure 1.** The proportion of total funds that would support each of the four Desired Future Conditions (DFCs) and support for a quality adaptive management program, under the proposed FY 2012 workplan. The total FY 2012 budget is estimated at \$11.6M, assuming a 3% Consumer Price Index increase over FY 2011. The GCMRC costs were based on an estimated 21% burden rate.



**Figure 2.** Proposed FY 2012 Reclamation (BOR) and GCMRC funding within each DFC category and for support of quality adaptive management program.

## **Desired Future Condition 1: Colorado River Ecosystem**

### **Proposed Changes**

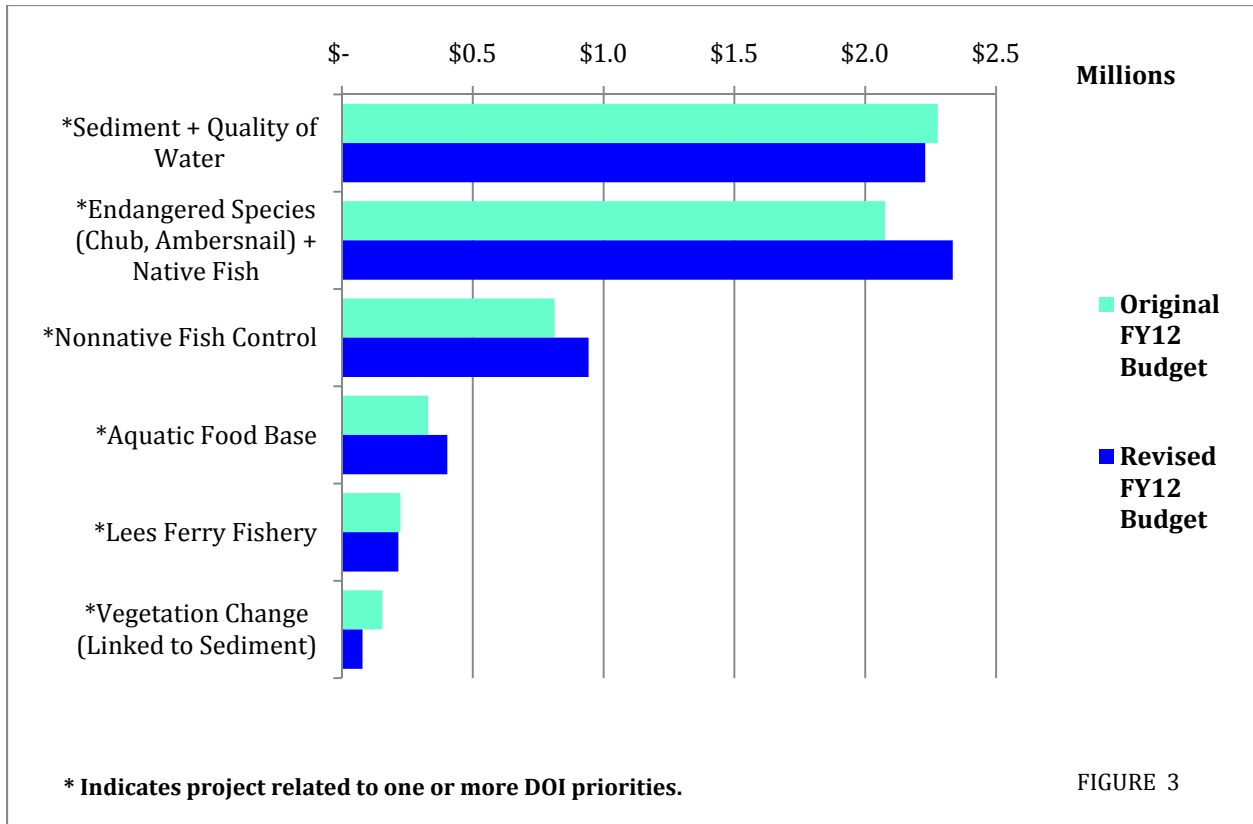
Proposed workplan activities related to the Colorado River Ecosystem DFC align well with DOI resource priorities (fig. 3). Although not identified as specific priorities, aquatic food base/food web studies and some terrestrial vegetation monitoring are included in the workplan to support native/nonnative fish and recreation priorities, respectively. Key points are:

- Endangered species/native fish monitoring and research is increased by \$258K (12%)
- Support for experimental nonnative fish control trips in Grand Canyon is increased by \$130K (16%)
- Funding for continued monitoring of the Lees Ferry fishery is decreased slightly (\$7.5K; -3%)
- Support for ongoing quality-of-water and sediment monitoring is decreased slightly (\$48K; -2%)
- Food web monitoring is increased by \$73K (22%)
- Vegetation monitoring is decreased by \$76K (-49%)

**Overall Financial Impact of Proposed Changes:** The proposed budget increases expenditures \$300K, from \$5.9M to \$6.2M.

### **Implications**

The proposed changes ensure that (1) 2008–2012 fall steady-flow testing studies are supported sufficiently to complete reporting requirements; (2) monitoring and research associated with endangered species (humpback chub and Kanab ambersnail) continue, with some increased support for native/nonnative fish monitoring; (3) proposed nonnative fish control is sufficiently funded; (4) flow, quality-of-water, and sand-storage monitoring are sufficient to support the proposed HFE protocol; and (5) monitoring of the Lees Ferry fishery is continued as originally proposed.



**Figure 3.** Comparison of GCDAMP activities in support of Desired Future Condition #1 (Colorado River Ecosystem) under the provisional (“original”) and revised FY 2012 workplans.

## Desired Future Condition 2: Cultural Resources

### Proposed Changes

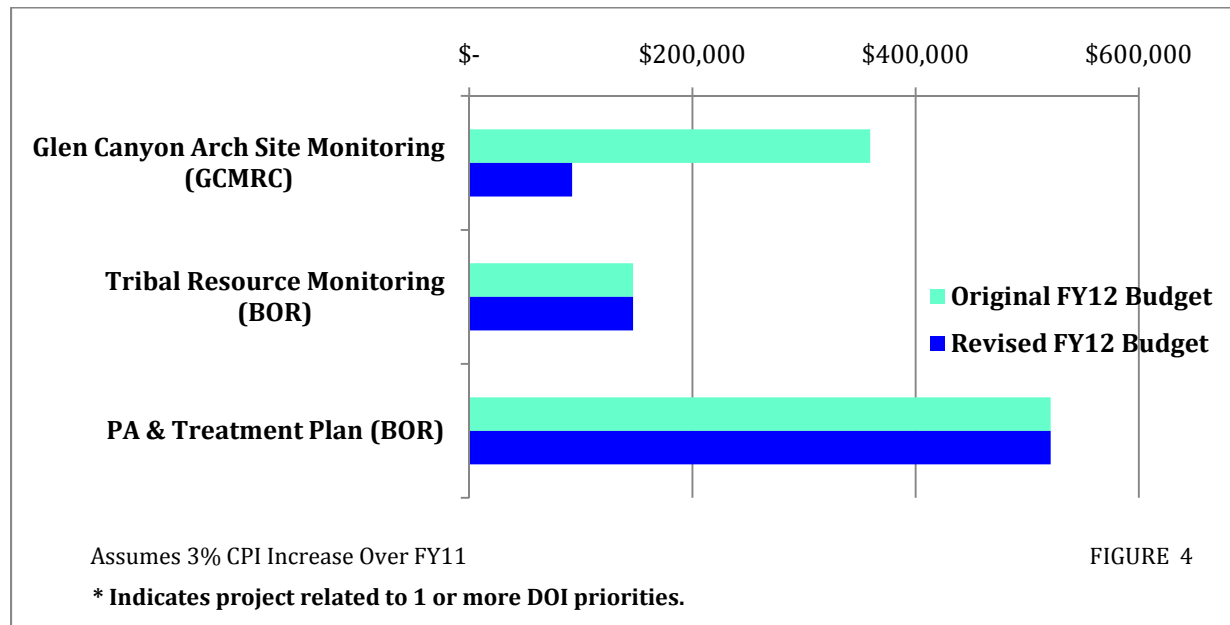
Under the proposed workplan, tribal resource monitoring and Programmatic Agreement activities supported by Reclamation remain unchanged. However, the planned implementation of GCMRC-based monitoring of archaeological sites would be restricted to Glen Canyon National Recreation Area and would not occur in Grand Canyon National Park (GRCA). Note that cultural resources were not identified by DOI as a current science priority for GCMRC, and that the majority of funding for this DFC is associated with Reclamation. Key points are:

- Tribal resource monitoring is unchanged
- Programmatic Agreement and treatment plan are unchanged
- Implementation of GCMRC-based archaeological site monitoring is decreased by \$267K (-75%)

### Implications

Under the revised workplan, the field-based archaeological site monitoring protocol recently developed by GCMRC will be initiated within Glen Canyon National Recreation Area as a proof-of-concept application for LiDAR-based field monitoring. This monitoring will not occur at GRCA sites as originally planned. However, the originally planned level of Reclamation and National Park Service (NPS) support for tribal resource monitoring and implementation of the treatment plan under the Programmatic Agreement will occur in FY 2012. In addition, GCMRC and NPS are working together to explore synergies in their cultural resource programs, and to determine whether analyses of historical and recent aerial imagery can be used to monitor post-HFE windborne sand availability at sites in GRCA.

**Overall Financial Impact of Proposed Changes:** The proposed budget decreases expenditures \$267K, from \$1M to \$760K.



**Figure 4.** Comparison of GCDAMP activities in support of Desired Future Condition #2 (Cultural Resources) under the provisional (“original”) and revised FY 2012 workplans.

## Desired Future Condition 3: Recreation

### Proposed Changes

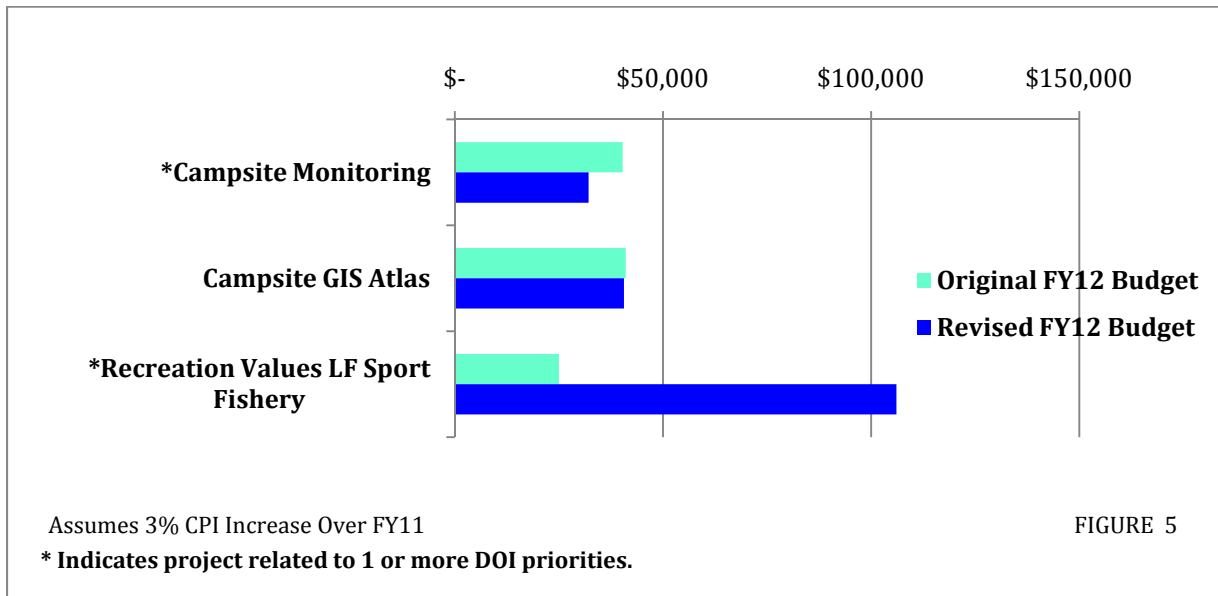
The proposed workplan substantially increases research on Lees Ferry sport fishery recreational values, while continuing to support monitoring of recreational campsites and development of the campsite GIS atlas (fig. 5). The key points are:

- Lees Ferry recreation values research is increased by \$81K (400%)
- Support for campsite monitoring is decreased by \$8K (-20%)
- Stable support for completing the campsite GIS atlas

### Implications

The revised workplan increases research into the recreational values in the Lees Ferry tailwater to (1) provide partial salary support for an economist to assist with developing requests for proposal (RFPs) and to coordinate recreational-use values studies, and (2) fund competitive RFPs in support of the recreation valuation project. The remainder of the economist's salary and efforts will be associated with Power-related activities (see Power, DFC 4, page 7). It is likely that an outside entity will be contracted to conduct a formal survey of recreational users of the Lees Ferry sport fishery about their preferences, but scoping efforts are ongoing to focus the proposed research. The revision also reduces the budget for campsite monitoring by 20% by eliminating support for the Grand Canyon River Guides Adopt-A-Beach Program. The campsite GIS atlas project, which compiles, maintains, and analyzes a variety of current and historical campsite data, remains largely unchanged in the proposed budget.

**Overall Financial Impact of Proposed Changes:** The proposed budget increases expenditures \$73K, from \$106K to \$179K.



**Figure 5.** Comparison of GCDAMP activities in support of Desired Future Condition #3 (Recreation) under the provisional (“original”) and revised FY 2012 workplans.

## Desired Future Condition 4: Hydropower

### Proposed Changes

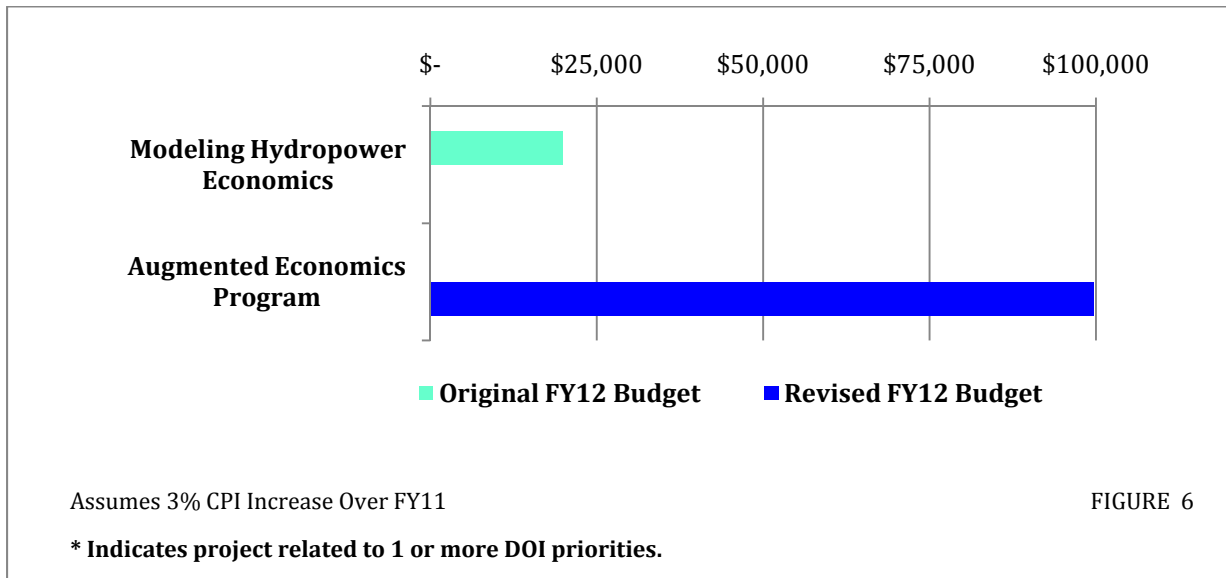
Under the proposed workplan, funding is realigned and increased (fig. 6) to support an economist position to facilitate hydropower-related studies. The key points are:

- Overall, the budget is increased by \$80K (400%) from \$20K to \$100K in order to partially support a position to coordinate hydropower-related economic studies managed by GCMRC

### Implications

The economic aspects of dam operations are important considerations in evaluating alternatives and understanding the relative costs and benefits of adaptive management actions. To date, GCMRC has not developed in-house expertise in the field of economics. Under the revised workplan, the hydropower-related budget is expanded to include partial funding to bring in new economics expertise to assist with developing RFPs and coordinate economic studies conducted by the Western Area Power Administration (or other entities) on hydropower modeling and economic forecasting under varying flow regimes. The proposed change creates a position to provide GCMRC with electrical hydropower economics expertise, either through a direct hire or through partnership with an outside organization. Note that this economist will also coordinate Lees Ferry recreation-use economic studies (see Recreation, DFC 3, page 6).

**Overall Financial Impact of Proposed Changes:** The proposed budget increases expenditures \$80K, from \$20K to \$100K.



**Figure 6.** Comparison of GCDAMP activities in support of Desired Future Condition #4 (Hydropower) under the provisional (“original”) and revised FY 2012 workplans.



## Support for a High-Quality Adaptive Management Program

### Proposed Changes

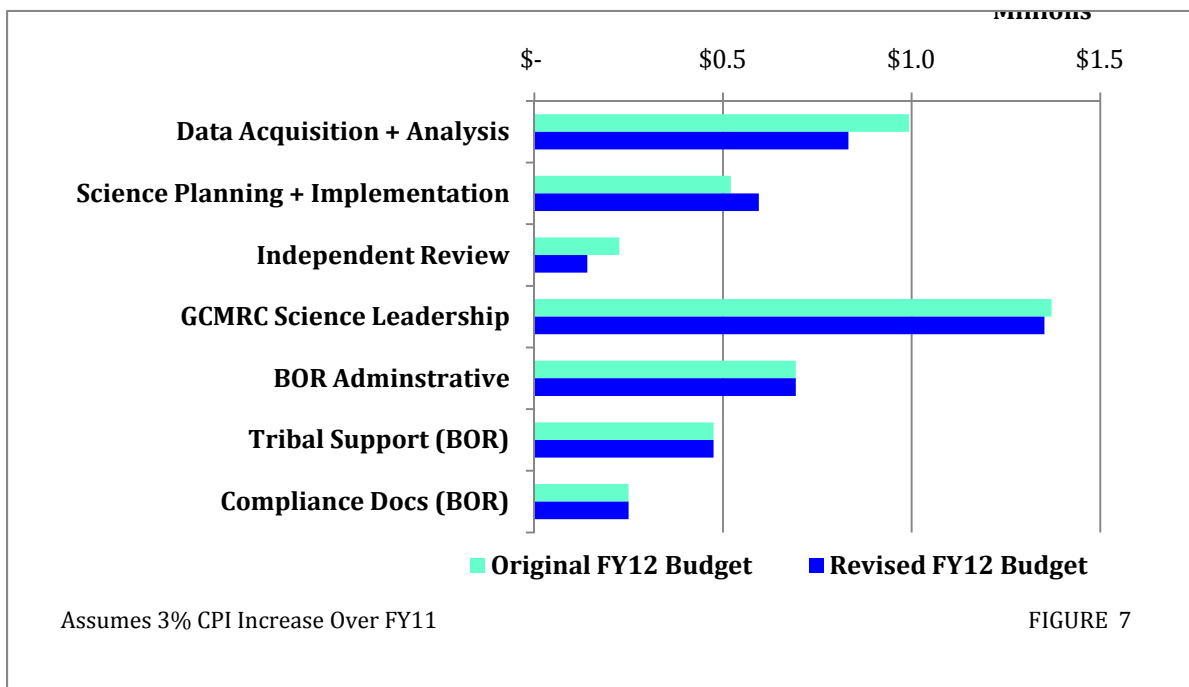
The proposed workplan reduces some adaptive management operational support activities (fig. 7) and redirects those funds to science activities that fall under DFCs #1, #3, and #4. The key points are:

- Data Acquisition, Storage, and Analysis (DASA) is reduced by \$160K (-16%)
- Science planning (decision support) and implementation is increased by \$74K (14%)
- Support for independent review is reduced by \$84K (-37%)
- Reclamation’s support for tribal participation and compliance documents is unchanged
- Support for Reclamation and GCMRC science leadership, support, and administrative activities is decreased by \$44K (-3%)

### Implications

The revised workplan will focus more of the GCMRC’s Data Acquisition, Storage & Analysis (DASA) program’s attention on change-detection analyses of 2002, 2005, and 2009 digital imagery in order to complete reporting on terrestrial resources of GCDAMP concern along river shorelines (campsites, vegetation, cultural sites, etc.). Although GCMRC total salary expenditures are reduced in DASA, there will be continued emphasis on improving public web interface and data access. The workplan revision will also increase science planning activities (including support for long-term experimental management planning through use of decision-support workshops and modeling), but does so at the cost of reduced support for independent review by the Science Advisors. Independent review needs continue to be evaluated for the workplan during FY 2011 and may be adjusted further as need is refined.

**Financial Impact of Proposed Changes:** The proposed budget decreases expenditures \$215K, from \$4.5M to \$4.3M.



**Figure 7.** Comparison of GCDAMP activities in support of a high-quality adaptive management program under the provisional (“original”) and revised FY 2012 workplans.

## **ADDENDUM:**

### **FY 2012 GCMRC Support for the LTEMP EIS**

A significant part of GCMRC's FY 2011 ongoing program and proposed FY 2012 workplan activities can support upcoming EIS efforts by Reclamation and the National Park Service. Approximately \$5.5M of the proposed FY 2012 program involves the following activities that would help inform the EIS:

- Staff participation in the LTEMP EIS process, including input and review of draft documents, plus modeling support
- GCMRC 2012-2017 Monitoring and Research Plan (for post-EIS monitoring)
- State of the Colorado River Ecosystem (SCORE) report (new and completed in FY 2012)
- Nearshore-ecology study report (FY 2011–2012; completed in FY 2012)
- Socioeconomic studies: Hydropower (FY 2011–2012; new in FY11) and Recreation (FY 2011–2012; new in FY 2011)
- Humpback chub population estimates based on Age-Structure Mark-Recapture (ASMR) modeling (FY 2011–2013)
- Sandbar modeling to evaluate effects of flow regimes (FY 2011–2013)
- Ecosystem modeling (FY 2011–2013)
- Various monitoring activities, including monitoring of sandbars and sand storage, sediment flux, aquatic food base, trout in the Lees Ferry reach, fish in the mainstem and Little Colorado River, rainbow trout movement, and riparian vegetation (FY 2011–2013)
- Analysis of sandbar and sediment-flux data (FY 2011–2013)
- Monitoring of campsites and cultural resources (FY 2011–2012)
- Technical support activities, including database and GIS support, and image analysis and change detection (FY 2011–2013)
- Publication of High Flow Experiment Synthesis (USGS circular 1366) and supporting USGS Fact Sheets on rainbow trout early life-stage survival and experimental nonnative fish removal results

Although not included in the proposed FY 2012 workplan, GCMRC has the capability to continue or augment existing activities, or conduct new ones, to provide additional LTEMP EIS support. Redirecting currently anticipated funds to any of the items listed below would result in reducing or eliminating ongoing or proposed activities. Therefore, additional funding would be required to conduct these activities.

- System-scale sand modeling to evaluate systemwide sandbar effects of flow regimes (FY 2012–2013; \$90K per year)
- Map topography/bathymetry of Lees Ferry Reach by collecting blue-green LiDAR data (FY 2012 for \$100K)
- Workshops for science-based alternatives using structured decision making (FY 2012 for \$85K)
- Multi-dimensional, nearshore temperature modeling (active in FY 2011; continue into FY 2012 and 2013 for \$12K and \$13K, respectively)
- Analyze legacy imaging data – DEM/orthorectification (FY 2012 for \$107K; FY 2013 for \$110K)
- Science Advisor Support for review of the draft LTEMP EIS (FY 2012–2013; \$30K per year)

## Descriptions of Projects in FY12 GCDAMP (GCMRC/BOR) Workplan

### DFC 1: Colorado River Ecosystem

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
<b>DFC 1, Sediment</b>				
Water Quality Monitoring of Lake Powell and the Glen Canyon Dam Tailwaters (Ongoing) BIO 7.R1.12	USGS monitors water quality of Lake Powell and forebay and tailwaters of Glen Canyon Dam in collaboration with the National Park Service and Bureau of Reclamation. The data are used by the Bureau of Reclamation to calibrate and verify a water-quality model (CE-QUAL-W2) of Lake Powell.	188,063	146,708	-41,355
Integrated Quality of Water Monitoring (downstream of GCD) (Ongoing) PHY 7.M1.12	Project monitors water quality (suspended sediment, turbidity, streamflow, temperature, dissolved oxygen, pH, salinity) at six locations along the Colorado River between Glen Canyon Dam and Lake Mead. Data are used to link dam operations to downstream resource conditions and track the sand budget for scheduling high flows.	1,002,389	1,005,955	3,566
Modeling Support & Temperature Models (Ongoing) PHY 7.R3.12	Project creates tools to predict the sand budget for use in scheduling high flows. New work in FY 2012 will be directed toward development of an eddy-deposition model to improve the ability to connect sand-budget predictions provided by the current model with sandbar response. This project may also create tools to predict mainstem water temperatures.	142,944	171,002	28,058
Integrated Long-term Monitoring of System-Wide Changes in Sediment Storage (Ongoing) PHY 8.M2.12	Project monitors a subset of sandbars and long-term changes in sand storage through repeat bathymetric and total station mapping of the Colorado River channel to evaluate effectiveness of dam operations, including if high flows achieve resource objectives related to sand bars and sediment storage.	479,183	500,280	21,097
Logistics Base Costs (See each project for project related logistics costs) (Ongoing) SUP 12.S1.12	Project provides complete logistical support for the 25 to 40 annual research, monitoring, and tribal river trips conducted annually through Grand Canyon by GCMRC. The project supports logistical support staff salaries, vehicles, equipment, and transportation.	213,153	209,461	-3,692
Survey & Control Network Operations (Ongoing) SUP 12.S2.12	Project provides spatial reference and survey support to various GCMRC projects. Under the proposed budget scenario for FY 2012, support is provided mainly to PHY 8.M2.12. Support is also provided to campsite monitoring, Kanab ambersnail monitoring, aquatic food base, and remote sensing projects.	251,265	195,329	-55,936
		<b>\$2,276,997</b>	<b>\$2,228,735</b>	<b>-\$48,262</b>

Comparison of funding for project components: original vs. revised FY12 GCMRC/BOR Workplan

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
<b>DFC 1, ESA &amp; Native Fish</b>				
LCR Fish Monitoring (Ongoing) BIO 2.M1.12	Through a cooperative agreement with USGS, USFWS has conducted mark-recapture and monitoring activities in the lower 13.57 km of the Little Colorado River since 2000. The primary objective is to monitor for annual changes in the spring and fall abundances of humpback chub $\geq 150$ and $\geq 200$ mm, respectively. Data are used to generate and update the Age-Structured-Mark-Recapture (ASMR) model developed at GCMRC.	595,001	594,538	-463
HBC Translocation & Monitoring Above Chute Falls (Ongoing) BIO 2.M3.12	Through a cooperative agreement with USGS, USFWS leads a monitoring effort of translocated humpback chub above Chute Falls and in a short stretch of the Little Colorado River (13.57 to 14.1 km). Translocations have been conducted for conservation purposes. Monitoring data are used in the Age-Structured-Mark-Recapture model developed by GCMRC.	135,696	131,103	-4,593
Monitoring Mainstem Fish (Ongoing) BIO 2.M4.12	Through a cooperative agreement with USGS, the Arizona Game and Fish Department leads a monitoring effort of native and nonnative fish abundance and distribution in Marble and Grand Canyons.	539,107	453,566	-85,541
Remote PIT Tag Reading (Ongoing) BIO 2.R13.12	Project evaluates new methods that minimize handling of fish but allow measurement of fish movement, particularly juvenile humpback chub, in the Little Colorado River and its confluence with the mainstem.	147,597	123,198	-24,399
Near Shore Ecology / Fall Steady Flows (FY08--FY12) BIO 2.R15.12	Through a cooperative agreement with USGS, the University of Florida is evaluating 1) whether steadier flows during fall increase survival rates of juvenile native and nonnative fish and 2) to what extent physical habitat structures, such as sandbars and backwaters, are used by young fish. This study supports the experimental flows described in the Biological Opinion and implemented during 2008-12.	423,475	353,004	-70,471
Biometrics & General Analysis Staff Position (Ongoing) BIO 2.R19.12	This budget item provides funding for a Research Statistician who supports the overall aquatic and physical science research of GCMRC, and the stock assessment of native fish in Grand Canyon (BIO 2.R7.12).	154,738	135,281	-19,457
Stock Assessment of Grand Canyon Native Fish (Ongoing) BIO 2.R7.12	Project produces annual estimates of size and capture rates of humpback chub and other native fish in Grand Canyon. Data are incorporated into Age-Structured-Mark-Recapture (ASMR) model every three years.	59,528	69,266	9,738
Mainstem juvenile HBC monitoring (including Marble Canyon sampling) NEW COST (NNFCF); informs removal decisions in LCR BIO 2.Rxx	Project replaces the field effort of the near shore ecology project (BIO 2.R15.12) by determining juvenile humpback chub survival in the mainstem below the confluence with the Little Colorado River. The field work will also include sampling in Marble Canyon for rainbow trout that are marked in Lees Ferry associated with project BIO 2.E18.12.	0	453,192	453,192

Comparison of funding for project components: original vs. revised FY12 GCMRC/BOR Workplan

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
Monitor Kanab Ambersnail (FY12--Ongoing) BIO 5.M1.12	Through a cooperative agreement with USGS, the Arizona Game and Fish Department leads a monitoring effort of the abundance and distribution of the Kanab ambersnail and its habitat at Vasey's Paradise.	20,684	20,684	0
		<b>\$2,075,826</b>	<b>\$2,333,832</b>	<b>\$258,006</b>
<b>DFC 1, Nonnative Fish Control</b>				
Detection of Rainbow Trout Movement from the Upper Reaches of the Col River below Glen Canyon Dam (FY11--FY12) (PBR & Tagging ) BIO 2.E18.12	Project collects information on the movement of rainbow trout between the Paria River (RM 1) and Badger Rapid (RM 8) to determine the feasibility of removing rainbow trout from this reach as an alternative to removal from the area near the confluence with the Little Colorado River.	453,028	454,378	1,350
Nonnative Control Plan Science Support (Ending) BIO 2.R17.12	Project evaluates threats from nonnative fish to native fish and develops plans to control the species that pose the greatest threat. Project scheduled to be completed March 2011.	62,512	0	-62,512
Nonnative Fish Control Contingency Fund BIO 2.Rxx	Money set aside to support nonnative fish removal at the confluence with the Little Colorado River.	0	191,126	191,126
Nonnative Fish Suppression Contingency Fund BOR BUDGET	None provided.	271,460	271,460	0
Experimental Funds Carryover - to be held by BOR BOR BUDGET	None provided.	26,037	26,037	0
		<b>\$813,037</b>	<b>\$943,001</b>	<b>\$129,963</b>
<b>DFC 1, Food Base</b>				
Aquatic Food Base Monitoring (Ongoing) BIO 1.M1.12	Project monitors key food items to track overall aquatic food availability to determine if humpback chub and other native fish are food limited. In FY 2012, algae and invertebrate production will be monitored monthly at Lees Ferry and Diamond Creek and monitoring will be expanded to include the confluence with the Little Colorado River, where the largest population of humpback chub in the basin is found.	329,349	402,773	73,424
		<b>\$329,349</b>	<b>\$402,773</b>	<b>\$73,424</b>
<b>DFC 1, Lees Ferry Fishery</b>				
Monitoring Lees Ferry Fish (Ongoing) BIO 4.M2.12	Through a cooperative agreement with USGS, the Arizona Game and Fish Department leads a monitoring effort of nonnative rainbow trout and whirling disease in the Lees Ferry reach.	223,710	216,170	-7,540
		<b>\$223,710</b>	<b>\$216,170</b>	<b>-\$7,540</b>

Comparison of funding for project components: original vs. revised FY12 GCMRC/BOR Workplan

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
<b>DFC 1, Vegetation</b>				
Vegetation Mapping (Ongoing) BIO 6.M1.12	Project evaluates the areal extents of riparian vegetation classes (woody and marsh/wetland vegetation) among the major habitat zones in the Colorado River ecosystem, and how they change over time in response to dam operations. Terrestrial vegetation contributes to above-ground primary productivity, arthropod densities, and associated food resources for terrestrial and aquatic vertebrates. Riparian vegetation also provides culturally important plant species.	61,063	61,169	106
Vegetation Transects (Ongoing) BIO 6.M2.12	Same as BIO 6.M1.12.	93,682	18,040	-75,642
		<b>\$154,745</b>	<b>\$79,209</b>	<b>-\$75,536</b>

<b>Total DFC 1</b>		<b>\$5,873,664</b>	<b>\$6,203,720</b>	<b>\$330,054</b>
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#### DFC 2: Cultural Resources

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
Glen Canyon Arch Site Monitoring (GCMRC) Was CUL 11.R1.12; now CUL 11.xx.12	This project quantifies and tracks trends in the archaeological site conditions using LiDAR to measure indicators of stability and physical change that can be linked to potential effects of dam operations. In FY 2012, monitoring efforts will be limited to the Glen Canyon Reach upstream of Lees Ferry.	359,362	92,191	-267,171
Tribal Resource Monitoring (BOR) BOR BUDGET	None provided.	146,856	146,856	0
PA & Treatment Plan (BOR) BOR BUDGET	None provided.	521,013	521,013	0
		<b>\$1,027,231</b>	<b>\$760,060</b>	<b>-\$267,171</b>
<b>Total DFC 2</b>		<b>\$1,027,231</b>	<b>\$760,060</b>	<b>-\$267,171</b>

### DFC 3: Recreation

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
Campsite Area Monitoring (Ongoing) REC 9.R1.12	Project measures changes in space available for camping by conducting annual surveys of a subset of sandbars between Lees Ferry and Diamond Creek. These surveys are conducted concurrently with the sandbar surveys of project PHY 8.M2.	40,298	32,107	-8,191
Analyze Campsite Data in the GIS Atlas (FY07--FY12) REC 9.R3.12	Project compiles and analyzes current and historical campsite data to track changes in overall campsite size, distribution, and quality on a system-wide basis over decadal time scales.	41,059	40,601	-458
Evaluate Recreation Values and Visitor Experience Quality in the Glen Canyon Reach (FY11--FY12) REC 9.R4.12	Project develops a survey instrument and collects data to measure and monitor angler and other recreational visitors perceptions related to the quality of the sport fishery and other recreational attributes in the Glen Canyon to Badger Creek reach. Project scope is still being determined, but is also likely to include assessment of economic value of the sport fishery and other recreational attributes of the reach.	25,000	106,090	81,090
		<b>\$106,357</b>	<b>\$178,798</b>	<b>\$72,441</b>
<b>Total DFC 3</b>		<b>\$106,357</b>	<b>\$178,798</b>	<b>\$72,441</b>

### DFC 4: Power

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
Evaluate the Suitability of the GTMax Model for Modeling Economic Implications of Power Generation under Current and Future Dam Operations and Conduct Initial Analyses (FY11--FY13) HYD 10.R2.12	Project evaluates suitability of the GTMax and other potential models for assessing economic impacts of different dam-operating scenarios in FY11, with ongoing effort as needed in FY12 (but with originally proposed funds shifted to support new initiative described below).	19,867	0	-19,867
New initiative for economics needs (revision of HYD 10.R2) – also supports DFC 3 HYD 10.xx.12	Project includes partial funding for an economist to work with GCMRC to assist in developing RFPs and providing oversight of economic studies that may be conducted by WAPA or other entities on hydropower modeling and economic forecasting under varying flow regimes.	0	99,717	99,717
		<b>\$19,867</b>	<b>\$99,717</b>	<b>\$79,850</b>
<b>Total DFC 4</b>		<b>\$19,867</b>	<b>\$99,717</b>	<b>\$79,850</b>

Comparison of funding for project components: original vs. revised FY12 GCMRC/BOR Workplan

## Support of Adaptive Management Program

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
<b>DASA</b>				
Quadrennial Remote Sensing Overflight (Ongoing) DASA 12.D1.12	Aerial photography for change analysis is conducted every four years, with the next scheduled overflight in FY 2013. Funds are set aside in intervening years to help pay for the next data-collection effort.	82,273	84,000	1,727
Grand Canyon Integrated Oracle Database Management System (Ongoing) DASA 12.D2.12	Project compiles all point data collected from ground-based studies into project-specific Oracle databases, maintains the databases, and works with the GIS Support project to develop internet access of archived data. The project also provides tools for the analysis of these data.	132,697	143,623	10,926
Library Operations / Scanning Support (Ongoing) DASA 12.D3.12	Project maintains all reports produced in support of the GCDAMP and any report relevant to the GCDAMP in hardcopy and digital forms; the digital forms are accessible from the internet. The library also houses all copies of the image and topographic data that have been collected for the Grand Canyon, which will be accessible through the internet within a year. The project is also working on converting some historical aerial photographic film to digital format.	40,051	40,049	-2
GIS Support for Integrated Analyses and Projects, GIS Lead (Ongoing) DASA 12.D5.12	Project compiles all spatial data either collected from ground-based studies or vector data generated from any source material and ingests the data into ArcMap coverages. This project also maintains the databases, works to develop internet access of archived databases, and works to provide GIS tools for the analysis of these data.	329,713	324,849	-4,864
Integrated Image Analysis and Change Detection (Ongoing) DASA 12.D9.12	Project plans and coordinates airborne image acquisition for the entire river corridor every 4 years and analyzes the resulting image data to provide a consistent, calibrated image mosaic. The project produces periodic change-detection databases that provide maps of changes throughout the river corridor.	254,975	86,896	-168,079
Program Planning & Management (Ongoing) ADM 12.A2.12	DASA Program Manager's technical oversight and implementation of Remote Sensing change-detection studies (camp sites, vegetation, cultural sites, etc.)	153,187	153,187	0
		<b>\$992,896</b>	<b>832,604</b>	<b>-\$160,292</b>
<b>Science Planning + Implementation</b>				
Support and Enhancement of Ecosystem Modeling Efforts (FY08--FY12) PLAN 12.P1.12	Project provides advisory assistance to GCMRC scientists and cooperators on data-analysis methods and model-integration of physical and biological data. Recent efforts have focused on aquatic ecosystem, but FY12 effort is proposed to scope potential for developing a terrestrial (landscape) ecosystem sub-model that could eventually be integrated with aquatics model(s).	114,381	149,591	35,210

Comparison of funding for project components: original vs. revised FY12 GCMRC/BOR Workplan



Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
Update of Knowledge and SCORE Report (FY11--FY12) PLAN 12.P4.12	The report will document evaluations of various experimental treatments relative to the resource goals of the GCDAMP and resource responses to flow and non-flow treatments. Treatments to be evaluated include different flow experiments (MLFF, LSSF, HFE, etc.), mechanical removal of nonnative fish, and translocation of humpback chub and Kanab ambersnail.	96,826	110,647	13,821
2012 Colorado River Basin Science and Management Symposium (Quadrennial) ADM 12.A6.12	Support for helping to plan and co-sponsor the second Colorado River Basin Science and Management Symposium. This is a forum for exchanging information and facilitating cohesive research, monitoring, data sharing, and adaptive management strategies among the four adaptive management programs in the Basin.	0	25,000	25,000
Program Planning & Management (Ongoing) ADM 12.A2.12	Portion of salary of Sociocultural, Biological & Physical/Modeling Program Managers, plus half of Deputy Chief's salary that directly supports science planning & implementation of GCMRC science project activities.	309,825	309,825	0
		<b>\$521,032</b>	<b>\$595,063</b>	<b>\$74,031</b>
<b>Independent Science Reviews</b>				
Independent Reviews (Ongoing) ADM 12.A4.12 (A)	Supports independent peer review for proposals received by GCMRC through a panel process. This project also supports Protocol Evaluation Panels (PEP) of GCMRC projects and methods. In FY 2012, PEPs are scheduled for campsite and sediment monitoring.	35,556	18,150	-17,406
Coordination and Review of Services Provided by Science Advisors (Ongoing) ADM 12.A4.12 (B)	Project supports the Science Advisors, who review scientific and planning documents and advise GCMRC on a range of scientific issues and questions. In FY 2012, the Science Advisors will include 4 to 6 senior scientists, primarily from universities. Review needs in FY12 include draft MRP and FY12-13 workplan, at a minimum. Budget may need to be revised as FY12 needs are further defined.	189,722	122,446	-67,276
		<b>\$225,278</b>	<b>\$140,596</b>	<b>-\$84,682</b>
<b>GCMRC Science Leadership</b>				
Administrative Operations (Ongoing) ADM 12.A1.12 (A)	Project provides support for budgetary oversight and tracking, including cooperative and interagency agreements, and publications and outreach services.	269,572	290,223	20,651
Administrative Operations - GSA Vehicle Costs (Ongoing) ADM 12.A1.12 (B)	Leasing and operation of GSA vehicles used to conduct fieldwork and other GCMRC business.	67,458	77,576	10,118
Administrative Operations - Interior Vehicle Costs (Ongoing) ADM 12.A1.12 (C)	Purchase and operation of vehicles used to conduct fieldwork and other GCMRC business.	34,114	39,231	5,117
Program Planning & Management (Ongoing) ADM 12.A2.12	Budget item for funding of the portion of salaries and travel of GCMRC's Program Managers, plus all of the Chief's and Logistics Program Manager's	760,430	697,941	-62,489

Comparison of funding for project components: original vs. revised FY12 GCMRC/BOR Workplan

Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
	salaries and travel, specific to program planning and management			
AMWG/TWG Meeting Travel Funds (Ongoing) ADM 12.A3.12	Travel expenses for GCMRC employees who travel to AMWG and TWG meetings.	21,180	30,250	9,070
GCMRC Component of SBSC Sys Admin Support (Ongoing) (IT Support) ADM 12.A5.12	Budget item for funding technology support provided by SBSC, including computer security, systems administration, and Web site support and development.	218,518	191,817	-26,701
		<b>\$1,371,272</b>	<b>\$1,327,038</b>	<b>-\$44,234</b>
<b>BOR Administrative</b>				
AMWG Personnel Costs BOR BUDGET	None provided.	181,659	181,659	0
AMWG Member Travel Reimbursement BOR BUDGET	None provided.	17,953	17,953	0
AMWG Reclamation Travel BOR BUDGET	None provided.	14,572	14,572	0
AMWG Facilitation Contract BOR BUDGET	None provided.	27,709	27,709	0
AMWG POAHG Expenses BOR BUDGET	None provided.	57,079	57,079	0
AMWG Other BOR BUDGET	None provided.	8,190	8,190	0
TWG Personnel Costs BOR BUDGET	None provided.	88,590	88,590	0
TWG Member Travel Reimbursement BOR BUDGET	None provided.	24,618	24,618	0
TWG Reclamation Travel BOR BUDGET	None provided.	18,148	18,148	0
TWG Chair Reimbursement BOR BUDGET	None provided.	25,310	25,310	0
TWG Other BOR BUDGET	None provided.	2,340	2,340	0
Administrative Support for NPS Permitting BOR BUDGET	None provided.	92,885	92,885	0
Contract Administration BOR BUDGET	None provided.	41,064	41,064	0
Programmatic Agreement Reclamation Administration BOR BUDGET	None provided.	61,815	61,815	0
*NPS Permitting with BOR Appropriated Funds BOR BUDGET	None provided.	30,962	30,962	0
		<b>\$692,894</b>	<b>\$692,894</b>	<b>\$0</b>
<b>BOR Tribal Support</b>				
Financial Agreements - Hopi Tribe BOR BUDGET	None provided.	95,000	95,000	0
Financial Agreements - Hualapai Tribe BOR BUDGET	None provided.	95,000	95,000	0
Financial Agreements - Navajo Nation BOR BUDGET	None provided.	95,000	95,000	0

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Project in FY12 GCMRC/BOR Workplan	Project Description	Original FY12 Budget	Revised FY12 Budget	Change
Financial Agreements - Pueblo of Zuni BOR BUDGET	None provided.	95,000	95,000	0
Financial Agreements - Southern Paiute BOR BUDGET	None provided.	95,000	95,000	0
		<b>\$475,000</b>	<b>\$475,000</b>	<b>\$0</b>
<b>BOR Compliance Documents</b>				
Compliance Documents BOR BUDGET	None provided.	250,000	250,000	0
		<b>\$250,000</b>	<b>\$250,000</b>	<b>\$0</b>
<b>Total Support of Adaptive Management Program</b>		<b>\$4,528,371</b>	<b>\$4,313,195</b>	<b>-\$215,174</b>
<b>Total All DFCs + Support of Adaptive Management Program</b>		<b>\$11,555,490</b>	<b>\$11,555,490</b>	<b>\$0</b>

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