RECOMMENDED INFORMATION NEEDS AND PROGRAM ELEMENTS FOR A PROPOSED AMP SOCIOECONOMIC PROGRAM

AS APPROVED BY AMWG ON FEBRUARY 23, 2012

AMWG Charge to TWG (August 2010)

The AMWG supports implementation of studies to further our understanding of the socioeconomics of adaptive management decisions within the GCDAMP; this includes and is not limited to market, non-market, and non-use studies. Thus, the AMWG directs TWG to further develop an economics implementation plan to be provided to AMWG at its next meeting for possible implementation starting in FY 2012. That implementation plan will include the following components:

a) Information needs associated with each study or analysis and the prioritization of those needs,
b) Scope and costs associated with each project and potential funding sources,
c) A description of how the information would be useful to the program, and
d) A more thorough review of the economics panel report.

RECCOMENDATION

The following Tables 1 and 2 contain the information needs and associated program elements developed by the SEAHG for consideration by the Technical Work Group which are responsive to the AMWG motion (above). The proposal does not incorporate any prioritization or specific application to managers or policymaker's needs regarding how this information would be used to make recommendations. These recommendations could be addressed by GCMRC and the SEAHG during the next phase if the AMP and the Secretary would like to proceed with developing either part or all of this proposed program. Although this program would add considerable value to the AMP it would also come at a substantial cost and has implications to the needs of the LTEMP EIS being developed. There are numerous policy level issues which need to be addressed before the SEAHG can work with GCMRC to develop a socioeconomics program from this plan.

A description of comments on the economics panel report and a crosswalk between the panel recommendations and direction taken in this implementation plan will be provided in a separate document in order to fulfill part (d) in the AMWG motion.

BACKGROUND

Economic values related to hydropower production under differing flow regimes have been developed by the Western Area Power Administration on a continued basis since development of the Adaptive Management Program (AMP). However, economic values related to other resources, although addressed in the 1995 GCD EIS process have since received minimal program attention. Although a broader socioeconomic science and management program emphasis has been discussed by the AMP and its operating entities (AMWG, GCMRC, TWG, Science Advisors), a formal program has not been developed and approved by the AMWG to date.

In spring 2009, GCMRC proposed in their annual work plan to host a workshop to clarify socioeconomic interests of the GCDAMP. This effort involved prospectus development by the GCMRC, stakeholders, and SAs during the summer of 2009 and resulted in a two-day workshop in December, 2009 that reviewed previous socioeconomic studies and their results and identified a suite of stakeholder questions: subsequently, a report was developed by a group of independent economists that included a list of recommendations to address the interests and issues identified by stakeholders during the December 2009 workshop (Hamilton and others, 2010). In August 2010, AMWG heard an oral report from the independent panel of economists and then charged the TWG to review the written report and develop their own socioeconomic program proposal that could be reviewed and evaluated by AMWG at their next meeting. This task was accomplished by forming a Socioeconomic Ad Hoc Group (SEAHG). An outline of elements of a Proposed Socioeconomic Plan, including draft information needs and program activities was developed by the SEAHG in January, 2011 as a "Table 3". Information needs in that "Table 3" also drew upon earlier work of the Science Planning Group (SPG 2006) as well as development efforts by the GCMRC and TWG on the Core Monitoring Plan (GCMRC 2009).

At the February, 2011 AMWG meeting, AMWG members received a briefing from Shane Capron, the TWG chair about "Table 3". At the same time, it was pointed out to AMWG that NPS was initiating a comprehensive study on the economic value of recreation on the Colorado River that would address several of the components identified in "Table 3", potentially rendering some elements of the SEAHG's plan redundant. Therefore, a new Survey Instrument Ad Hoc Group (SIAHG) was formed and charged to review the two survey instruments proposed for use by the National Park Service to evaluate economic values for recreation in the CRE. It was felt that the NPS ongoing recreation science and management surveys and assessments represented similar efforts, at least in part, to those being proposed in the AMP, and both programs might benefit from the interaction. The SIAHG provided recommendations to the NPS on several economic values being developed in the two surveys, including market, non-market and non-use values. The recommendations were proposed for consideration by the NPS and were also considered as potential information needs for the AMP.

At the August, 2011 AMWG meeting, the TWG was charged by AMWG to continue refining "Table 3" (see below as Table 2). The SEAHG approached this task by reviewing the existing socioeconomic information needs and determined if additional needs should be proposed in this area. The review did identify potential additional information needs to be considered by the AMP.

In the fall of 2011 the SEAHG continued to review its past efforts and worked on developing a revised set of information needs and program elements for consideration by the TWG at its January, 2012 meeting.

The first task of the SEAHG was specification of a revised set of succinct socioeconomic information needs. This revised set of information then became the primary basis for establishing a required set of science and management activities, i.e. program elements to respond to these needs. The effort involved development of a progression of revised and improved Information Needs (INs) and program element revisions captured in power points from meetings on 11/2/11, 11/14/11 and 12/8/11.

DEVELOPING RECOMMENDED SOCIOECONOMIC INS AND PROGRAM ELEMENTS

A SEAHG review of developed socioeconomic information needs by the SEAHG and SIAHG determined that significant duplication existed, and many information needs lacked clarity. In addition, there was a need to winnow extraneous information that addressed questions, protocol, process, methods, costs etc. The SEAHG proposes that this information is more adequately addressed once the TWG agrees to a set of information needs to pursue and specifies the program elements for addressing these needs.

As noted above, the December 2009 workshop first identified information needs in the form of a series of questions. The SEAHG subsequently translated those questions into a set of information needs. Significant duplication was reduced in earlier work on information needs. Without succinct statements on information needs, development of program elements to accomplish the individual needs becomes problematic.

In general, this effort of the SEAHG has resulted in a significant expansion of socioeconomic information needs recommended for consideration by the TWG. Several general areas of socioeconomic information needs were considered important to the stakeholder group, i.e. recreation, cultural, water, and power resources. In addition, a general information need category was also identified. For each area, three or more types of socioeconomic values are specified for development, including market, non-market and non-use values. The effort also became more focused on delineating clear distinctions among differing social and economic values being proposed for evaluation, a direction encouraged in the October TWG meeting.

The area of information needs that received greatest attention by the SEAHG was recreation. The area was the focus of an earlier effort by the SIAHG and was expanded by this SEAHG effort. Market, non-market, non-use, etc. evaluations of alternative management actions on recreation are now proposed for development. The diversity of recreation resources in both Glen Canyon and the Grand Canyon are proposed for evaluation, i.e. angling, boating, camping, hiking, wilderness values, etc.

Intra-regional market efficiency impacts of alternative dam operations have traditionally been the AMP focus in hydropower. This direction is modified in the SEAHG proposal with the new direction incorporating inter-regional impacts and assessments of total economic implications that incorporate market, non-market, non-use etc. values.

Evaluating implications of alternative GCD operation scenarios on associated values of water resources has not been an element of the AMP. The SEAHG is proposing that assessments be developed related to market, non-market, non-use and other values.

Determination of alternative dam operation impacts on various values of cultural resources is recommended by the SEAHG. Because cultural resources per se often do not enter the arena of market exchange, much of the need lies in determination of non-market, non-use, existence value etc. of impacts associated with operations changes.

The SEAHG also determined that a category of general information needs was important to capture both needs and program elements that are important to effective implementation of the proposed socioeconomic program. The general area could expand but currently incorporates an IN that addresses valuation needs in resource areas currently not defined by SEAHG. It also addresses the need of the AMP

to continue to educate members on the meanings, benefits and costs, and utility of information from market, non-market, non-use, etc. evaluations being proposed for the program. It addresses as well the need for a workshop for specification of how information proposed for development might best be utilized by the AMP, in core monitoring and other areas.

MORE COMPLETE EVALUATIONS OF RESOURCE ECONOMIC VALUES

In its deliberations, the SEAHG decided to propose that more complete economic values be evaluated for the identified resources of concern. This relates primarily to the fact that both market and non-market resource values of the CRE that may be impacted by alternative dam operations are not being completely accounted for in current AMP evaluations. Therefore, more comprehensive market and non-market economic resource values of concern to the AMP, including cultural values and sites, recreation, water quantity and quality, and hydropower are proposed for development in the socioeconomic program. The following brief overview highlights general characteristics of more complete economic evaluations. More specific definition of needed valuations to be pursued in individual resource areas would be developed in a general science and management plan proposed for 2012.

Market exchanges of goods and services of economic value has persisted for thousands of years as has societal methods and requirements for creating uniform economic basis for these exchanges. This has resulted in monetary systems and theories of the economy of these exchanges being applied globally in the last century. The most common existing theories of market exchange relates to scarcity and the free or quasi-free interaction of supply of goods and services by producers and demand for these supplies by consumers. The agreed upon price for the exchanges is determined to reflect the market value of the good or service. The theoretical and practical performance of this system in existing societies uses different forms of money as the uniform basis to define the actual market value.

Market values of exchange of goods and services, although they reflect individual consumption measures, may not reflect the total economic value of the good or service to society. Goods and services not normally exchanged in the market and even those which are exchanged and do have established market values may also have non-market values. Included are many natural resources that society values and provides to the public. Examples include goods and services provided by governments as public goods. These are desired, accessed and benefited by the public, and often with minimal or no market exchanges. They are generally provided through taxation or minimal fee structures established exogenous to the market system. Examples in the CRE are rafting and recreational fishing, camping and hiking, tours of archeological sites.

Although market exchanges (fees) occur for some public goods and services, the prices paid are not established by the free market mechanism and often are assumed to be less than the true economic value of the resource. That is, even though some market exchange occurs, additional non-market value in the form of consumer surplus would normally exist at higher prices consumers would be willing to pay. Even exchange fees established for water and power resources in the CRE may not express the true economic value of these resources. Additional non-market value may also exist in the form of consumer surplus.

Current proposed assessments of varied flow and non-flow management alternatives for Glen Canyon Dam and the CRE and the resulting marginal changes to market and non-market values of

recreation, cultural, hydropower, water and other resource values, presents a classic example of the need for complete economic valuation of this large social investment. In many assessments of this type evaluation of impacts utilize cost/benefit or other economic analyses which attempt to express change in total economic value of goods and services in monetary terms.

Several different forms of economic non-market values have been defined for assessment purposes as are methodologies for deriving these values. Generally in science, management and legal applications two general types of non-market values have had significant application, revealed preference and stated preference approaches.

The first approach, revealed preference, studies actual revealed behavior on closely related markets to define the non-market value of a good or service. Two widely used methods for determining revealed preference are the hedonic pricing and travel cost methods. The revealed preference approach has a strong attribute in that it utilizes actual choices and market transactions to derive non-market values. A weakness is its use of only current and past levels of the non-market values. It also cannot be used to evaluate passive or non-use values such as existence values.

A second approach, stated preference, has received greater use in the past thirty years because it can be used to develop willingness to pay values over a range of conditions, including expected or proposed future conditions. It also can be used to develop non-use values including existence, altruistic and bequest values. The approach utilizes surveys to define individuals stated behavior under hypothetical conditions and settings. Development of actual willingness to pay values has involved several methodologies including conjoint analysis, contingent valuation, and choice experiments. Contingent valuation methods have had greatest application.

Greater specification of where and how market, non-market, non-use evaluations may be applied in the socioeconomic program will depend upon what information needs and program elements proposed by SEAHG are recommended by the TWG for further assessment. Once proposed information needs and program elements are recommended for evaluation, a Socioeconomic Program Plan can be developed.

Important to all proposed market and non-market economic assessments is the context in which these assessments will be eventually applied. The direction of the AMP in pursuit of goals outlined in the GCPA is to evaluate impacts of alternative dam operations and other management actions proposed on resources of the CRE (e.g., water, recreation, cultural, power). Before one can effectively ascertain the impacts of these alternative actions on the economic value of the resources, it may be necessary (depending on the methods of economic evaluation that are eventually employed) to first determine with some measure of certainty the biological, social or physical impact of the actions. The AMP is expending resources to improve the certainty of these impacts to varied resources, but significant uncertainty still exists. Without knowing these impacts with reasonable certainty, the additional step of defining marginal economic impacts is difficult.

DEFINING PROPOSED SOCIOECONOMIC INFORMATION NEEDS AND PROGRAM ELEMENTS

The following Table 1 contains the information needs and associated program elements developed by the SEAHG for consideration by the Technical Work Group.

Table 1: Proposed Information Needs and Program Elements

PROPOSED SEAHG INS	PROPOSED PROGRAM ELEMENTS
Recreation Information Needs **RIN 1**.What are the total market, non-market, and non-use values for the following recreational uses of the Colorado River Ecosystem downstream from Glen Canyon Dam, including pre-rod and post-rod demand and economic assessments • Glen Canyon boating and walk-in trout fishery and related components • Glen Canyon recreational boating industry • CRE day hiking and overnight camping • Grand Canyon Private and commercial rafting operations including Native American enterprises	Conduct recreation expenditure analysis of Lees Ferry anglers and boaters, and Grand Canyon boaters. (Note: Some of this may be covered by the NPS economic study being carried out by University of Montana in 2012) Initiate and conduct recreation non-market and non-use assessments (Note: Some aspects of this program element may be covered by the NPS economic study.)
RIN2. Define and value key attributes and key benefits that affect the Grand Canyon wilderness and Glen Canyon recreation experiences • How do they affect market values for these different CRE recreation activities? • How do they affect non-market for these different CRE recreation activities? • How do they differ under alternative flow regimes and events such as HFEs, low steady flows and other experiments? • How do they differ under alternative management actions?	Conduct focus groups and pilot non-market surveys Conduct full non-market value surveys
Tribal Information Needs **CRIN1.** What are the market, non-market and non-use values for CRE resources valued by tribes as affected by dam operations?	Scoping; identify tribes for specific surveys. Determine if separate tribal studies are needed. Conduct tribal market, non market, non-use scoping and value assessments

Hydropower Information Needs	
HIN1. What are the impacts to federal hydropower customers from implementation of Record of Decision dam operations and various other flow regimes and segregate those effects from other causes such as changes in the power market.	Define GCD operational base cases and change cases. Base cases proposed: MLFF and pre-ROD. WAPA will conduct base case analysis with GT Max and analyze spillover effect with WECC.
HIN2. What would be the market impacts on marketable capacity and energy of: • Increasing the daily fluctuation limit • Increasing up-ramp and down-ramp limits • Raising maximum power plant flow limit above 25,000 cfs • Lowering the minimum flow limit below 5,000 cfs	
HIN3. What are the total market, non-market and non-use impacts on upper and lower basin water users from proposed alternative dam operations?	
HIN4. What are the socioeconomic impacts of Glen Canyon Dam operations and experiments to tribal communities, including market, non-market and non-use?	
HIN5.What are the market, non-market and non-use values associated with Glen Canyon electrical power, and determine these values.	Develop market, non-market and non-use values for power and water resources
HIN6. What are the market, non-market and non-use values associated with water released through Glen Canyon Dam, and determine these values.	
General Information Needs	
GIN1. What are merits of market non-market, non-use, and existence values being proposed for development (i.e., reliability of information gained, costs, area of proposed use in program, etc).	Develop workshop to inform TWG/AMWG of various socioeconomic information types and their utility. (Note: some of this work completed during previous workshops)
IN 2. Define how socioeconomic research information should be used by AMP	
GIN3. Determine methods to assist more real-time assessments of resource impacts of alternative management activities.	Conduct workshop on appropriate socioeconomic research information use.
GIN4. Evaluate, as needed, market, non-market, and non-use values for other resources also found to have	Develop real time model capability to evaluate biophysical and socioeconomic resource impacts and tradeoffs under

impacts from dam operations and deemed important to the AMP	differing flow and non-flow alternatives. Develop general program capability to evaluate market, non-market and non-use values for resource impacts not yet defined by the AMP

PROPOSED SOCIOECONOMIC IMPLEMENTATION PLAN

The following Table 2 contains the implementation plan requested by AMWG. It is a further refinement of the previous "Table 3" which has been presented to TWG and AMWG at numerous meetings.

Table 2. Proposed Socioeconomic Plan by year of implementation.

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
Year 1			
1	Conduct workshop to inform TWG/AMWG of various socioeconomic information types and their utility. Make a recommendation on appropriate socioeconomic research information use within the AMP. Cost: $15,000	**GIN 1.** What are merits of market non-market, non-use and existence. values being proposed for development, i.e., reliability of information gained, costs, area of proposed use in program.. **GIN 2.** Define how socioeconomic research information should be used by AMP	The socioeconomics panel recommended that GCMRC host a Non-Use Values 101 workshop to help TWG & AMWG understand the relevance and value of this type of study for informing future decision making. In 2011, TWG and GCMRC held a basic introduction to the concepts and rationales underlying socioeconomic studies in general, to clarify terminology, and to provide an overview of how various types of analyses (market, non-market, non-use studies) are conducted and how the resulting data could be interpreted. This proposed workshop would tier off that effort and delve more deeply into how data collected could be applied to AMP decisions. One result of the workshop should be a recommendation on how the AMWG, DOI, and DOE/WAPA should use the recommended socioeconomic data in the different decision making processes such as NEPA analysis, adaptive management, and in any benefit-cost analysis.
2	Define GCD operational base cases and change cases. Base cases proposed: MLFF and pre-ROD Cost: Policy decision	**HIN 1.** What are the impacts to federal hydropower customers from implementation of Record of Decision (ROD) dam operations and various other flow regimes and segregate those effects from other causes such as changes in the power market.	This task addresses the fundamental need to define a base case (i.e., a "standard") against which proposed changes in GCD operations can be evaluated in the future. The panel recommended that TWG select an operational scenario that reflects current (MLFF) operations. The base case needs to define monthly volumes, hourly (or even within hourly) outputs, amount of peak and off-peak power production, etc. There is disagreement of what the base case should reflect; pre-rod conditions or MLFF. We recommend developing two base case scenarios that captures current MLFF operations and pre-ROD.
3	Power modeling: conduct the base case analysis and initial	**HIN 1.** What are the impacts to federal hydropower customers from	Implement the report recommendation to complete the base case study for hydroelectric operations. The detailed description of the base case

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
	power modeling using currently available models and test "spill over" effects with the WECC. Cost: GCMRC $30,000, Western $107,000 WECC = Western Electrical Coordinating Council (i.e., western grid).	implementation of Record of Decision dam operations and various other flow regimes and segregate those effects from other causes such as changes in the power market. **HIN 2.** What would be the market impacts on marketable capacity and energy of: • Increasing the daily fluctuation limit Increasing up-ramp and down-ramp limits • Raising maximum power plant flow limit above 25,000 cfs • Lowering the minimum flow limit below 5,000 cfs	study will be prepared by GCMRC, with input from WAPA , and any additional specifications by the TWG/AMWG. This base case study will also include an analysis of "spill over" with the WECC. The base case and spill over analysis will be completed by WAPA and a report prepared at no cost to the AMP. The report will be submitted by WAPA to GCMRC for peer review. GCMRC will oversee the peer review process and use the Science Advisors as needed. WAPA will incorporate changes into the report based on comments received from the peer review process. If WAPA's power flow models demonstrate changes in flows at the border of WAPA's system, or at interconnection points with other systems, then a more extensive modeling effort may be required, to check for changes in four indicators throughout the WECC (generation, transmission, reliability, and hub prices).
Year 2			
4	Non-use values workshop to incorporate review of the 1994 Non-Use Value Survey and update the questionnaire. Cost: $30,000	**HIN 3.** What are the total market, non-market and non-use impacts on upper and lower basin water users from proposed alternative dam operations? **HIN 4**. What are the socioeconomic impacts of Glen Canyon Dam operations and experiments to tribal communities, including market, non-market and non-use? **HIN 5.** What are the market, non-market and non-use values associated with Glen Canyon electrical power, and determine these values.	A new non-use value study is needed to properly assess resource values associated with Grand Canyon, and potential impacts to those values from dam operations. The focus would be on values that are important to tribes and the broader American public that are not dependent on human use or consumption for their value. Data on tribal values may be gathered as part of this study depending on the outcome of preliminary investigations. Preparing for this study will take considerable time; therefore the panel recommended that GCMRC and TWG start planning early for a future non-use value study, taking into account changes that have occurred in the canyon and to dam operations since 1995. Initiating Step #1 – discussion and review of old questionnaire – could be done at no additional cost to the AMP. However, TWG is recommending that this be accomplished in a workshop format to include a more detailed review of non-use economics.

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
		HIN 6. What are the market, non-market and non-use values associated with water released through Glen Canyon Dam, and determine these values. **RIN 1.** What are the total market, non-market, and non-use values for the following recreational uses of the Colorado River Ecosystem downstream from Glen Canyon Dam, including pre-ROD and post-ROD demand and economic assessments: • Glen Canyon boating and walk-in trout fishery and related components • Glen Canyon recreational boating industry • CRE day hiking and overnight camping • Grand Canyon private and commercial rafting operations including Native American enterprises **RIN 2.** Define and value key attributes and key benefits that affect the Grand Canyon wilderness and Glen Canyon recreation experiences: • How do they affect market values for these different CRE recreation activities • How do they affect non-market and non-use values for these different CRE recreation activities • How do they differ under	

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
		alternative flow regimes and events such as HFEs, low steady flows and other experiments • How do they differ under alternative management actions	
5	Scoping activity: identify tribes for specific surveys of preferences and attitudes and determine if separate tribal studies are needed. Cost: $5,000	**CRIN 1.** What are the market, non-market and non-use values for CRE resources valued by tribes as affected by dam operations?	There is a need to better integrate tribal values in AMP decision making. This task is intended as a scoping activity to determine how tribal values should be assessed and then integrated into AMP decision making. Future activities per the panel's recommendations are provided below but they are placeholders if scoping finds that a separate process is needed to specifically address tribal preferences and values. This scoping process should fully include the tribes and any similar processes they may be involved in (such as the surveys currently being conducted by the Hopi Tribe as part of their monitoring project).
6	Recreation Use Analysis: Part A (Market): initiate recreation expenditure analysis of Glen Canyon anglers, day-use rafters, and Grand Canyon and Marble Canyon white water users including Diamond Creek to Mead rafters. Part B (Non-Market): initiate development of survey instrument for recreation non-market use analysis and obtain OMB clearances. Cost: $150,000 - $200,000	**RIN 1.** What are the total market, non-market, and non-use values for the following recreational uses of the Colorado River Ecosystem downstream from Glen Canyon Dam, including pre-ROD and post-ROD demand and economic assessments: • Glen Canyon boating and walk-in trout fishery and related components • Glen Canyon recreational boating industry • CRE day hiking and overnight camping • Grand Canyon private and commercial rafting operations including Native American enterprises	The panel proposed that GCMRC undertake socioeconomic studies focused on recreational values that include both market and non-market use values for specific river reaches. While the panel suggested that economics of scale could be had by gathering recreational data on both market and non market aspects at the same time, this is really a program decision. Market data are easier to gather and can be analyzed easily. Data on recreational consumer surplus (preferences) will require a proper survey design and additional input from stakeholder groups. The expenditure data could be gathered and analyzed while the nonmarket survey instrument is being developed. The regional economic effects of GCD experiments and other DOI actions will be analyzed. This analysis would be devoted to the impact on the regional economy as a result of changes in expenditures resulting from these actions. The groups of interest for this study would be Glen Canyon day use rafters and anglers and Grand Canyon Whitewater rafters (commercial and private boaters) from Lees Ferry to Diamond Creek or Lake Mead and the Hualapai white water recreational enterprise that services Diamond Creek to Lake Mead. This expenditure data can be used in the IMPLAN regional input-output model to estimate the positive economic impacts to the surrounding counties and Indian Reservations in terms of direct and indirect personal income and employment generated. Indirect effects would capture the multiplier effects from subsequent rounds of

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
			spending in the surrounding region. Separate interviews with the guides and the tribes will be needed to obtain their expenditures associated with the guiding, access fees, food, and other costs. We recommend that the economic impact analysis use two impact areas. For consistency with past research, it would be appropriate to use the counties surrounding the Grand Canyon. However, since many outfitters have their base of operation in Nevada or Salt Lake City, it would be appropriate to show results using a broader multi-state economic impact area (Report page 16) (Note: Some aspects of this program element may be covered by the NPS economic study.)
7	Power modeling: conduct change case analyses, and power flow studies that show the financial and economic consequences of GCD management alternatives on WAPA and WAPA customers. Cost: $100-200,000	**HIN 1.** What are the impacts to federal hydropower customers from implementation of Record of Decision dam operations and various other flow regimes and segregate those effects from other causes such as changes in the power market. **HIN 2.** What would be the market impacts on marketable capacity and energy of: • Increasing the daily fluctuation limit Increasing up-ramp and down-ramp limits • Raising maximum power plant flow limit above 25,000 cfs • Lowering the minimum flow limit below 5,000 cfs	This task would evaluate economic outcomes from alternative GCD operations in relation to the base case. TWG/AMWG/or DOI first need to define what "change cases" they want to analyze before this can be initiated (see task above). Determine if this will be done as part of the LTEMP process or external to that process.
8	*[Contingent upon power modeling in Year 1]* WECC power analysis: GCMRC to solicit firms for	**HIN 1.** What are the impacts to federal hydropower customers from implementation of Record of Decision dam operations and various other flow regimes and segregate those effects from other	This project will be informed by power modeling done by WAPA in Year 1 to determine "spill over" effects to the WECC. The panel believed there was a need to more fully analyze how proposed changes in GCD operations may affect the larger western electrical grid,

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
	future WECC analysis and work with WAPA to establish framework for future economic and financial analyses if deemed necessary by power modeling completed in Year 1. Cost: 250,000 to 500,000 or more if new models are required WECC = Western Electrical Coordinating Council (i.e., western grid).	causes such as changes in the power market. **HIN 2.** What would be the market impacts on marketable capacity and energy of: • Increasing the daily fluctuation limit Increasing up-ramp and down-ramp limits • Raising maximum power plant flow limit above 25,000 cfs • Lowering the minimum flow limit below 5,000 cfs	thus influencing power market values. The need to evaluate the impacts on the WECC would be assessed in step 1 under power modeling in Years 1 and 2. During Year 1, information generated by the WAPA modeling effort would be used to develop budgets for Year 2 and beyond, once a determination is made about the potential geographical scope of economic effects and whether the expanded WECC-level analysis is deemed necessary to influence GCDAMP decision-making. If determined that WAPA's models are not sufficient to capture "spill over" effects, GCMRC should solicit outside consultants to perform the WECC analyses using models that are appropriate for this purpose. If these tasks are needed, GCMRC should enlist additional expertise to develop the RFQs for the power modeling work (see staffing).
Year 3			
9	Recreation Use Analysis Continues: Part B (Non-Market): initiate recreation surveys of Glen Canyon anglers, day-use rafters, and Grand Canyon and Marble Canyon white water users including Diamond Creek to Mead rafters. Cost: =$150,000 - $200,000	**RIN 1.** What are the total market, non-market, and non-use values for the following recreational uses of the Colorado River Ecosystem downstream from Glen Canyon Dam, including pre-ROD and post-ROD demand and economic assessments: • Glen Canyon boating and walk-in trout fishery and related components • Glen Canyon recreational boating industry • CRE day hiking and overnight camping • Grand Canyon private and commercial rafting operations including Native American enterprises	GCMRC should undertake socioeconomic studies focused on recreational values that include both market and non-market *use* values for specific river reaches. In Year 2, work would focus on the second phase of this project implementing the non-market use values surveys. This recommendation combines areas from Glen Canyon down to Mead in order to maximize efficiency in developing surveys. The intent of the non-market use work is to determine the broader value of the resource to recreation users beyond the simple expenditure analysis under the market use analysis (above). This broader analysis of "willingness to pay" for changes in resource conditions would help the AMP in determining economic consequences of actions by including overall changes in benefits. For example, changes in operations might increase the value of power but might have a negative consequence on the overall benefits to recreational visitors or other user groups. This analysis would put dollar amounts on those changes in benefits and allow an economic analysis to be performed on GCDAMP decisions. (Note: Some aspects of this program element may be covered by the NPS economic study.)

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
		RIN 2. Define and value key attributes and key benefits that affect the Grand Canyon wilderness and Glen Canyon recreation experiences: • How do they affect market values for these different CRE recreation activities? • How do they affect non-market and non-use values for these different CRE recreation activities? • How do they differ under differing flow regimes and events such as HFEs, Low Steady Flows and other experiments? • How do they differ under differing management actions?	
10	[*Contingent on scoping results Year 2]* Prepare surveys of tribal preferences and social values. The analysis could include consideration of both use and non-use values and include sociology and socioeconomics. Cost: $40,000	**CRIN 1.** What are the market, non-market and non-use values for CRE resources valued by tribes as affected by dam operations?	This activity is dependent on the outcome of the scoping exercise in Year 2. Although it is important to consider tribal values in AMP decision making it is unclear whether these values require separate analyses or whether these values could be adequately considered during the use and non-use tasks described elsewhere in this plan. It is important that this research program incorporates tribal values so that decisions can incorporate those values in a meaningful way. A socioeconomic research program needs to recognize not only the economic impacts but also the social impacts on the tribes that result from changes in dam operations. Socioeconomic impacts to Tribes may suggest both opportunities and constraints that should be considered as changes in river operations are contemplated. Information to be covered in this survey could include attitudinal questions about preferences and impacts of flow regimes. Tribal representatives would be invited to participate in the development

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
			and testing of the survey.
11	Initiate OMB clearance to conduct surveys with focus groups in Year 3 in order to develop a non-use values survey in Year 4. Cost: $20,00	**RIN 1.** What are the total market, non-market, and non-use values for the following recreational uses of the Colorado River Ecosystem downstream from Glen Canyon Dam, including pre-ROD and post-ROD demand and economic assessments: • Glen Canyon boating and walk-in trout fishery and related components • Glen Canyon recreational boating industry • CRE day hiking and overnight camping • Grand Canyon private and commercial rafting operations including Native American enterprises **HIN 3.** What are the total market, non-market and non-use impacts on upper and lower basin water users from proposed alternative dam operations? **HIN 4**. What are the socioeconomic impacts of Glen Canyon Dam operations and experiments to tribal communities, including market, non-market and non-use? **HIN 5.** What are the market, non-market and non-use values associated with Glen Canyon electrical power, and determine	

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
		these values. **HIN 6.** What is the market, non-market and non-use values associated with water released through Glen Canyon Dam, and determine these values. **RIN 2**. Define and value key attributes and key benefits that affect the Grand Canyon wilderness and Glen Canyon recreation experiences: • How do they affect market values for these different CRE recreation activities • How do they affect non-market and non-use values for these different CRE recreation activities • How do they differ under differing flow regimes and events such as HFEs, low steady flows and other experiments • How do they differ under differing management actions	
Year 4			
12	*[Contingent on scoping results in Year 3]* Conduct tribal market, non-market, non-use scoping and value assessments. Cost: $100,000	**CRIN 1.** What are the market, non-market and non-use values for CRE resources valued by tribes as affected by dam operations?	A socioeconomic research program for GCMRC needs to recognize not only the socioeconomic impacts but also the social impacts on the Tribes that result from changes in dam operations. Conduct tribal surveys for preferences and social values potentially affected by GCD operations.
13	Conduct focus groups and piloting of Non-Use Value survey, and initiate OMB	**HIN 3.** What are the total market, non-market and non-use impacts on upper and lower basin water users from proposed	The panel recommended that GCMRC start to plan for a future non-use value study to be ready for actual implementation. These Year 4 tasks are part of the preparatory phase preceding implementation of the actual

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
	clearance for full survey implementation. Cost: $200,000	alternative dam operations? **HIN 4**. What are the socioeconomic impacts of Glen Canyon Dam operations and experiments to tribal communities, including market, non-market and non-use? **HIN 5.** What are the market, non-market and non-use values associated with Glen Canyon electrical power, and determine these values. **HIN 6.** What is the market, non-market and non-use values associated with water released through Glen Canyon Dam, and determine these values. **RIN 2**. Define and value key attributes and key benefits that affect the Grand Canyon wilderness and Glen Canyon recreation experiences: • How do they affect market values for these different CRE recreation activities? • How do they affect non-market and non-use values for these different CRE recreation activities? • How do they differ under differing flow regimes and events such as HFEs, Low Steady Flows and other experiments? • How do they differ under	survey.

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
		differing management actions?	
14	Develop "real-time decision-making spreadsheet" for power impacts and benefits. Cost: $50,000 - $100,000	**GIN 3.** Determine methods to assist more real time assessments of resource impacts of alternative management activities. **GIN 4.** Evaluate, as needed, market, non-market, and non-use values for other resources also found to have impacts from dam operations and deemed important to the AMP	To the extent that repeated analyses of power market impacts are required as part of the future decision-making it may well be possible to ease the calculations by developing a simplified response-surface model, embodied in a spreadsheet, linking changes within the CRSP service area to impacts on prices and capacity requirements within WECC. The GTMax Lite model may be applicable to develop this, but only after adequate testing is done in tasks above. Develop general program capability to evaluate market, non-market and non-use values for resource impacts not yet defined by the AMP
Year 5			
15	Conduct full non-use value survey. Cost: $500,000	**HIN 3.** What are the total market, non-market and non-use impacts on upper and lower basin water users from proposed alternative dam operations? **HIN 4**. What are the socioeconomic impacts of Glen Canyon Dam operations and experiments to tribal communities, including market, non-market and non-use? **HIN 5.** What are the market, non-market and non-use values associated with Glen Canyon electrical power, and determine these values. **HIN 6.** What is the market, non-market and non-use values associated with water released through Glen Canyon Dam, and determine these values.	By Year 4, it will have been 20 years since the Welsh et al. (1995) study was conducted. Much has changed including the management scenarios in the Grand Canyon and the demographics of the U.S. population, especially in the Four Corners Region. As recommended by the National Research Council in its report “Downstream”, these nonuse values are quite important to understanding the public benefits of alternative management strategies in the Grand Canyon. By tying flow-related changes to the environment to the non-use value survey, the incremental or marginal nonuse values can be estimated that are most useful for evaluating potential management actions in the Grand Canyon.

ROW #	Proposed Study/Activity	Information Needs	Description of Activity
		RIN 2. Define and value key attributes and key benefits that affect the Grand Canyon wilderness and Glen Canyon recreation experiences: • How do they affect market values for these different CRE recreation activities? • How do they affect non-market and non-use values for these different CRE recreation activities? • How do they differ under differing flow regimes and events such as HFEs, Low Steady Flows and other experiments? • How do they differ under differing management actions?	
16	Implement Core Monitoring Plan for Socioeconomics. Cost: $20,000	Develop Core Monitoring Information Needs (CMINs)	The panel recommends that socioeconomic surveys be repeated every 2-3 years as a monitoring tool to assess how changes in GCD operations affect recreational values. This should be integrated into the Core Monitoring Plan. A placeholder for socioeconomics should be kept in the initial General Core Monitoring Plan.