TWG Initial Biennial Budget Considerations for FY 2015/16
Considered by the Budget Ad Hoc Group February 25, 2014

The biennial budget and workplan guidance provides for an opportunity for the TWG to provide initial budget considerations to DOI in January. The TWG is expected to consider the information needs and progress made in meeting those needs. The initial input is intended to help GCMRC and BOR to begin the development of the FY 2015/16 biennial budget and workplan.

1. **Food Base Enhancement Project (Expansion of Project H)**. During the 2015-2016 budgeting process the GCMRC could schedule a workshop to develop a project in coordination with responsible agencies. A good foundation may be data collected in the tail water synthesis project. By introducing a basic outline at this time the TWG, scientists of the GCMRC and constituents parties have the opportunity to utilize their understanding of the basic research at hand and organize a logical investigative approach for an applied application to address the issued discussed here. The project should include:
    a. A review/develop data on flows and Temperature to determine what flow regimes are most positive to higher densities of aquatic invertebrate.
    b. Test stream habitat augmentation to improve colonization and establish host colonies of invertebrate. Such augmentation can include movement of rocks and boulders as well as introduction of wood and logs. Consideration should also be given to nutrient supplementation.
    c. Translocation of native insect taxa to establish colonies in the main stream.
2. **Food Base Studies (Project H).** GCMRC should explain the dramatic shift in the aquatic food base in Lees Ferry from scuds to black flies, midges and mud snails.
    a. What are the possible causative factors and does dam placement or operations have any influence on this shift?
    b. GCMRC should attempt to determine the implications of aquatic food base set adrift by higher densities and/or flow changes on fish at the LCR and downstream. Humpback chub at the LCR rely heavily on drift as their primary food source and the drift studies need to determine how the values found in the reports by Kennedy et al. on drift relate to downstream fish populations.
3. **Lees Ferry Low Flow Study.** The TWG discussed with GCMRC at the January 2014 meeting the possibility of implementing a study in to determine the minimum flows needed to protect the aquatic food base and the Lee Ferry trout fishery, and the impacts of low flows on those resources. An initial analysis was brought forward to the TWG and numerous options were discussed for further consideration. It is our understanding that GCMRC will consider what work could be done in 2014 and will also then consider options for continuing that work in 2015/16. This proposal would likely bridge these two budgets, so some of this work may pertain to 2014 and some to 2015/16.

    The first step in this effort would involve mapping the river channel at representative riffle areas and other critical food base "hot spots" to determine the relationship between river flow and

surface area of the river. Our understanding is that while there are a variety of transects in the Lees Ferry reach, few are located in riffle areas or other food base hot spots. This work could be accomplished within the existing channel mapping capabilities at GCMRC/NAU.

Channel mapping alone will not provide all the data need to establish a biologically based minimum flow for the Lees Ferry reach. Therefore, we also recommend that the relationship between minimum flows and aquatic productivity should also be assessed. The Lee Ferry fishery has been doing well for the past several years and the rainbow trout are generally robust and in excellent condition. In the past, the condition of the fishery has deteriorated rapidly for reasons that are not clearly understood. We believe that establishing a biologically based minimum flow for Lee Ferry will allow for more informed decisions related to operation of Glen Canyon Dam and help maintain a quality trout fishery below the dam.

GLCA: Based on the presentation by Melis on aquatic habitat and low flow impacts, a flow model in GLCA(channel mapping project) would be useful for park managers in determining how flows are affecting sites and at what elevations. In addition to assisting us in understanding the aquatic food base, it could inform us as to the complexity related to sediment resources (designated campsites, cultural sites and key concessioner beach stop locations visited by over 65,000 people a year). Also, additional cross sections to assist in our understanding of flows on low angle habitats in Glen Canyon which can also tie into continued Glen Canyon sediment studies.

4. **Remote Sensing.** Use of remote sensing to determine sand bar area in Glen Canyon.
5. **Project A.1.2 or A.1.3**. Geomorphologic and Vegetation Analysis at Colorado River at designated campsites in Glen Canyon (3 Sites).
6. **Web.** Addition of Glen Canyon into the web mapping and photo viewer application for GCMRC.
7. **Assessment of Direct Recreation Expenditures in the Colorado River Ecosystem (CRE).** This market assessment project is proposed for completion by GCMRC in cooperation with SEAHG and the TWG. The project proposal is supported by the GCMRC Chief and will be led by GCMRCs economist. GCMRC proposes collaboration with the SEAHG and TWG in completion of the project. The assessment will utilize consumer direct expenditures on recreation activities in the CRE. This will include fishing, boating, hiking, camping, etc. activities. It will not include assessment of recreation direct expenditures on Lake Powell or Lake Mead. The data will be gathered via survey instruments in final approval stages with the Office of Management and Budget (OMB). GCMRC will oversight data collection and complete all data analysis and report writing. The project is proposed for initiation in winter/summer 2014 and completion in 2016. The approximate budget for the program is $240,000. It is proposed by GCMRC that the budget be taken from GCMRC 2013/14 carryover funds allocated to the SE program but not expended. No funds are proposed at this time from FY2015/16 budget allocations unless AMWG would request expansion or significant changes in the proposed research.
8. **Evaluation of Decision Support Methods for the AMP.** This project is proposed for completion utilizing the decision methods personal expertise of the GCMRC economist. The AMP has over its existence invested resources in science and assessment programs to utilize existing decision methodology and develop methods specific to the problems it addresses. The

SEAHG recommended and the AMWG approved a program to evaluate decision support methods that can incorporate economic parameters and provide more rapid assessment capabilities in science and management program planning. The GCMRC economist has both academic and work experience in development and use of analytical methods to support planning decisions. GCMRC has proposed to conduct this project in a collaborative effort with the SEAHG and TWG to assure any methods developed are properly specified to respond to specific needs of the AMP. Although specific methods have not been proposed, the effort would involve evaluation of analytical tools that would best apply to the AMP environment when considering need for collaboration, constraints on time of members and budgets, complex biophysical/socioeconomic interactions in resource issues, need for tradeoffs to gain resolves, etc. The project is proposed for initiation in 2015 and completion of first generation methods(s) in 2016. Funding for the project would include support for the economist, travel, workshop(s), and possible contract work with other specialists. A budget estimate is being developed by GCMRC.

9. **Conduct a Non-Market Assessment Methods Workshop for the AMP.** The SEAHG identified the information need for a workshop to better inform AMP members on the various attributes, development methods and uses of market and non-market economic values. In part the workshop was thought to be important for AMWG in guiding the development of socioeconomic analysis in the LTEMP and EIS processes. It is still determined by the SEAHG to have critical importance in science and management project planning as well as guiding the most appropriate use of developed data and analysis. The workshop would be a collaborative effort of the SEAHG and the GCMRC economist and staff. It is proposed to be a four hour workshop planned around a regular AMWG or TWG meeting to accommodate all AMP members and other specialists associated with the AMP program. Three or more contracted non-market and market economists would present the program, with approximately half the time devoted to presentations of principals and half to examples demonstrating appropriate applications. The workshop would be presented in early FY 2015 and is proposed to be a project for the 2015 budget. The cost is estimated at $8-$10,000.

10. **Administrative History Pilot Project.** The AHAHG recommends a pilot project to implement the Strategy for Development of the Administrative History (SDAH) by considering funding measures to accomplish the history objectives. The cost is estimated at $100,000. Highlighted are the following (further detail can be found in the AHAHG report to the TWG):
    a. Begin developing Oral Histories and Interviews with AMP historical figures.
    b. Annotated Bibliography for program related literature.
    c. Website and library database for information archival and retrieval.
    d. Chronological Program Overview including participants.
    e. Develop New Participants Handbook for the AMP.
11. **Facilitation for TWG and AMWG.** The TWG believes that facilitation, for some or all of the meetings and preparation for meetings, is very useful and should be reconsidered in the 2015/16 budget, similar to past funding amounts.

12. **Continue Project E3, Humpback Chub Population Modeling.** Continue to explore development of the Yackulic (and others) humpback chub population model as a replacement model for population level assessments (e.g., ASMR and LSMR). Explore the possibility of having this meet our assessment needs for USFWS. Ideally the model would be developed so that it could be run annually without excessive staff time. Not that we expect adult numbers to change that much, but the model includes many other parameters such as differential survival rates, juvenile survival, and the promise of being able to include LCR conditions to predict year class strength. It seems that this model would be very informative as our learning progresses. Use the model to explore future needs for humpback chub management (e.g., trout management).

13. **Consider Dropping or Reducing the Frequency for Lower 1200m Monitoring (Project F4.2).** From the 2009 FISH PEP recommendations: "…compare the spring random hoop net data to the fixed site 1200 meter hoop net data. Although the 1200 meter data is a valuable long-term series, it may be redundant to the ongoing spring hoop netting. These two programs should be evaluated by comparing catches in the 1200 meter program to data from the lower sections of the FWS program." Some work may have been done, perhaps by Yackulic to consider this, but it is unclear that this project is needed or could not be replaced with information from the PIT tag antenna array.

14. **Project H.4.** The tailwater synthesis study should be enhanced by inclusion of trout strain data. We know there are vast differences in growth rates, achievable size, survival, catchability, etc. from strain to strain and such differences should be included in the report to achieve any level of validity when attempting to determine dam effects on trout size.

15. **Nutrient Budget.** Develop a nutrient budget model for the Colorado River ecosystem.

16. **CRE Conceptual Model.** Develop a revised CRE conceptual model relating channel topography, flow, water quality, sedimentology, and fish distribution and population dynamics to channel and landform geomorphology, and ecological development. Develop the CRE concept model, incorporating existing flow, sediment, WQ, and fisheries models. Apply the concept model to modeled channel and river landforms. Develop a CRE nutrient budget model and relate it to the overall concept model. Consider for 2017-2018 budget cycle the next steps needed to expand ecosystem modeling: how to model of ecosystem productivity, trophic efficiency, biological, cultural diversity, and ecosystem management.

17. **Juvenile Chub Monitoring.** GCMRC should improve its ability to track the 40% of young humpback chub "lost" or unaccounted for from the LCR each year to determine if they all die or whether emigration up- and downstream occurs. This will give us a better idea of survival numbers.

18. **Monitoring Cultural Resources Effects of Aeolian Sediment Transport on Resources in Addition to Archaeological Sites**. Although the benefits of High Flow Experiments (HFEs) that stage sand in particular areas, which is subsequently transported to nearby archaeological sites, thereby stemming erosion, are just recently becoming understood, we recognize other effects that should also be considered. Specifically, it has been noted that certain native perennial grasses and other native plants are becoming re-established in some of these same contexts. Some of these plants were economically important to Native American subsistence and is appropriate to study

and evaluate as an aspect of Traditional Cultural Knowledge (TEK). This phenomenon is worthy of additional research and monitoring, and should be pursued in the near future so that changes can be identified while still in their earliest stages in order to evaluate whether they are, in fact, due to HFE related processes.

19. **Restoration/Preservation of Gooddings Willow**. Although Gooddings willow was present throughout the canyon during pre-dam times, it is now nearly extirpated. Although much emphasis has been placed on the historic willow at Granite Park (ca. RM 209), which may be nearing the end of natural life, we believe that a program to reintroduce Gooddings willow in other optimal habitats would be desirable and timely. We would specifically like to obtain cuttings from the Granite Park willow and propagate new trees from the cuttings (which would preserve the spirit of the tree), as well as obtain cuttings from other willows, possibly from tributaries such as Diamond Creek, in order to establish a nursery from which to plant back along the Colorado River at a later date. The cuttings would be taken to one or more controlled settings outside the canyon in order to prevent destruction by beaver or other pests, and reintroduced when the likelihood for survival is more assured.

    A project such as this will have measurable results as well as incorporating TEK. It presents an ideal opportunity to integrate tribal values with scientific methods, in addition to creating educational opportunities for tribal members and non-tribal members. It furthermore could become an excellent example of co-management of ecological resources along the river, which can be built upon with other native species such as Fremont cottonwood, native perennial grasses, etc.

20. **Native Fish Studies Below River Mile 208 (especially below Diamond Creek).** We note that critical habitat for humpback chub, for example, is currently designated as RM 34 to RM 208. Yet, as reported by David Rogowski during the Annual Reporting meeting on January 28, 2014, approximately 88% of fish studied below Diamond Creek are native species, which is almost the exact opposite of percentages above Diamond Creek. Warmer water temperatures (and perhaps greater turbidity) in the western Canyon may be advantageous to native fishes, as has been suggested in the gradual population increases in the Little Colorado River area. Considering that razorback sucker, an endangered species that was thought to be extirpated in the Canyon, has been recently identified in Lake Mead, it would be well worth allocating additional resources to investigate this relatively neglected stretch of the river.

21. **Sediment Studies Below Diamond Creek.** This is an ecological as well as socio-economic issue. By far, most of the research and monitoring efforts surrounding sedimentology have focused on the Marble Canyon reach of the Colorado River, to the neglect of the lower reaches. Dramatic changes in sediment deposition have affected riverine ecology, including riparian vegetation and aquatic and near-shore animal species, that the Hualapai people view as important components of the life of the river, and are part of the constellation of factors that make the river significant as a Traditional Cultural Place (TCP).

    Furthermore, changes in sediment deposition have an impact on the Hualapai Tribe's recreation and tourism operations the Western Grand Canyon, including changes to the navigable channel, river turbidity, stability to boat docks, and damage to boats and motors. Although these effects

have resulted from the combined management of Lake Powell and Lake Mead, certain Glen Canyon Dam operations, such as equalization flows, likely exacerbate the problem.

Renewed focus on the sedimentology below Diamond Creek is necessary to understand and ultimately mitigate these effects, and perhaps others that are as yet unforeseen. The Hualapai Tribe views such an effort as an opportunity for a collaborative partnership that would incorporate western science and tribal values.

22. **Project D.** Could sampling design be adjusted to target spring areas more? Example of capturing the untagged humpback chub at 35 mile spring this last year. If these fish really don't move around a whole lot, and they seem to be associated with spring inflows, could targeting spring inflows for sampling improve our understanding of the aggregations. Do we have a good springs map for the canyon?
23. **Project F.** Can we yet describe the utility of the translocation program (Project F.4.3)? How have these efforts improved the situation for humpback chub in Grand Canyon? Especially with respect to the Little Colorado River/Chute Falls translocations, what is the definition of success with regard to these efforts? Funding should be provided to determine the implications of these translocation programs especially chute falls.
24. **Project F.** Should we move to a Natal Origins/Juvenile Chub Monitoring-type level of population monitoring using capture/recapture data instead of using a more standard CPUE metric (i.e. the Glen Canyon trout monitoring, Lower 1200 LCR sampling) for monitoring fish populations in the canyon? Including Lees Ferry trout monitoring? CPUE metrics may be very unreliable in Grand Canyon.
25. **Glen Canyon Photo Monitoring (Project A.1.1).** The National Park Service would like to see some additional photo monitoring sites (similar to 46 Sites in GRCA) in Glen Canyon in the upcoming biennial work plan to mirror Grand Canyon monitoring. Even though our beaches are not used for overnight camping except at designated sites, those sites still have value and we want to monitor them carefully as they provide important habitat for wildlife, have day and overnight recreational value, and are mostly a non-renewable resource. Request to add 3 sites to network in addition to 46 sites in Grand Canyon per Component A.1.1.
26. **Cultural Resources Ad Hoc.**

    a. Develop a list of species of management concern to the participating Tribes, and use that discussion to clarify how to better incorporate traditional ecological knowledge into CRE science and management programs.

    b. **Tribal Perspectives.** Fund an outside panel of experts to work with the Tribes and GCMRC to develop methodologies for integrating Tribal perspectives into the science program.

    c. **Synthesis for Tribal Involvement.** Develop synthesis project that evaluates the management of other river systems and the involvement of Native American/indigenous peoples.

d. **TWG will charge the CRAHG to work on these, potentially with help from GCMRC, perhaps a workshop.**