

**Glen Canyon Dam Technical Work Group Meeting**  
August 30-31, 2017

**Summary of Actions Taken**

- Draft Minutes for April 20-21, 2017, meeting were approved by consensus.
- Budget Motion: The TWG recommends that the AMWG recommend for approval the Glen Canyon Adaptive Management Program Triennial Budget and Work Plan – Fiscal Years 2018-2020 (Draft August 17, 2017) to the Secretary of Interior with the following changes:
  1. Approving GCMRC's Project C as written contingent upon adding language to Reclamation's Project C.7., Experimental Vegetation Treatment, for funding tribal engagement as partners in planning and executing the experiment.
  2. Approving GCMRC Project D with no funding for D.1, D.2 or D.3, but with funding for D.4.
  3. GCMRC Project G.5 – Add one annual seining trip funded by the Native Fish Conservation Contingency Fund.
  4. Approve GCMRC Project I with an additional Spring system-wide monitoring trip to I.1 and a Fall Diamond Down trip
  5. GCMRC Project E. with reinsertion of Project E.7.1, Aquatic Vegetation Surveys, and Project E.7.2, Artificial Streams.
  6. Without a net increase to the budget, add a new Project N, Hydropower, to the GCMRC work plan with work efforts that include (also add to Reclamation Project C with complementary language):
    - a. Develop Glen Canyon Dam operational experiments to meet the hydropower objective.
    - b. Consider and estimate impacts of experiments on hydropower as part of experimental design.
    - c. Incorporate total hydropower value into Decision Support Systems being developed in GCMRC Project J.2
    - d. Utilize WAPA and Reclamation hydropower data, as available, and include WAPA technical staff in the development of models, design of experiments, and monitoring metrics.
  7. GCMRC Project J. Socioeconomics as written with additional language:
    - a. Clarifying language will be added to Project J.2 that indicates integrating hydropower analysis into the modeling of trout management flows will be a primary focus. Incorporating hydropower analysis follows the development and integration of rainbow trout and humpback chub population models and cost-effectiveness analysis, used to identify efficient management actions to meet adult humpback chub abundance goals. Hydropower analysis in J.2 is an incremental step in the development of applied decision and scenario analysis research at GCMRC. Adding hydropower analysis into the applied decision and scenario analysis research is timely provided the proposed LTEMP EIS experiments, including trout management flows.
    - b. A workshop will occur with GCMRC staff and GCDAMP stakeholders in fiscal year 2018 to review and discuss the trade-offs between trout management flows, expected downstream rainbow trout and humpback chub outcomes and associated costs of management actions, including hydropower. This workshop will provide an opportunity to explore opportunities to improve hydropower resources while meeting downstream rainbow trout and humpback chub resources goals as defined in the LTEMP EIS.
  8. Approve Reclamation Project D. with addition of identifying how Reclamation Project D elements and GCMRC project elements address stipulations in the PA and track their progress.
  9. Increase funding for Reclamation Project D.10 to a target balance of about \$200,000 by the end of FY 2018.
  10. Approve Reclamation Project C. with changes to allow allocation of some funds from Reclamation Project C.5 into Reclamation Project D.10.

The motion passed by majority with one stakeholder voting no. A minority report will be prepared by the NPCA and forwarded to the AMWG.

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**Date: August 30, 2017**

**Start Time: 9:30 a.m.**

**Conducting:** Seth Shanahan, TWG Chair  
Vineetha Kartha, TWG Vice-Chair

**Committee Members/Alternates Present**

Melinda Arviso-Ciocco, Navajo Nation  
Cliff Barrett, UAMPS (phone)  
Carlee Brown, State of Colorado  
Charley Bullets, So. Paiute Consortium (phone)  
Kelly Burke, Grand Canyon Wildlands Council  
Shane Capron, WAPA  
Kerry Christensen, Hualapai Tribe  
Kevin Dahl, National Parks Conservation Assn.  
Kurt Dongoske, Pueblo of Zuni  
Katrina Grantz, U.S. Bureau of Reclamation  
Paul Harms, State of New Mexico

Ken Hyde, NPS/GLNRA  
John Jordan, Federation of Fly Fishers/TU  
Vineetha Kartha, State of Arizona/TWG Vice-Chair  
Ryan Mann, Arizona Game & Fish Department  
Robert King, State of Utah (phone)  
Don Ostler, State of Wyoming  
Ben Reeder, Grand Canyon River Guides  
Peggy Roefer, State of Nevada/UCRC  
Seth Shanahan, TWG Chair  
Michael Yeatts, Hopi Tribe  
Kirk Young, U.S. Fish and Wildlife Service

**Committee Members Absent**

Jan Balsom, NPS/GRCA  
Bill Davis, CREDA  
Chris Harris, State of California  
Chip Lewis, Bureau of Indian Affairs

Joe Miller, Int'l Federation of Fly Fishers/TU  
Larry Stevens, Grand Canyon Wildlands Council  
Steve Wolff, State of Wyoming

**U.S. Geological Survey (USGS) and  
Grand Canyon Monitoring and Research Center (GCRMC) Staff**

Lucas Bair, Economist  
Mike Moran, Deputy Chief, GCMRC  
Ted Kennedy, Aquatic Biologist

Scott Vanderkooi, Chief, GCMRC  
David Ward, Fishery Biologist

**Interested Persons, TWG Members and Alternates**

Rob Billerbeck, NPS  
David Braun, Science Advisors (phone)  
Bill Chada, U.S. Bureau of Reclamation  
Marianne Crawford, U.S. Bureau of Reclamation  
Paul Davidson, U.S. Bureau of Reclamation  
Craig Ellsworth, WAPA  
Bret Esslin, Arizona Dept. of Water Resources  
Jessica Gwinn, U.S. Fish and Wildlife Service

Brian Healy, NPS/GRCA  
Dawn Hubbs, Hualapai Tribe  
Leslie James, CREDA  
Theresa Pasqual, DOI Federal Tribal Liaison (phone)  
Sarah Rinkevich, DOI Federal Liaison  
Randy Seaholm State of Colorado  
Chris Watt, U.S. Bureau of Reclamation

**Meeting Recorder:** Linda Whetton

**Welcome and Administrative:** Mr. Shanahan welcomed the members and the public. Introductions were made and a quorum determined.

- Approval of April 20-21, 2017, Meeting Minutes. Pending one edit, the minutes were approved by consensus.
- Review of Action Items. No action required.
- Next Meeting Date: A "doodle" poll will be sent requesting availability for a conference call during October 9-13.
- Update on monitoring and research trips (**Attachment 1**). Mr. Vanderkooi distributed a table listing field trips that will be launching mid-October. This will be a recurring agenda item. Reclamation and NPS will provide input as well.
- Ad Hoc Group Updates – Mr. Shanahan. Ad hoc groups have been coordinating with their members in support of budget and work plan development activities.
- Cultural Resources Activities Update – Dr. Rinkevich. Kurt Dongoske stepped down as the CRAHG chair. The tribes

will talk among themselves regarding who will be the new chair. Dr. Grantz said the PA was signed by all parties to the agreement, and it is currently being reviewed by the Historic Preservation Advisory Council.

- **Green Sunfish Update** – Mr. Hyde. The exclusionary barriers didn't get installed until April. Within a month NPS verified that the GSF had moved back into the upper slough even though there was a successful ammonia treatment last year. Approximately 15-20 GSF were found in the Nov-April period. Most of the bigger fish had been removed by electrofishing but at least two were able to spawn. About three weeks ago black plastic across the entire upper slough (1/3 acre) was installed to see if this would disrupt the oxygen cycle and heat the pond. As of last Thursday, there were still several GSF visible, even though the oxygen levels had dropped from 10.5 down to 1.5. The black plastic will be left in place for two more weeks. If there are still GS, one more ammonia treatment will be performed in late September in anticipation of a possible HFE. Should an HFE occur, the exclusionary barriers will be put back into place the week following the HFE.
- **Update on Plan for Controlling High Risk Aquatic Invasive Fish Species** – Mr. Billerbeck. Given all the complications with recent increases in BT and feedback received, the NPS is developing a more comprehensive plan. They are moving forward with cooperating agency agreements and consulting with the tribes. NPS hopes to get meetings scheduled soon and start public scoping in November-December. Reclamation is assisting with some of the analysis- Reclamation's Provo construction office and Denver Technical Services Center will evaluate potential engineering issues related to the sloughs.

**TWG Chairperson and Vice Chairperson Election** – Dr. Grantz. The TWG Chair position is a one-year term, Mr. Shanahan's term ends Sept. 30, 2017. Consequently it's time to re-elect the TWG Chair and Vice-Chair. Nominations were requested. Ms. Roefer nominated Mr. Shanahan as the TWG Chair, which was seconded by Mr. Yeatts. With a verbal vote, Mr. Shanahan was approved as the TWG Chair for FY18. Mr. Capron nominated Ms. Kartha as the TWG Vice-Chair which was seconded by Ms. Brown. By verbal vote, Ms. Kartha was approved as the TWG Vice-Chair for FY18.

**DOI FACA Review Update** – Dr. Grantz. In May, Reclamation received notification that all DOI FACA committees were undergoing a review; all committee and subcommittee activities were suspended. Reclamation applied for and received a waiver in June to resume subcommittee activities in order to prepare the FY18-20 budget and work plan, and to prepare for a potential BT Workshop, a possible fall HFE, and a tentative AMWG meeting September. The waiver was put in place and Reclamation is planning for an AMWG meeting on September 20, 2017 in Phoenix. The Federal Register Notice for that meeting was published on Aug. 29, 2017. Even though the FACA review is ongoing, DOI committees and subcommittees can resume their work beginning in September.

**Update on Hydrology and GCD Operations (Attachment 2)** – Mr. Davidson. The April through July unregulated inflow to Lake Powell was 8.17 maf, or 114 percent of average. Snowpack peaked in early March at 126 percent of average. Lake Powell inflows peaked at 60,600 cfs on June 13th, and the reservoir elevation peaked at 3,635.8 feet, with a content of 15.5 maf, or 64% full. Lake Powell current operations are in the Upper Elevation Balancing Tier (UEBT). Water year 2017 unregulated inflow is currently forecasted to be 12.1 maf, or 111% of average and 9.0 maf will be released from Glen Canyon Dam. Lake Powell is currently 61% full with 14.9 maf in storage. The current pool elevation is 3,630 feet; 70 feet below full pool (3,700 feet) and 140 feet above minimum power pool (3,490 feet). The minimum probable, most probable and maximum probable release volumes from Glen Canyon Dam for water year 2018 are projected to be 9.0, 9.0, and 13.8 maf, respectively.

**Dam Maintenance Schedule**. Mr. Davidson. Glen Canyon Dam power plant maintenance is a continual process and management keeps the maximum number of power units online in November for a potential HFE. However, this November only six of the eight units will be available because of ongoing maintenance activities. Assuming current unit efficiencies given the reservoir elevation, these six units could release approximately 20,700 cfs. Combined with the river bypass tubes of 15,000 cfs, the total release from Glen Canyon Dam could produce a peak release of 35,700 cfs for an HFE. As of Sept. 6, 2017 there isn't enough sediment input to trigger a fall 2017 HFE.

**Glen Canyon Reach Rainbow Trout Experimental Stocking (Attachment 3)** – Mr. Cantrell. Reclamation, Park Service and Arizona Game and Fish did monitoring on July 4, 2017. AGFD proposed stocking in May but postponed in order to discuss shared goals. The goal is to maintain a fully recreational RBT fishery in Lees Ferry, while maintaining healthy populations of all native fish including HBC and RBS populations. Lees Ferry has been stocked since 1964, the last stocking was in 1998. Due to declines in early 2000 and 2005, or AGFD proposed stocking again. At that time AGFD and others received a Notice of Intent to sue from the Center for Biological Diversity and Upper Colorado Living Waters based on jeopardy for HBC and RBS. At the time there was little information about movement within Lees Ferry and affects to HBC and RBS in the lower Colorado River. Today there is low trout abundance, angler days are down, businesses are closing, and the river guides are suffering. The HBC population is exceeding 11,000. After working with the anglers, AGFD developed some objectives and goals for the fishery. AGFD plans to stock 13,000 triploid RBT annually between April 1, 2017 and October 15, 2021. Mr. Cantrell said he would send out information to people on proposed work to be done.

- *Concern was expressed that planning has taken place with very little stakeholder involvement.*
- *The foodbase is limiting the fishery and will effect native fish in the system. The RBT will be the least of issues to be concerned about.*
- *The Pueblo of Zuni is very concerned about stocking trout in Lees ferry, mechanical removal and the taking of life.*
- *FWS isn't comfortable using the calculations provided by AGFD. Your website states you don't expect any take.*
- *The Hualapai Tribe wants consultation on this action.*
- *Strongly support the request for collaboration and request for working with federal agencies on environmental compliance.*

**Brown Trout Workshop Update** – Dr. Grantz. A Brown Trout Workshop will be held at the DoubleTree Hotel in Tempe, Arizona, on September 21-22 (1.5 days), directly following the AMWG meeting. A white paper will be distributed before the workshop and updated after the workshop. Dr. Mike Runge will facilitate the workshop.

**Status of Developing Triennial Budget and Work Plan (Attachment 4)** – Mr. Shanahan. The BAHG has been working with the Interior agencies to provide input on the budget and work plan. In order to get to a budget recommendation, the TWG will use the “red, green and yellow” cards indicating their acceptance level for the various budget components. The group will go through all of the projects very quickly, each member will display a green, yellow or red card and then have discussion on the most difficult (red) projects/elements first. A reminder on the card usage:

**Green** = no concerns, support

**Yellow** = need more information or minor concerns, but would not block consensus

**Red** = major concerns, and will block consensus (members need to very specific)

**Budget Ad Hoc Group (BAHG) Input to the Triennial Budget and Work Plan (Attachment 5)** – Mr. Capron. The BAHG prepared a consensus document from meetings held and comments offered. He thanked Seth for chairing some of the meetings and assisting with that document. A meeting was held on August 4 to coordinate the final comments and get consensus on what they could accomplish given the shorter timeline. There were a lot of things they didn't get consensus on and in the past there was a process whereby they could elevate issues to the DOI level; those issues will be addressed in today's meeting. That document went to Reclamation and GCMRC for their consideration and is available for TWG review.

**GCMRC Response to Input on TWP** – Mr. VanderKooi. Scott summarized the process used and past guidance documents that are still relevant to bringing continuity to the program.

- *There were questions about research characteristics and methods. Rather than pull them out, they were left in the chapter narratives.*

- *A question about the Science Advisor role was deferred to either the GCDAMP as a whole or to Reclamation.*
- *There was a suggestion that projects should be considered in a 20-year context.*
- *The Fish PEP conducted last summer recommended looking at a theoretical approach with multiple hypotheses, collecting data, comparing against those hypotheses and taking that information forward.*
- *There was a request to identify research activities or new experiments that might occur as conditions warrant. There are at least three projects that have separate sections that are condition dependent (e.g., an extended duration HFE).*
- *GCMRC will continue to look for opportunities for tribal participation and possibly identify additional funding sources.*
- *Power analysis has been done for some projects and will be conducted with going forward.*

Reclamation Responses on TWP – Dr. Grantz. The Native Fish Conservation Contingency Fund for emergency conservation needs generated the most interest. She purposely didn't include an amount because analysis hasn't been done to determine what that number should be. In talking with other stakeholders, she's comfortable including past targeted information and information on how excess funds would be used.

**Resolution of Triennial Budget and Work Plan Items that Lack Consensus and Development of Budget Recommendation to the Adaptive Management Work Group (AMWG)** – Mr. Shanahan advised the members that if there is something missing, they need to be prepared to offer a change.

- *Hydropower is a resource and needs to be included in the work plan. Need experiments associated with fluctuating flow factors, ramp rates, and the 8K cap. Need analysis that was undertaken as part of the alternatives that were proposed within LTEMP.*
- *Need to capture results of implementing the LTEMP.*

The group reviewed the projects and identified which ones were supported and those with concerns by raising red, yellow and green cards.

**Public Comment:** None

**Adjourned:** 5 p.m.

**Glen Canyon Dam Technical Work Group Meeting**  
August 31, 2017

**Date: August 31, 2017**

**Start Time: 8:32 a.m.**

**Conducting:** Seth Shanahan, TWG Chair  
Vineetha Kartha, TWG Vice-Chair

**Committee Members/Alternates Present**

Melinda Arviso-Ciocco, Navajo Nation  
Cliff Barrett, UAMPS (phone)  
Carlee Brown, State of Colorado  
Charley Bullets, So. Paiute Consortium (phone)  
Kelly Burke, Grand Canyon Wildlands Council  
Shane Capron, WAPA  
Dawn Hubbs, Hualapai Tribe  
Kevin Dahl, National Parks Conservation Assn.  
Kurt Dongoske, Pueblo of Zuni  
Katrina Grantz, U.S. Bureau of Reclamation  
Paul Harms, State of New Mexico

Ken Hyde, NPS/GLNRA  
John Jordan, Federation of Fly Fishers/TU  
Vineetha Kartha, State of Arizona/TWG Vice-Chair  
Ryan Mann, Arizona Game & Fish Department  
Robert King, State of Utah (phone)  
Don Ostler, State of Wyoming  
Ben Reeder, Grand Canyon River Guides  
Peggy Roefer, State of Nevada/UCRC  
Seth Shanahan, TWG Chair  
Michael Yeatts, Hopi Tribe  
Kirk Young, U.S. Fish and Wildlife Service

**Committee Members Absent**

Jan Balsom, NPS/GRCA  
Bill Davis, CREDA  
Chris Harris, State of California  
Chip Lewis, Bureau of Indian Affairs

Joe Miller, Int'l Federation of Fly Fishers/TU  
Larry Stevens, Grand Canyon Wildlands Council  
Steve Wolff, State of Wyoming

**U.S. Geological Survey (USGS) and  
Grand Canyon Monitoring and Research Center (GCMRC) Staff**

Lucas Bair, Economist  
Dave Lytle, Director, USGS Southwest Biological Ctr.  
Mike Moran, Deputy Chief, GCMRC  
Ted Kennedy, Aquatic Biologist

Scott VanderKooi, Chief, GCMRC  
Joel Sankey, Research Geologist  
David Ward, Fishery Biologist

**Interested Persons, TWG Members and Alternates**

Rob Billerbeck, NPS  
David Braun, Science Advisors (phone)  
Bill Chada, U.S. Bureau of Reclamation  
Marianne Crawford, U.S. Bureau of Reclamation  
Craig Ellsworth, WAPA  
Bret Esslin, Arizona Dept. of Water Resources  
Ed Gerak, CREDA  
Jessica Gwinn, U.S. Fish and Wildlife Service

Brian Healy, NPS/GRCA  
Leslie James, CREDA  
Theresa Pasqual, DOI Federal Tribal Liaison (phone)  
Sarah Rinkevich, DOI Federal Liaison  
Dave Rogowski, Arizona Game & Fish Department  
Randy Seaholm, State of Colorado  
Chris Watt, U.S. Bureau of Reclamation

**Meeting Recorder:** Linda Whetton

**Welcome and Administrative:** Mr. Shanahan welcomed the members and the public. Introductions were made and a quorum determined. Unresolved issues from yesterday will be dealt with later.

**Resolution of Triennial Budget and Work Plan Items that Lack Consensus and Development of Budget Recommendation to the AMWG** – Mr. Shanahan. It was decided to review all the projects in preparation for a final vote. Mr. Capron suggested that after reviewing all the projects and possibly missing something, he wanted to reserve the right to hold up a red card. The TWG was agreeable to that.

### **Project D. Effects of Dam Operations and Vegetation Management for Archaeological Sites**

- Comments on Project D:
- D1. The effect of aeolian sand maybe a preservation component, but it's not the responsibility of the AMP. No funds should be spent to document windblown sand.
- D2. NPS has responsibility for GCD terraces. If they want expertise, they should pay for it.
- D3. Is integrated into D.1 and we don't need to know where available sand deposits are.
- D4. Putting the cart before the horse. We haven't discussed what the HPP looks like. Have concerns with GCMRC putting information together.
- A portion of funding should go into a contingency fund for arch sites. The BOR has a project with \$25K for mitigation of sites and that won't pay for anything. Let's take money and fund real mitigation for arch sites that are at risk.
- Suggest reworking D2 to have the experimental component that is more similar to when the actual activity is occurring.
- Make sure to use basin funds appropriately.

Result: D.1, D.2, and D.3 changed to eliminate funding, but fund D.4

### **Project G. Humpback Chub Population Dynamics throughout the Colorado River Ecosystem**

Comments on Project G:

- Not sure there is enough money to do experimentation and follow-up on these experiments.
- Concerned about the loss of backwater seining that's been dropped from the work plan.
- Add aggregation monitoring trip for HBC.

Result: Add one annual seining trip funded by the native fish conservation contingency fund.

### **Project I. Warm Water Native and Non-Native Fish Research and Monitoring**

Comments on Project I:

- Have serious problems based on management decisions.
- The measures to correct will include substantial taking of life in other areas.
- Don't see cross-integration or synthesis on this or other projects.

Result: Approve with one additional Spring system-wide monitoring to 1.1 and a Fall Diamond Down trip.

### **Project E. Nutrients and Temperature as Ecosystem Drivers: Understanding Patterns, Establishing Links and Developing Predictive Tools for an Uncertain Time.**

Result: Reinsertion of Project E7.1 Aquatic vegetation surveys and Project E7.2 Artificial Streams

### **Project F. Aquatic Invertebrate Ecology**

Comments on Project F:

- Not sure there is enough experimentation in this project. Research related to substrate got dropped.
- This is doing research just for research sake.

### **Project J. Socioeconomic Research in the Colorado River Ecosystem**

Comments on Project J:

- Need to add another GCMRC project for work associated with hydropower monitoring and other investigations.

Result: "Project N" will be a new project under GCMRC integrating hydropower analysis into the modeling of trout management flows as a primary focus.

### **Project L. Remote Sensing Overflight in Support of Long-term Monitoring and LTEMP**

Comments on Project L:

- This has been a condensed process.
- When first presented, the cost was divided – don't understand statement of setting aside \$75K.
- Work is necessary and provides information about large scale changes in the river corridor.

### **Project H. Salmonid Research and Monitoring**

Comments on Project H:

- Can't support if there is killing of trout via Trout Management Flows.
- Propose to reduce a number of surveys from 3 to 2 and add in the additional monitoring for the fall trip.

The votes on each project were captured in a final document (**Attachment 6**).

The group developed a final budget motion. All changes will be included in the next version of the Triennial Budget and Work Plan for the AMWG to review at their next meeting. The budget motion can be found on page 1. There was an objection to moving the motion by consensus. The following vote was recorded: Red – 1 (Kevin Dahl), Green – 10, and Yellow – 2 (Carlee Brown, Mike Yeatts).

The motion passed by majority with NPCA voting in the minority. The NPCA will write a minority report and provide to the AMWG before its next meeting. Dr. Grantz advised that the report needs to be submitted to Reclamation within the next three days in order to be included in the AMWG pre-meeting materials.

**Potential Fall Flow Experiment (HFE) ≤ 192 Hours; status of resources** – Dr. Grantz. Due to time constraints, this item will be discussed at the next AMWG meeting.

**Request for Agenda Items for Next Meeting** – Mr. Shanahan. It was decided to hold a half-day webinar on October 10, 2017 to discuss the potential for a Fall HFE and other TWG issues. Members should submit proposed agenda items to Mr. Shanahan by September 8, 2017.

**Public Comment:** None

**Adjourned:** 3:05 p.m.

Respectfully submitted,

Linda Whetton  
Upper Colorado Region  
Bureau of Reclamation



## Key to Glen Canyon Dam Adaptive Management Program Acronyms

|                                                   |                                                                     |
|---------------------------------------------------|---------------------------------------------------------------------|
| ADWR – Arizona Dept. of Water Resources           | HFE – High Flow Experiment                                          |
| AF – Acre Feet                                    | HMF – Habitat Maintenance Flow                                      |
| AGFD – Arizona Game and Fish Department           | HPP – Historic Preservation Plan                                    |
| AIF – Agenda Information Form                     | IG – Interim Guidelines                                             |
| AMP – Adaptive Management Program                 | INs – Information Needs                                             |
| AMWG – Adaptive Management Work Group             | KA – Knowledge Assessment (workshop)                                |
| AOP – Annual Operating Plan                       | KAS – Kanab Ambersnail (endangered native snail)                    |
| ARM – Annual Reporting Meeting                    | LCR – Little Colorado River                                         |
| ASMR – Age-Structure Mark Recapture               | LCRMCP – Lower Colorado River Multi-Species<br>Conservation Program |
| BA – Biological Assessment                        | LTEMP – Long-Term Experimental and Management Plan                  |
| BAHG – Budget Ad Hoc Group                        | LTEP – Long Term Experimental Plan                                  |
| BCOM – Biological Conservation Measure            | MAF – Million Acre Feet                                             |
| BE – Biological Evaluation                        | MA – Management Action                                              |
| BHBF – Beach/Habitat-Building Flow                | MATA – Multi-Attribute Trade-Off Analysis                           |
| BHMF – Beach/Habitat Maintenance Flow             | MLFF – Modified Low Fluctuating Flow                                |
| BIA – Bureau of Indian Affairs                    | MO – Management Objective                                           |
| BO – Biological Opinion                           | MRP – Monitoring and Research Plan                                  |
| BOR – Bureau of Reclamation                       | NAU – Northern Arizona University (Flagstaff, AZ)                   |
| BWP – Budget and Work Plan                        | NEPA – National Environmental Policy Act                            |
| BT – Brown Trout                                  | NHPA – National Historic Preservation Act                           |
| CAHG – Charter Ad Hoc Group                       | NNFC – Non-native Fish Control                                      |
| CAP – Central Arizona Project                     | NOI – Notice of Intent                                              |
| GCT – Grand Canyon Trust                          | NPCA – National Parks Conservation Association                      |
| CESU – Cooperative Ecosystems Studies Unit        | NPS – National Park Service                                         |
| cfs – cubic feet per second                       | NRC – National Research Council                                     |
| CFMP – Comprehensive Fisheries Management Plan    | O&M – Operations & Maintenance (Reclamation Funding)                |
| CMINS – Core Monitoring Information Needs         | PA – Programmatic Agreement                                         |
| CMP – Core Monitoring Plan                        | PBR – Paria to Badger Creek Reach                                   |
| CPI – Consumer Price Index                        | PEP – Protocol Evaluation Panel                                     |
| CRBC – Colorado River Board of California         | POAHG – Public Outreach Ad Hoc Group                                |
| CRAHG – Cultural Resources Ad Hoc Group           | Powerplant Capacity = 31,000 cfs                                    |
| CRCN – Colorado River Commission of Nevada        | R&D – Research and Development                                      |
| CRE – Colorado River Ecosystem                    | RBT – Rainbow Trout                                                 |
| CREDA – Colorado River Energy Distributors Assn.  | RFP – Request for Proposal                                          |
| CRSP – Colorado River Storage Project             | RINs – Research Information Needs                                   |
| CWCB – Colorado Water Conservation Board          | ROD Flows – Record of Decision Flows                                |
| DAHG – Desired Future Conditions Ad Hoc Group     | RPA – Reasonable and Prudent Alternative                            |
| DASA – Data Acquisition, Storage, and Analysis    | SA – Science Advisors                                               |
| DBMS – Data Base Management System                | SAEC – Science Advisors – Executive Coordinator                     |
| DOE – Department of Energy                        | Secretary – Secretary of the Interior                               |
| DOI – Department of the Interior                  | SCORE – State of the Colorado River Ecosystem                       |
| DOIFF – Department of the Interior Federal Family | SHPO – State Historic Preservation Office                           |
| EA – Environmental Assessment                     | SOW – Statement of Work                                             |
| EIS – Environmental Impact Statement              | SPAHG – Strategic Plan Ad Hoc Group                                 |
| ESA – Endangered Species Act                      | SPG – Science Planning Group                                        |
| FACA – Federal Advisory Committee Act             | SSQs – Strategic Science Questions                                  |
| FEIS – Final Environmental Impact Statement       | SWCA – Steven W. Carothers Associates                               |
| FRN – Federal Register Notice                     | TCD – Temperature Control Device                                    |
| FWS – United States Fish & Wildlife Service       | TCP – Traditional Cultural Property                                 |
| FY – Fiscal Year (October 1 – September 30)       | TEK – Traditional Ecological Knowledge                              |
| GCD – Glen Canyon Dam                             | TES – Threatened and Endangered Species                             |
| GCES – Glen Canyon Environmental Studies          | TMC – Taxa of Management Concern                                    |
| GCT – Grand Canyon Trust                          | TMF – Trout Management Flows                                        |
| GCMRC – Grand Canyon Monitoring & Research Center | TWG – Technical Work Group                                          |
| GCNP – Grand Canyon National Park                 | UCRC – Upper Colorado River Commission                              |
| GCNRA – Glen Canyon Nat'l Recreation Area         | UDWR – Utah Division of Water Resources                             |
| GCPA – Grand Canyon Protection Act                | USBR – United States Bureau of Reclamation                          |
| GLCA – Glen Canyon Nat'l Recreation Area          | USFWS – United States Fish & Wildlife Service                       |
| GRCA – Grand Canyon National Park                 | USGS – United States Geological Survey                              |
| GCRG – Grand Canyon River Guides                  | WAPA – Western Area Power Administration                            |
| GCWC – Grand Canyon Wildlands Council             | WY – Water Year                                                     |
| GSF – Green Sunfish                               |                                                                     |
| HBC – Humpback Chub (endangered native fish)      |                                                                     |