

**GLEN CANYON DAM ADAPTIVE MANAGEMENT
PROGRAM TECHNICAL WORK GROUP MEETING
January 26, 2023**

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Start Time: 8:08 AM Mountain Standard Time (MST)

Conducting: Seth Shanahan, Southern Nevada Water Authority (SNWA) and Technical Work Group (TWG) Chair.

Meeting called to order by: Daniel Picard, Bureau of Reclamation (Reclamation) Upper Colorado Basin Assistant Regional Director and Designated Federal Official (DFO)

Meeting Recorder: David McIntyre, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum:** Roll call was taken, and a quorum reached.
- **Adoption of Prior [Meeting Minutes](#)** from the October 12-13, 2022 meeting with minor edits.
- **Next Meeting Date(s): April 12-13, 2023:** This meeting will be in-person at the Arizona Department of Water Resources (ADWR) in Phoenix.
- **Ad Hoc Group Membership and Updates:** The list is on the [TWG website](#).
 - **[Seth Shanahan, SNWA]** The Steering Committee Ad Hoc Group (SCAHG) continues to be active supporting the TWG. It is a good forum for developing a schedule reflective of TWG needs.
 - **[Erik Skeie, Budget Ad Hoc Group (BAHG) Chair and Colorado Water Conservation Board (CWCB)]** A BAHG 101 course was held last week to discuss the Triennial Work Plan.
- **Review Action Items, Motions, and Votes Form:** **[Seth Shanahan, SNWA]** Reviewed the [action item document](#) from the October meeting. Completed items are: 1) Budget prioritization procedures and the Native Fish Contingency Fund will be discussed during the BAHG presentation; 2) the Flow Ad Hoc Group (FLAHG) charge will be discussed with the Smallmouth Bass Ad Hoc Group (SBAHG) presentation; 3) The SBAHG heard from subject matter experts; 4) Reclamation will discuss the National Environmental Policy Act (NEPA) and smallmouth bass; 5) Comments from TWG members were received on the draft Fish Strategic Plan, which will be reviewed later today; 6) Heather has added generation to her slides; 6) The TWG and BAHG will need to discuss Project M and hydropower flows; 7) Comments from TWG members on the monitoring metrics were received by Helen Fairley, Grand Canyon Monitoring and Research Center (GCMRC).
- **Update on Monitoring and Research Trips to Occur from Today Until Next Meeting:** **Ted Kennedy, GCMRC** Refer to the [table](#) of upcoming trips, which are organized and administered by GCMRC.
 - **Other Items:** **[Bill Stewart, Reclamation]** The smallmouth bass environmental assessment (EA) and the Glen Canyon Dam supplemental environmental impact statement (SEIS) are consuming lots of staff time. Reclamation and GCMRC has been discussing a continuation of the work plan to free up resources for some of these higher priority issues.

Update on Hydrology, Glen Canyon Dam Operations, and Water Quality Conditions in

Lake Powell and Below Glen Canyon Dam and an Update on the Development of a Supplemental Environmental Impact Statement for the 2007 Interim Guidelines

[Heather Patno, Reclamation] [PRESENTATION] Basin storage is decreasing. Flaming Gorge is at a lower elevation from what would be typically seen because of the Drought Response Operations Agreement (DROA) releases in the 2022 Plan. Month-to-Date precipitation and Water Year (WY) precipitation as of the end of December have been wetter than normal in the southern portion, which has not been seen over the last couple of years. Precipitation is looking positive right now and that does not include January. WY 2023 conditions are normal to above average. The slide from the Climate Prediction Center (CPC) Short-Term Precipitation Forecast is new. This shows more about where the precipitation is expected and the amount. Additional precipitation is expected into the second week of February for the Upper Colorado River area. Expecting to see additional snow accumulation and active patterns over the next couple of weeks. Observed runoff is also looking better than it has over the last couple of years. Last year was the new minimum record for snowpack during the January through March period. There is still a lot of potential this year for additional snow accumulation. The January 2023 forecast increased almost 2 million-acre-feet (maf) because of observed snow on the ground. With continued precipitation, Lake Powell is projected to receive 9.5 maf or 99% of average for the spring runoff period. Under the DROA actions, the adjustment of 523 kaf from winter to summer resulted in increases in Glen Canyon Dam of about 10 feet. Currently operating in WY 2023. For 2023 and 2024, there will be an initial annual release of 7 maf and an assumption of an April adjustment, if going above 7 maf. Reclamation is seeking a balancing release in January of 7.4 maf. Release patterns and volumes are still being discussed. The month of January is when Reclamation releases and updates its 5-year percentages from the Colorado River Mid-term Modeling System (CRMMS) ensemble. The 5-year table with additional analysis will be out next week. With almost 2 maf of additional water in Lake Powell, the minimum probable is no longer showing the elevation going below minimum power pool. However, there is still significant uncertainty between now and spring, and soil moisture is still plenty low. Lake Mead will be in a Level 2 shortage in 2024, but it is close to the Level 3 threshold.

Q&A and discussion

[Leslie James, Colorado River Energy Distributors Association (CREDA)]: What would the forecast for minimum power pool look like if no more snow happens this year? How long can that additional 2 maf last? **[Heather Patno, Reclamation]** This is what happened last year. Without any additional operational adjustments or additional 2023 DROA water from the upper reservoirs, the elevation would be at 3,525 feet, but it would not reach minimum power pool even with no more snow for the rest of the year. This is because the snow is already significantly above where it was at the end of last year. Soil moisture deficits are being filled by high snow accumulations. **[Larry Stevens, GCWC]** How are Upper Basin flow extractions across the Rockies incorporated into this data? The presentation showed precipitation distribution across the landscape, with the Colorado Plateau lower in precipitation than the adjacent Rocky Mountains and the Wasatch front. Is there a rain shadow effect between those two ranges that affect the Colorado Plateau? **[Heather Patno, Reclamation]** The River Forecast Center models their own type of natural flow for the system that includes these depletions. This natural flow is then translated into Reclamation's unregulated inflow that can be used in the CRMMS model. All that information on potential demands, along with soil moisture and historic precipitation and temperature, is included in the Upper Basin forecast. As to the second question, there were trace amounts of precipitation in the forecast, which means this is an active system with continued precipitation in the higher elevations through the second week of February that will influence runoff. There is still the possibility for a high-pressure ridge to shut down the system but there is a lot of snow on the ground

that is filling the soil voids and creating the potential for increasing runoff efficiency. **[Sinjin Eberle, American Rivers]** Are there any more details on soil moisture across the basin? **[Heather Patno, Reclamation]** The River Forecast Center (RFS) uses soil moisture in their forecast, and the base is set during the first couple weeks in November as the ground freezes for the winter snow accumulation period. That is based on historical information. This period before snowpack runoff is when Reclamation does not have great soil moisture data. Will have to wait and see because there is a lot of uncertainty. That deficit still exists this year, which is why it is important to pay attention to the minimum probable runoff trace.

[Heather Patno, Reclamation] Showed the unit outage schedule for 2023. Reclamation is still looking at the issue of coating the bypass tubes. The work will be adjusted depending on hydrology and needs.

[Leslie James, CREDA] Is the fourth transformer a new unit or an upgrade? **[Heather Patno, Reclamation]** It is a new one. All four transformers are onsite now. **[Rob Billerbeck, National Park Service – Glen Canyon National Recreation Area (NPS-GLCA)]** How would the maintenance schedule be affected if the smallmouth bass EA were to consider a flow spike for June/July? **[Heather Patno, Reclamation]** Don't have an answer to that right now.

[Robert Radke, Reclamation] Quarterly sampling is done across the reservoir at Lake Powell. In December, the discharge was a little over 12 degrees Celsius (°C) with higher dissolved oxygen concentrations on the inflow end of the reservoir. A zone of 4 mg/liter zone exists because of the San Juan discharge into the main channel. Lowest temperatures for Lake Powell are predicted to occur around mid-March. Low oxygen levels typically occur around September when water temperature is the warmest.

Q&A and discussion

[Larry Stevens, GCWC]: Is there a threshold for the system as specific conductance gets close to 1000? What is the relation between Glen Canyon and salinity control for the river downstream? **[Robert Radke, Reclamation]:** Specific conductance is measured by total dissolved solids (TDS) with the average salinity value of concern at 0.62. Salinity levels are being measured below Hoover Dam, and at Davis and Imperial. There are standards at these three locations, but don't recall what they are. Multiplying 1000 milligrams per liter (mg/l) with 0.62 gives an average TDS of 600-650, which is below the standard. There is a concern at higher levels, but it is not over the standard yet. **[Seth Shanahan, SNWA]:** Suggested others with the Salinity Control Forum can help Larry with answer.

Glen Canyon Dam Supplemental Environmental Impact Statement

[Kathy Callister, Reclamation] The SEIS notice of intent (NOI) was published on November 17, 2022, and public webinars were held on November 29 and December 2. The scoping period closed on December 20. About 1300 comments were received, which are being posted to [the SEIS website](#). Planning to complete a summary comments memo by January 25, 2023. Hope to have consensus alternative from states, tribes, and non-governmental organizations (NGOs) by January 30. Reclamation is working on a Framework Alternative to consider the scoping comments received. The draft SEIS is anticipated to be released in April 2023 with the final SEIS to be released in July 2023.

Long-Term Experimental and Management Plan (LTEMP) Biological Opinion Conservation Measures Updates

[Kerri Pedersen, Reclamation] The number of adult humpback chub for the Tier 1 Action Initiation Trigger is based on an annual point estimate which was 15,000 in 2022, which was way over the trigger. There are two triggers for subadults in the LCR in the spring and fall that are based on a 3-year average. The subadults in the mainstem along the Juvenile Chub Monitoring (JCM) reach; however, are not doing great. Tier 1 triggers are meant to initiate conservation actions and provide an early warning and a buffer of time before Tier 2 actions happen. A [\[Trigger Response Report\]](#) was submitted to the U.S. Fish and Wildlife Service (USFWS), which discusses potential reasons for decline and suggested actions. Also provided updates on all of the conservation measures and progress in 2022.

Q&A and discussion

[Craig Ellsworth, WAPA] Regarding the hypothesis for low numbers of juveniles in the LCR, the Annual Meeting included a presentation about how higher temperatures might be causing subadults to become adults faster. Is that a possibility for why we have fewer subadults? **[Kerri Pedersen, Reclamation]** Yes, in the past it has taken several years to go from juveniles to subadults to adults. There is the potential that with warmer temperatures they are moving faster between age classes.

[Craig Ellsworth, WAPA] Thinks that Randy said they had population estimate for chub in the western Grand Canyon of 60,000 to 80,000. There are a lot of chub in the canyon and that population down there also needs to be considered **[Kerri Pedersen, Reclamation]**: Thinks the number was 30,000 to 50,000, but either way, there are a lot of chub down there. It is exciting that the population is growing really fast, but under the current BO, that population does not count in the sense that there are no triggers because of how new that population is. If the barrier of Pearce Ferry Rapids should change, then that chub population could change quickly, too. **[Craig Ellsworth, WAPA]** The research and monitoring project in the TWP for western Grand Canyon was on the chopping block. Do we know what happens if that work is delayed? **[Seth Shanahan, SNWA]** Will delay that question until later.

[Ben Reeder, Grand Canyon River Guides (GCRG)] Are there Passive Integrated Transponder (PIT) tag transceivers below the dam to see if any of the marked smallmouth bass are coming through? **[Kerri Pedersen, Reclamation]** No, there are not, but it is possible they have only a limited chance of passing through. **[Ben Reeder, GCRG]** Are razorback sucker ultrasonic receivers much lower? **[Ryan Mann, Arizona Game and Fish Department (AZGFD)]** There are receivers in the upper section that were being maintained by Bob Shelly for brown trout. Would have to look at the technology to see if they are compatible. **[Emily Omana-Smith, NPS-Grand Canyon National Park (GRCA)]** NPS has them at Lees Ferry.

[Larry Stevens, GCWC]: There must be a lot of information on chub recruitment related to LCR flows. Could the hydrograph be used to predict the annual production of young chub and look at why 2022 was a non-productive year? Perhaps high flows trigger spawning. **[Charles Yackulic, U.S. Geological Survey (USGS)]** Maria Dzul looked at whether recruitment varied in the LCR. Some of the more recent PIT tags are also more reliable. Is it possible to predict strong years versus weak years? One thing learned is that the timing of the survey matters because sometimes they come in early and sometimes, they come in later. This predictive capability is not available yet.

[Martina Dawley, Hualapai Tribe] It is not appropriate to say that humpback chub do not count. Why is there a study on hybridization? **[Kerri Pedersen, Reclamation]** Agrees that chub are important. It was meant that there is not a trigger related to the those fish. The hybridization study is related to the

conservation measures to better understand the hybrid fish to preserve razorback sucker. **[Martina Dawley, Hualapai Tribe]** There is concern about modifying the fish. **[Kerri Pedersen, Reclamation]** The hybridization is occurring naturally. According to Pilar Rinker's study, there was more successful hybridization with certain species being male and others female. The hybridization study is being done at the Southwest Native Aquatic Resource and Recovery Center (SNARRC) in Dexter, New Mexico. **[Martina Dawley, Hualapai Tribe]** Would like to visit SNARRC and learn more about this study. **[Kerri Pedersen, Reclamation]** Happy to put Martina in touch with them. **[Ryan Mann, AZGFD]** Those investigations were done by AZGFD in Flagstaff. The two species hybridize naturally, which has always occurred in the system, but the study is to see if hybridization is more likely to occur because of changes in the system, if there was a change in the timing of spawning, or if geographical isolation had increased rates of hybridization. This relates to looking at impacts to razorback sucker as an endangered species from hybridization.

Status of the Glen Canyon Dam Operational Flexibilities in Response to Warmwater Invasives Environmental Assessment:

[Bill Stewart, Reclamation] Reviewed the purpose and need of the smallmouth bass EA, which will consider alternatives of using the bypass tubes to cool the water. The idea is to pull cold water through the bypass tubes, which are ~100 feet below the penstocks. The alternatives include a No Action and the Proposed Action with four flow options. The smallmouth bass ideal temperature for spawning is 16 °C. There are four flow options. There was an information session on December 1, 2022. Written input from stakeholders was due on December 15 with 11 comments received. The draft EA should be ready by early February with a 14-day public review, then early to mid-April 2023 for final EA.

Q&A and discussion.

[Dan Leavitt, USFWS] Will the smallmouth bass EA comments be posted to the web? **[Kerri Pedersen, Reclamation]** Comments will be included in an appendix in the draft EA. **[Leslie James, Colorado River Energy Distributors Association (CREDA)]** All of the action alternatives include bypass. How would determine when to use bypass? From a resource planning standpoint, how will it be known when generation has to be replaced? **[Bill Stewart, Reclamation]** The clarity of those projections will be clearer by April based on temperature projections. **[Leslie James, CREDA]** Will those operational decisions be made at a certain time, or will they happen in the summer? **[Bill Stewart, Reclamation]** It will be in real-time as much as possible given the number of notices that have to be given. That is still being sorted out. **[Leslie James, CREDA]** The power customers need to be noticed ahead of time. **[Kerri Pedersen, Reclamation]** These are evolving conversations. One thing discussed is to take the 24-month study then possibly project it out at least 30 days so that these commitments can be made in time and Reclamation can honor its obligations. **[Rob Billerbeck, NPS-GLCA]** The relationships between reservoir elevation and the passthrough temperatures are critical to what happens with smallmouth bass. This summer is going to be particularly important because it is early in the invasion. The higher the reservoir elevation, the lower the hydropower cost because less bypass is needed.

[Kurt Dongoske, Pueblo of Zuni] Concerned about the 14-day public review period. It is hard for the Zuni to provide meaningful comments in that time. Zuni are concerned about the taking of life. How does Reclamation plan on consulting with Zuni? Reclamation should come to the Zuni to get feedback

and record what the Zunis are saying. **[Bill Stewart, Reclamation]** There has been some discussion around the non-native fish Memorandum of Agreement. The tight timeline is due to the action that needs to happen with temperatures increasing. Will do best to accommodate the Zuni. **[Kurt Dongoske, Pueblo of Zuni]** Zunis would criticize the Federal Government for not being more proactive sooner. The movement of non-natives from Lake Powell into the main river has been going on for at least seven years. It would be a failure to not recognize the Zuni's concerns over the past 15 years.

[Sheri Farag, CREDA] Is there any indication that running these flows early and often would be better than the entire summer? The Southwest has grid reliability challenges in the summer, specifically in August and into September. Is it helpful to have these smallmouth bass flows earlier so it does not have to happen in the summer? **[Bill Stewart, Reclamation]** Anything helps. Even a little bit shortens the spawning period. It does not take much for them to establish if that opportunity exists. **[Charles Yackulic, USGS]** It depends on which option. The Cool Mix option is to keep temperatures below 16 °C. The idea behind Cold Shock is that it would only be needed for 12 weeks starting with those higher temperatures. That should minimize effects to hydropower because it means less bypass, particularly at lower elevations. It is more experimental. The intent is to confuse them into not spawning. This might also affect other non-natives to keep them from reproducing. **[Emily Omana Smith, NPS-GRCA]** It is an important point that the intent is to prevent further harmful actions that might result in taking life, and to confuse them instead. **[Dan Leavitt, USFWS]** Regarding the effectiveness of monitoring these flows and predicting their effects, it would be important to also hear about the aftereffects and how long this might go on. **[Jakob Maase, Hopi Tribe]** Hopi requests a 30-day review period. **[Seth Shanahan, SNWA]** This topic will be discussed more.

[Report from the Smallmouth Bass Ad Hoc Group Including a Discussion about the Secretary's Designee's August 2022 Requests](#)

[Laura Dye, Colorado River Commission of Nevada (CRC) and SBAHG co-chair] An overview of the Fish Strategic Plan was provided and then edits made in real time so that a motion can be prepared.

[Emily Higuera, Arizona Department of Water Resources (ADWR) and SBAHG co-chair]

Recommendation Addendum will be an attachment to the plan. It answers bigger questions from the group and addresses concerns regarding the budget. This is a consensus document with options required to prevent fish entrainment into Glen Canyon Dam. The plan is not tailored specific to the smallmouth bass but addresses non-natives. Rapid response actions could be mechanical or chemical. Comments and feedback received, and how they were addressed, will be included as an attachment. It was noted that the plan cannot capture all diverse cultural perspectives.

Q&A and discussion

[Larry Stevens, GCWC] Rapid response actions might be needed periodically over time. Were these reflected in the short-, mid- and long-term actions? **[Emily Higuera, ADWR]** It is noted that if an action is done over and over, then it is not really a short-term action. Rapid response is reactive to a new detection or locality. **[Kelly Burke, GCWC]** Is there any way to capture the possibility of being successful in the near term that prevents establishment but then being confronted with a pulse of invasion that needs to be responded to again. What if there is another wave? **[Emily Higuera, ADWR]** Rapid response can be used for new detections over a long period and is not limited. This is a broad strategy to prevent establishment. **[Laura Dye, CRC]** This is just one piece of the puzzle, e.g. NPS already has an EA for

compliance to handle detections over time. This is captured in the plan and is not overly limiting or prescriptive. It recognizes there are other plans in place. **[Seth Shanahan, SNWA]** This is a guide, and it gives options and a process to be able to follow through to the right answer.

[Emily Higuera, ADWR] Suggests sending the language to the TWG to review over lunch. **[Seth Shanahan, SNWA]** Agrees to this approach. **[Daniel Picard, Reclamation]** Appreciates the effort put into this. It shows, overall, that the adaptive program works and that issues are addressed as they arrive. **[Seth Shanahan, SNWA]** A proposed motion will be prepared to work through after lunch that would be sent to the Adaptive Management Work Group (AMWG) to the Secretary's designee. **[Wayne Pullan, Reclamation]** Thanks everyone involved in this effort. It has been a heavy lift over a short time. Knows this plan will not satisfy everyone and it will not address everything. That is okay. There is power in consensus. Consensus brings weight to a document. There is concern whether this document will bind decision-making and implementation agencies. The AMWG is a means of institutionalizing input from a wide range of stakeholders, and ensuring that federal decisions are informed by a variety of perspectives. All of the agencies will be better informed as a result of this plan and endorsed by TWG and AMWG.

Proposed Motion of the Nonnative Fish Strategic Plan

The TWG provides the draft Nonnative Fish Strategic Plan, as developed through the Smallmouth Bass Ad Hoc Group, to the Adaptive Management Work Group for their consideration in response to the Acting Secretary's Designee's request from the August 2022 AMWG meeting.

Q&A, discussion, and action

[Larry Stevens, GCWC] Proposed to adopt the motion. **[Craig Ellsworth, WAPA]** Seconded the motion with edits reviewed and incorporated.

[Seth Shanahan, SNWA] Are there any objections to adopting this motion? **[Kurt Dongoske, Pueblo of Zuni]**: Yes, as the Zuni Tribal Historic Preservation Officer (THPO), a plan that contains lethal management options cannot be supported given the position the Zuni have maintained over the last 15 years. If any of these options are implemented in the near future by a federal agency or by funding from this program, licensing, permitting or any other form of federal involvement, then that action has to comply with the National Historic Preservation Act (NHPA), the 2017 LTEMP Programmatic Agreement (PA) or with the 2019 PA for the Non-Native Aquatic Species Management Plan. All aquatic life is considered significant elements that contribute to the National Register eligibility of the Colorado River and the Grand Canyon and are properties of traditional cultural and religious importance to the Pueblo Zuni. That is recognized in the NHPA. Adverse impacts have to be mitigated to the integrity of that National Register property and that has to be done from the perspective and informed decisions of the Zuni. Direct, indirect, and cumulative effects to the Zuni Tribe have to be considered. Do not wait to consult with the Zuni. Make note that the Zuni have objected.

[Seth Shanahan, SNWA] The TWG does not have consensus so a vote needs to be taken by the members. This is a standard operating procedure. **[Jakob Maase, Hopi Tribe]** This is not really an objection because there are mitigation plans in the document, but that is very different. This is a list of options and not a single option.

[Craig Ellsworth, WAPA] Had similar thoughts as Kurt. This motion is to pass this plan on to AMWG. Is

Reclamation going to be asking for stakeholder support in all elements of this plan? At what point do stakeholders express concern about certain elements that may be implemented? In WAPA's case, it may be there are issues with implementation of excessive amounts of bypass.

[Daniel Picard, Reclamation] This motion is to get it out of the TWG and to the AMWG for a discussion there and a recommendation to the Secretary Designee for a final decision. Suggests taking a formal vote. It may not be a consensus that comes out of AMWG either.

[Ben Reeder, GCRG] Acknowledges Zuni and Hopi concerns. By passing this through quickly, can get to the least impactful management actions to avoid taking actions that would harm the fish.

[Seth Shanahan, SNWA] Motion passes with a majority vote. Unfortunately, consensus cannot be achieved on this issue but understands why. There are many problems on the horizon and the TWG needs to be creative. Final vote is on the Action Items, Motions, and Vote form on the TWG website.

Breakout Group Discussion

[Seth Shanahan, SNWA] TWG members are to break out into groups. After the last couple of days in the Annual Reporting meeting, think about the following items: 1) What are the perspectives on the health of the Colorado River ecosystem and whether the LTEMP goals are being met, 2) What information can be provided to those developing the next TWP and budget that might support understanding a healthy Colorado River ecosystem and to meet the goals of LTEMP? This is to provide initial direction for those writing the TWP. At least one person should speak on behalf of the group on the outcome of their conversation.

[Clarence Fullard, Reclamation and Vice Chair] The SEIS is a DOI priority. Extending the TWP into next year could help reduce that workload. Would likely follow the template of 2023 budget and TWP. The BAHG process would be copied and would be more like what was done last year.

[Leslie James, CREDA] One thing that might help inform the discussion is to start with using the prioritization process from BAHG last year. That is where the process ended, and was the group's thinking at the time, rather than starting new. **[Clarence Fullard, Reclamation and TWG vice-chair]** Reclamation can make that available. **[Ryan Mann, AZGFD]** Were those the priorities that were not available for funding or were they all priorities for the programs? This might be two different conversations because the third year of JCM-West was cut from the plan and then reinstated with surplus funds. Believes that was the number one priority. **[Seth Shanahan, SNWA]** Also knows there are federal priorities that might be shown at a different time. The breakout groups should be aware this is all happening in the background.

Report Out from Breakout Groups

Group 1 Breakout Summary

Problem: Current amount of recreation is high, which leads to overuse of river corridor and sometimes disrespectful behavior of river runners, both of which adversely affect the health of the Colorado River ecosystem.

Evidence and indicators of these negative impacts on river health include:

- food in river

- trash in river (water bottles, basket balls, oil cans)
- trailing to archaeological and cultural sites (hematite mine, pictographs)
- drunkenness seems to be primary objective of some river trips, as evidenced by partying and waving whiskey bottles at Hualapai tribal monitoring trip that was comprised of elders and religious leaders as they passed by
- high abundance of humpback chub in western Grand Canyon where recreation load is potentially lighter and more dispersed.
- scarcity of wildlife sightings during periods of peak river use

Question: Will impacts of recreation on Colorado River health be amplified by climate change and aridification. I.e., will aridification of the Grand Canyon ecosystem make it less resistant, less resilient, and slower to recover from overuse and human disturbance?

Implications/Suggestions for Management and Monitoring:

Reduce and monitor impacts of recreational users through:

- Reductions in number of user days (i.e., fewer people on river at any one time).
- Garbage monitoring and pickup. I.e. have one or more river trips that are dedicated to monitoring and removing garbage. Update: TK will consider adding garbage monitoring and pickup as science project for 2023 Partners in Science trips that we do in collaboration with Grand Canyon Youth and Ancestral Lands. There are three trips per year (early June through late July) so lots of opportunity to engage 20 high school aged youth per trip in repeat sampling and making a serious dent in garbage removal.
- Cultural competency training for river runners. Concept is a video that would help increase cultural competency of river runners so they would, for example, be more respectful of this sacred place and the people that have traditionally called it home. Video could raise this issue of not visiting archaeological sites and maintaining respect for the place by telling the story of tribal monitoring trips and the important role these trips play in maintaining connection between tribal members and this sacred place, describe how tribal monitoring informs river management, describe how you [joe or jane river runner] may want to adjust your behavior as you would upon entering any sacred place, and especially if you see a tribal monitoring trip in the neighborhood. Question for NPS: what kind of training is provided to river runners, is there value in new video or similar focused on increasing cultural competency of general public?
- Maintain and, if possible, increase funding for management actions where the science is relatively settled, the action can have a large, positive impact on multiple LTEMP management objectives, and the action is in harmony with tribal views on the sacredness of life.
 - Examples of these type of broadly supported management actions include:
 - Vegetation treatments appear to be highly effective and help support multiple LTEMP goals including Riparian Vegetation (Goal 11), Archaeological and Cultural Resources (Goal 1), Natural Processes (Goal 2), and Recreation Experience (Goal 6).

Group 2 Breakout Summary

[Larry Stevens, GCWC] FY 2024 Planning Recommendations from Breakout Group 2

- Program review process for next year, due to the SEIS, Reclamation will move FY 2024 to continuation of the existing monitoring plan.

Background Questions:

- Prioritize funds available beyond basic resource monitoring – how much is there?
- What is the status of the Contingency Fund?
- Use 2024 to prioritize 2025-2027 Triennial Work Plan.
- Provide GCMRC with support for SEIS workload.
- Include support for direct Tribal involvement in the SEIS preparation, especially for consideration of climate change and water management.
- Need to revisit and re-configure the GCMRC aquatic foodbase program, with more systematic incorporation of nutrient dynamics.

Project Recommendations:

- Develop a scorecard for the AMP based on ARM results – how successful is the AMP in meeting LTEMP goals (an integrated questionnaire that includes metrics, and is designed for annual evaluation and long-term program assessment)
- Improve understanding of the Western Grand Canyon HBC population
- Engage the Hopi Tribe to coordinate an inter-tribal and inter-agency monitoring of CRE herpetofauna
- Update “Kanab ambersnail” population status, and improve understanding of riverside spring ecosystem conditions and responses
- Trailing in LCR – Navajo evaluation
- Enhance education of public about Tribal values
- Determine collateral damage to RBT with NN fish removal
- Recreational modeling and monitoring under low flows
- Fish health (e.g., parasites) in LF reach and LCR
- Move from vegetation monitoring to habitat analyses

Group 3 Breakout Summary

[Ryan Mann, AZGFD]: In terms of the status of the system some things are in better shape than before dam. Also potentially at the highest risk to some resources. Potential issues or observations many have seen relate to budget planning process or other consideration for the adaptive management process. Expressed concerning for funding for core monitoring programs. On the flip side there is a concern we’re doing lots of observing and not a lot of doing. Suggestions for the program to have an exercise to look back at priorities and successes and failures. Acknowledges lots of constraints on being adaptive. Maybe we should be thinking about the minimum probable occurrences; is that our future? Need to build options into the future. In the current workplan, Reclamation doesn’t have enough personnel but GCMRC scientists. Lot of asks, need to catch up. Acknowledgement of funding shortcomings.

Group 4 Breakout Summary

[Sinjin Eberle, American Rivers] The group started with the health of the Colorado River ecosystem and created a scorecard of the 11 elements from LTEMP. The three that rose to top in most jeopardy are: natural processes, hydropower and energy, and non-natives with sediment a close fourth. Some resources are in good shape like other native fish. Recreational experience is doing okay. Hydropower and energy are in less good health because of reduced lake levels and dealing with smallmouth bass issues. Non-natives scored low because they are doing well, such as green sunfish and carp. Natural

processes overall have challenges from broader concerns about temperature and food base and flows. Items that contribute to these issues are high flow experiments (HFE), increased temperatures, and high-risk nonnatives. Human factors came up in particular those related to archaeology and those potential impact.

Group 5 Breakout Summary

[Erik Stanfield, Navajo Nation] This group also talked about cultural training, which should be prioritized. Also went through LTEMP goals as Group 4 and came up with similar answers. Connected to that is how is the budget responsive to what is found with the metrics program? In general, it seems that humpback chub and other native fish are doing well. How is the focus of this program going to be responsive whether or not they are seen as successful or stabilized? If there is a delay in the budgeting process, need to make sure it can focus on big important changes. The group thought that there is a good opportunity if that time can be used widely with what is learned from the monitoring program. There was also some discussion on a more holistic management that recognizes operational effects from behind dam (fish, water quality, cultural issues, etc.). Not looking for or monitoring some of the larger issues such as invasives coming from outside the system is difficult and may be because of perceived legal limitations. Maybe budgeting could allow a focus on other wildlife issues. The beaches, archaeology, and water quality all have problems and are not healthy. **[Helen Fairley, USGS]** Some of the real crisis issues are being driven by factors that the program has no direct control over until they are part of the Grand Canyon ecosystem. How to deal with that reality? There are the LTEMP goals but there are outside factors that are impinging on the program. **[Ben Reeder, GCRG]** In looking at the system wholistically, beaches are in their worst condition ever. If HFEs can occur, even with hydropower taking hit but doing the bypasses, the experiments might be less costly. There are ways to combine efforts to work on the beaches and also address biological concerns. Need to look at what needs to be put in place at the dam to address fish passage problems.

Group 6 Breakout Summary

- We are working in a dynamic ecosystem in which the health of one resource depends heavily on the status of others. Due to this complexity, linear solutions may not always be possible.
- There is a tradeoff between quantifiable goals and meaningful engagement from all stakeholders
- Key issue: Determine metrics before target or target before metrics.
 - Find a way to use “desired future conditions” report
- We must continue to circle back to WHY we are doing the actions, and ask: what are our values? But also, what are the priorities in the moment? What is most valuable and irreplaceable?
 - May be helpful to take a survey of TWG and AMWG folks to gauge where we are at with these questions
- Bring back federal agencies into voting process a healthier decision-making environment
- We are inevitably failing some of our resources (e.g. sandbars)
 - Critical piece to ecosystem and other resources in the Colorado River ecosystem

Discussion of Emerging Issues, Updates on Items of Interest That Are in Consideration

for Implementation Before Next TWG Meeting, and Request for Agenda Items for Next Meeting:

[Seth Shanahan, SNWA] Are there any major issues that have not been talked about. Is anything going to happen before April that we don't already know about?

[Ben Reeder, GCRG] Did not hear anything about possibility of a spring HFE in Heather's talk. **[Seth Shanahan, SNWA]** From the sediment trigger point of view, the accounting window starts up, they track it, and it will go into consideration. **[Martina Dawley, Hualapai Tribe]** Hualapai have a new Tribal Chairman, Sherry Parker.

[Larry Stevens, GCWC] GCWC will be doing revegetation in March at the Paria Beach site with the planting of 200 cottonwood and willow trees.

[Leslie James, CREDA] Would the TWG be interested in a grid reliability presentation by the National Renewable Energy Lab (NREL)? Are there potential grid or resource adequacy concerns? Glen Canyon had to respond to a resource adequacy issue last September. It would be a good topic for this group to understand because Glen Canyon Dam is so integral to grid stability. **[Laura Dye, Colorado River Commission of Nevada (CRC)]** Adrian Marshall could do such a presentation. She works on Western grid reliability and hydropower. She is at the Colorado School of Mines.

Public Comment

[Alicyn Gitlin, Sierra Club Grand Canyon Chapter] There is a clear legal and ethical requirement to protect the Grand Canyon. The Grand Canyon Protection Act language is clear and unambiguous to protect and mitigate cultural and natural values. The value of these is usually measured by some number. There is no clear and unambiguous requirement to subsidize the health of the Grand Canyon by providing power production. Natural flows are probably the best way to achieve multiple goals in what is most likely to be a culturally appropriate manner. A lot of flow actions have been postponed over the last few years to protect hydropower. There is a moral obligation to protect the Grand Canyon. It is important to not just hear the tribes, but to listen to them and to act. Communication needs to occur early and often. The Fish Strategic Plan does not capture diverse cultural perspectives, and the EA will only include a 14-day comment period. This raises questions as to why the tribes were not consulted early. It is not fair and does not seem to qualify with the intent of the law.

Meeting adjourned at 3:50 PM PDT

TWG Members and Alternates

Cliff Barrett, UMPA
Rob Billerbeck, NPS-GLCA
Daniel Buletts, Southern Paiute Consortium
Kelly Burke, GCWC
Carrie Cannon, Hualapai
Shane Capron, WAPA
Hannah Chambless, NPS-GRCA
Colleen Cunningham, NMISC
Kurt Dongoske, Pueblo of Zuni

Dan Leavitt, USFWS
Jakob Maase, Hopi Tribe
Ryan Mann, AZGFD
Scott McGettigan, Utah DWR
Betsy Morgan, Utah DWR
Christina Noftsker, State of New Mexico
Emily Omana-Smith, NPS-GRCA
Kerri Pedersen, Reclamation
William "Bill" Persons, FFI/TU

Laura Dye, CRC
Sinjin Eberle, American Rivers
Craig Ellsworth, WAPA
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Clarence Fullard, Reclamation and TWG vice-chair
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Interested Parties

Jan Balsom, NPS
David Braun, Sound Science
Kevin Bullets, University of Arizona
Julie Carter, AZGFD
Martina Dawley, Hualapai Tribe
Sheri Farag, CREDA
Bud Fazio, NPS-GLCA
Derek Fryer, WAPA
Kevin Garlick, UMPA
Alicyn Gitlin, Sierra Club
Michelle Garrison, CWCB
Christina Kalavritinos, DOI
Matt Kaplinski, NAU
Michelle Kerns, NPS
JoJo Matson
Amy McCoy, Amp Insights
Craig McGinnis, Salt River Project
David McIntyre, Sealay Environmental

Shana Rapoport, CRBC
Ben Reeder, GCRG
David Rogowski, AZGFD
Seth Shanahan, SNWA and TWG vice-chair
Erik Skeie, State of Colorado
Erik Stanfield, Navajo Nation
Larry Stevens, GCWC
Gary Tallman (FFI/TU)

Ted Kennedy
Keith Kohl
Bryce Mihalevich
Emily Palmquist
Joel Sankey
Shannon Sartan
Scott VanderKooi
David Ward

Wayne Pullan
Robert Radtke
David Speas
Bill Stewart
Alex Walker
Chris Watt

Andrew Morin, NPS
G Nealon
Jess Newton, USFWS
Ronda Newton, NPS
Jen Pelz, Grand Canyon Trust
Bill Persons, FFI/TU
Amanda Podmore, Grand Canyon Trust
Zak Podmore, Salt Lake Tribune
Ted Rampton, CREDA
David Rheinheimer, CRB
Peggy Roefer, CRCN
Morgan Ross, Environmental Defense Fund
Andrew Schultz, USFWS
Elyssa Shalla, NPS-GRCA
Jim Strogon, FFI/TU
Melissa Trammell, NPS
Arturo Vale, USFWS

Acronyms and Abbreviations

°C – degrees Celsius	NEPA – National Environmental Policy Act
AMWG – Adaptive Management Work Group	NGOs – non-governmental organizations
ADWR – Arizona Department of Water Resources	NHPA – National Historic Preservation Act
AZGFD – Arizona Game and Fish Department	NMISC – New Mexico Interstate Stream Commission
BAHG – Budget Ad Hoc Group	NOI – Notice of Intent
BO – Biological Opinion	NPS – National Park Service
CRBC – Colorado River Board of California	NPS-GLCA – Glen Canyon National Recreation Area
CRC – Colorado River Commission of Nevada	NPS-GRCA – Grand Canyon National Park
CREDA – Colorado River Energy Distributors Association	NREL – National Renewable Energy Lab
CRMMS – Colorado River Mid-term Modeling System	PA – Programmatic Agreement
CWCB – Colorado Water Conservation Board	PST – Pacific Standard Time
DFO – Designated Federal Officer	PIT – Passive Integrated Transponder
DOI – Department of the Interior	Reclamation – Bureau of Reclamation
DROA – Drought Response Operations Agreement	RFS – River Forecast Center
EA – environmental assessment	ROD - Record of Decision
FLAHG – Flow Ad Hoc Group	SBAHG – Smallmouth Bass Ad Hoc Group
FFI – Fly Fishers International	SCAHG – Steering Committee Ad Hoc Group
FY – Fiscal Year	SEIS – supplemental environmental impact statement
GCDAMP – Glen Canyon Dam Adaptive Management Program	SNARRC – Southwest Native Aquatic Resource and Recovery Center
GCMRC – Grand Canyon Monitoring & Research Center	SNWA – Southern Nevada Water Authority
GCRG – Grand Canyon River Guides	TDS – total dissolved solids
GCWC—Grand Canyon Wildlands Council	THPO – Tribal Historic Preservation Officer
HFE – High Flow Experiment	TU – Trout Unlimited
JCM-West – Juvenile Chub Monitoring-West	TWG – GCDAMP Technical Work Group
LCR – Lower Colorado River	TWP – Triennial Work Plan
LTEMP – Long-Term Experimental and Management Plan	USFWS – United States Fish & Wildlife Service
LTEMP – Long-Term Experimental and Management Plan	USGS – United States Geological Survey
mg/l – milligrams per liter	WAPA – Western Area Power Administration
maf – million acre-feet	WY – Water Year
MST – Mountain Standard Time	