

Glen Canyon Dam Adaptive Management Program

Technical Work Group Meeting

October 29-30, 2024

Day 1: Tuesday, October 29, 2024

Start Time: 8:33am PDT

Conducting: Seth Shanahan, State of Nevada and TWG Chair

Designated Federal Official: Daniel Picard (Bureau of Reclamation, Acting)

Meeting Recorder: Beccie Mendenhall, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum (16 members)** A quorum was reached.
- **Next Meeting Date(s)** February 4-6, 2025 (Annual Reporting Meeting and TWG). The location will be the Embassy Suites, Tempe.
- **Ad Hoc Group Membership and Updates Seth Shanahan (Chair)** We are going to hear from many of these groups later on the agenda. The only one missing is the SCAHG, which meets to help prepare for these meetings, so no report out needed. All the ad hoc groups are open for volunteer participation, if you are interested in joining one, please contact Tara or Jeremy.
- **Review Action Items, Motions, and Votes Form** Review completed.
- **Upcoming Monitoring and Research Trips Mark Anderson (GCMRC)** We are almost done for this year. Two trips are underway, and the final one is set to launch in November.

Hydrology, Glen Canyon Dam Operations, and Water Quality Conditions in Lake Powell and Below Glen Canyon Dam:

Heather Patno (BOR) Hydrology Reservoir storage is typical for this time of year, reflecting some recovery from the previous shortage. Water Year (WY) 2025 began on October 1. It has been dry so far, but we are at the very beginning, so not a predictor of the year to come. There is precipitation forecast in the coming weeks which will get things back to median levels. Observed WY 2024 precipitation was 100% of Median, with the reservoir maintaining steady volume. For WY 2025 Lake Powell will operate in Mid-elevation Release Tier and Lake Mead is again in the Level 1 Shortage Condition. Reference slides for details on CRMMS projections. **Dam Operations** Penstock maintenance last week reduced releases for October. There was a fall High-Flow Experiment (HFE) triggered, that will be discussed later in the meeting. Supplemental Environmental Impact Statement (SEIS) Smallmouth Bass (SMB) releases continued through August and September as dictated by temperature monitoring downstream. Bypass releases are decreasing through October and will likely be off ramped soon.

Clarence Fullard (BOR) Water Quality Reclamation monitors Lake Powell four times per year supplemented with monthly updates at Wahweap from GCMRC. In September, the penstock temperature was hovering at 17°C and the bypass tubes at 9°C. Salinity is higher at the bypass elevation where the temperature is lower. Dissolved Oxygen (DO) is the opposite, with higher DO seen at the bypass level. This is interesting to note as we are mixing the two with the SMB releases. The hourly chart of temperatures at the sonde below Glen Canyon (GC) Dam tracks with the release patterns. Note that this is not a well-mixed location for measurement during bypass operations. The plot of temperature at Lees Ferry shows a significant reduction in temperature after the bypass releases started in July. River Mile 61 (RM61) showed a similar temperature reduction, hovering around the target temperature of 15.5°C,

several degrees below the previous two years. Reference slides for the 24-month model projections of temperature with no bypass flows versus actual measured with bypass at different points on the river.

Q & A and Discussion

Craig Ellsworth (WAPA) Can you pull up slide for Glen Canyon release temperatures again? One thing that popped out for me is this model is assuming a steady temperature release from the dam through November 11, 2024. This model is not capturing the natural cooling we expect to occur. **Clarence**

Fullard (BOR) You are suggesting this red line, which is straight, should naturally start to dip as the lake cools. **Craig Ellsworth** Yes, these slides are assuming a constant release temperature at the dam. But we expect the lake will be cooling which will then reduce this temperature. **Clarence Fullard** You are right, it is going to change, but we don't know how much. It is very weather dependent. But we have not seen it start to cool yet. **Jeremy Hammen (BOR)** One way of viewing these graphs, the three lines are not a forecast of what temperature will be on that day but more a prediction. If the release temperature is 18°C, then this is what we expect to see. **Clarence Fullard** Good clarification Jeremy, we don't have very good confidence in the short-term temperature release forecast right now.

Bill Persons (TU) Excellent presentation. As far as what happens in November and December, I think the Dibble model gives us some hints about what we might expect. I am comfortable with how you have done this.

Melissa Trammell (NPS) Can we go back to the RM61 predictions? It is concerning that the model always under predicts the temperature. What about adding an offset to the prediction? **Clarence Fullard** I don't think we would be comfortable with that. **Heather Patno (BOR)** The forecasts change quickly, as do the release temperatures out of the dam. We have been using the 10th percentile to look at what the potential temperatures may be. And when the release temperatures are higher, then we add that to the projection. So, there is some correction being done on a weekly basis looking at this 10th percentile. **Clarence Fullard** Thanks for that clarification. **Bill Persons (TU)** I was just going to add sometimes the model under or over predicts, but I think Heather nailed it. **Melissa Trammell** It is interesting if he is already adding in some temperature adjustment, and it is still under prediction. **Clarence Fullard** I just want to reiterate what Heather said. We have weekly meetings to evaluate and adjust the projections. It becomes harder when we have shifts in weather. **Melissa Trammell** Thank you. It is great to have these predictions and models. **Seth Shanahan (Chair)** Maybe a takeaway is that models have some uncertainty.

Leslie James (CREDA) Would there be a way to do a what if based on the Dibble model and apply it to the straight-line model penstock chart? **Clarence Fullard** I understand the proposal, but the Dibble model does not predict release temperatures. It predicts downstream temperatures. I think you will find diminishing returns as you try to do that exercise of adjusting the release temps.

Report from the Smallmouth Bass Ad Hoc Group (SBAHG) Including a Report About Smallmouth Bass Experimental Flows and Annual Report, Warmwater Nonnative Fish Status and Actions, Effectiveness of Actions Including Rapid Response Actions, Recommendations to Update the Strategic Plan, and Other Related Items:

Emily Young (State of Arizona and SBAHG Chair) We had three meetings since the July TWG. We discussed gaps in the Triennial Work Plan (TWP) and after the August AMWG we started an outline for an annual SMB report. That was passed onto Reclamation and TWG for comments. At our last meeting we discussed topics for Annual Reporting Meeting (ARM) and a potential SMB workshop. I will be sending those topics out for review soon. The workshop is still under discussion, no concrete plans yet. **Seth Shanahan (Chair)** I just want to bring awareness that the SBAHG has not made any

recommendations yet for the strategic plan. That is an ongoing task we charged the SBAHG with, which we will address as more information is developed. **Leslie James (CREDA)** When do you need comments on the draft SMB report you shared? **Emily Young** Brian is going to address that next.

Brian Hines (BOR) I am sharing here the outline we prepared for the SMB Actions Annual Review. This includes some of the comments already received on desired content. This starts with the report objectives, a review of some historical actions from 2023 as well as the assessment of actions in 2024. This includes effectiveness assessment and lessons learned for short-, mid- and long-term actions. We will also look at estimating the cost for SMB Actions in 2024. To answer Leslie's question, if people could return comments by the end of next week that would be great.

Q&A and Discussion

Leslie James (CREDA) Thanks. We will provide a few comments. When you talk about inability to look at population estimates, were you just referring to SMB? **Brian Hines** Yes **Leslie James** I would like to see some similar analysis added for Humpback Chub (HBC) population because this experiment is intended to impact / improve that population. **Brian Hines** We intend to do that. Looking at catch rates is one thing we plan to measure. **Leslie James** One general comment then, this was a very quickly developed process and a unique experiment. We would like to see some independent science advisor input into this report. Given that this is new and in the early stages we feel this input would be really important. **Brian Hines** Are you thinking about an advisor review? **Leslie James** Not sure what I am thinking, I just want to get it out there that we bring in outside, independent input. **Jeremy Hammen (BOR)** We are going to be talking about that suggestion. But I believe GCMRC is trying to find a way to get SMB population estimates. We hope this may be available in the future. **Seth Shanahan (Chair)** Maybe Drew can touch on that when he presents some of the science.

Bill Persons (TU) I am not sure it needs to be in the report, but it would be nice to have information on the impact of cooler water temperatures on the rainbow trout population. **Brian Hines** This report is going to be specifically for SMB. **Bill Persons** OK, hopefully we can cover the trout impact somewhere else. **Seth Shanahan (Chair)** I am going to suggest you bring that point to the Trout AHG report out tomorrow.

Shana Rapoport (State of California) I want to make sure we are addressing more widely the non-native warm water fish, such as Green Sun Fish. **Brian Hines** I know GCMRC is getting more interested in Green Sun Fish and some Walleye modeling. **Drew Eppheimer (GCMRC)** Good point, there are a lot of other warm water natives that we would expect to be impacted by the cool water releases. We are looking at ways to measure and quantify those impacts. **Seth Shanahan (Chair)** I am going to add that this report is SMB focused. Other species are important to monitor but they will be addressed in other settings. Our annual reporting meeting is the place we should expect that information and discussions.

Drew Eppheimer (GCMRC) Smallmouth Bass Science Update There have been a total of 224 SMB captured to date in 2024, the majority from NPS targeted removal. The lowest capture was at RM15, previously the lowest capture was at RM6.9. No age-0 fish have been captured, most are estimated to be Age 1 or Age 2 fish that are growing very slowly. Fish greater than 200 mm are estimated to be reproductively viable. We have only captured a handful of these this year. The bulk of the fish have been captured upstream from Lee's Ferry. One way to measure effectiveness is comparing YoY catch measures at specific sites. Results show the numbers decreasing each year, although we are not adjusting for temperature variation. Based on the absence of age-0 fish, there is no evidence of reproduction in 2024. In general, the SMB fish in this system exhibit low growth rates compared with optimal fish. We expect the cool mix to further reduce growth rates as temperatures drop. Reference slides for details on SMB growth rate as impacted by temperature and hatch date.

Q&A and Discussion

Dan Leavitt (USFWS) Can you detail the procedure used for the boat electrofishing measurements?
Drew Eppehimer (GCMRC) At each Trout Reproduction and Growth Demographics (TRGD) site they do multiple nights of electrofishing that covers the entire site. **Dan Leavitt** So it sounds like this is our best effort so we can compare over time our success rate. Is there a way to get a sense of capture probability from the datasets we have? **Drew Eppehimer** We do have some estimates of capture probabilities, but it is messy, and most are age-0 fish. We have very few examples of adult fish captures in the system. That means the uncertainty will be much higher. **Dan Leavitt** Is it safe to assume that if effort to remove is successful, your likelihood of capturing them will decrease? **Drew Eppehimer** Yes, if there are fewer fish, detection will be harder. Also, in colder temperatures bass become less mobile thus less likely to detect.

Larry Stevens (GCWC) Your conclusion is that cool temperature control is effective. To what extent are other locations of thermal refugia besides the slough being explored? I am thinking about the eddy right across from the launch ramp and the mouth of the Paria. Any sampling being done there? **Drew Eppehimer** Great question. Based on our rough flow chart metric, if we had evidence of reproduction we would expand sampling for more data. We have found no evidence of reproduction this year. There was one adult fish, we will be doing otolith analysis to find out where that one came from. Regarding measurements in other locations, we did notice some warmer temperatures in the hidden slough for instance. We have artificial spawning beds in some of these locations, there has been no evidence of spawning. In terms of what these SMB are eating, adults were eating some crayfish, the juveniles were eating primarily damsel fly larvae. **Larry Stevens** The mouth of the Paria is certainly a concern, I will follow up with you offline on that. **Seth Shanahan (Chair)** Emily says that sampling is done across from Lees Ferry but not at the mouth of the Paria due to access issues.

Bill Persons (TU) You have estimates of daily growth rates, does that mean you are estimating hatch dates? **Drew Eppehimer** We did this not from otolith analysis of hatch dates but on how their growth rate in samples changed month over month. We plan to implement otolith analysis soon, which would allow the hatch estimates. **Seth Shanahan (Chair)** Could you explain the term modal progression as it relates to the hatch cohort and growth rates? **Drew Eppehimer** Sure, when you plot the lengths of fish captured in a given year, that gives a normal distribution with a mean. We can then use the mean to make an estimate on hatch grouping and growth rate.

Craig Ellsworth (WAPA) Looking at the catch YoY and the catch by river mile, we see most of the catch is still found near the dam. How are you assessing continued entrainment and whether changes in the rate of entrainment might be the reason for declining catch rather than electrofishing removal? **Drew Eppehimer** We have model estimates for entrainment rates, but we do not have any actuals. We have not yet been able to identify entrained fish. We have suspicions but no definitive data. The entrainment rate will vary depending on lake Powell elevation. We expect entrainment to be lower with higher levels of the lake. It is an important variable that we cannot tease out today. Hopefully genetic analysis in the future can help inform this. **Seth Shanahan (Chair)** Can you identify the entrained from non-entrained on this slide of length? **Drew Eppehimer** I will point to the very large fish found in close proximity to the dam, which also had swim bladder oddities, likely came through entrainment. It is unlikely to identify entrainment in the smaller fish until we have genetic modeling. But it is less likely that these small fish would swim at the depth and location for entrainment. **Seth Shanahan** Do you have a perspective on the 240 mm fish that is in the center of the chart? **Drew Eppehimer** We do not have a good read on if that fish was entrained or in the system for years prior.

Betsy Morgan (State of Utah) The Long Term Experimental and Management Plan (LTEMP) Supplemental Environmental Impact Statement (SEIS) included the lambda variable. Is that a metric you only look at in the modeling space or do you plan to calculate and use that based on the new data? **Drew**

Eppehimer Lambda is a fancy word for saying population growth rate. Looking at the actual numbers in this system is difficult because we would need to know the population abundance estimate to start with. And the occurrence of the fish is rare, making it difficult to get a robust measure.

Jim Strogon (TU) Isn't there a suspect ledge in the forebay near one of the penstocks and some fish using the face of the dam as refuge? Could those fish possibly be getting through as small young of year? **Drew Eppehimer** That is a good point, there is potential for that to be habitat. I still think it is less likely for small fish to be using that cover, but it is possible.

Matt O'Neill (BOR) Artificial Spawning Beds We have two types of spawning beds, one a commercial product and the other a homemade version. The artificial nests were placed in early July at multiple locations along the river. They have been monitored weekly for activity, but no bass were detected.

Q&A and Discussion

Larry Stevens (GCWC) Are any other fish using these nests? **Matt O'Neill** I don't have any information on that. I think they would have mentioned that, but I do not know. **Melissa Trammell (NPS)** No other fish have been reported nesting in those beds. **Christina Noftsker (State of New Mexico)** Are the temperatures staying low at these locations? **Melissa Trammell** I don't have recent downloads, I have a slide with temperatures through August. They were similar to the main channel temperature. **Matt O'Neill** That does include the beds placed in the Lower Slough? **Melissa Trammell** Yes, and the temperatures stayed below 16°C.

Bill Persons (TU) I am curious about how deep the artificial gravel was in the water column? **Matt O'Neill** I believe they were 3 to 4 feet deep. Of course that fluctuates daily with the outflows. **Melissa Trammell** SMB usually spawn in less than 1 meter of water, so they were set to take advantage of that pattern.

Leslie James (CREDA) What do you conclude from not finding any SMB using these? **Matt O'Neill** The definitive information would have been finding nests. The point you are making is valid, negative data is not conclusive. **Leslie James** If you found them nesting, what would that have concluded? **Matt O'Neill** That the temperature controls did not prevent spawning.

Mel Fegler (State of Wyoming) Have we tried these two spawning systems on the upstream side of the dam to see if the fish use them there? Also to get patterns on how they use them for comparison to the beds on the dry side. **Matt O'Neill** That is a great idea, I think we should try that next year. **Jeremy Hammen (BOR)** Similar question, what would you do differently with the beds next year? **Matt O'Neill** Leave them after the off ramp, start earlier in the year, place them above the dam as Mel suggested, explore other locations like the Verde River where we know SMB spawn.

Matt O'Neill (BOR) Side Scan Sonar Nest Detection This is a tool being developed by Cameron Bodine, a former NAU Graduate Student, to map habitat types. We used this tool in combination with GCMRC flow monitoring, identifying low water velocity sites from the model and then applying the Sonar tool. The first survey was conducted at the end of May when temperatures were well below spawning. We found no evidence of nests. On this trip, we identified two low flow sites that would be ideal for bass nesting. On our second trip in August, we did the sonar survey again, along with visual surveys, seining, snorkeling. The water temperatures were 13.5°C this trip, so again below spawning.

Q&A and Discussion

Christina Noftsker (State of New Mexico) When the tail race inspection happened, did anybody swim around and look for nests up close to the dam? **Matt O'Neill (BOR)** I don't think so. **Melissa Trammell (NPS)** We did not swim around during the inspection, but they did a lot of electrofishing under the dam. I think the important point is there have been no adults.

Melissa Trammell (NPS) Nonnative Fish Update This first slide provides a chart of the Non-Native Fish (NNF) capture distribution as reported per month from January to August 2024. As previously reported, captures are predominately around Lees Ferry. Water temperature loggers at the slough were all below spawning trigger expect in the Hidden Slough. Water temperature in the Lower Slough was more variable but still below or just at the edge of spawning temperature. A block net was installed in the Main Slough to prevent SMB from entering for spawning. That seemed to be successful as no adult fish were captured. NNF captures for the GSF, SMB and Walleye were lower in 2024 than the previous two years, although 2024 sampling is not yet complete. There were higher catches for all three species in Glen Canyon than Grand Canyon. Note that the Rainbow Trout are not captured in this NNF database. Looking specifically at the Grand Canyon, since the highest density of NNF is at Lees Ferry, removal efforts are focused there. Green Sunfish exhibit little growth or evidence of reproduction in the Hidden Slough and Upper Slough. Very few Walleyes were found with no YoY specimens. This is a very predacious species, however, so we will monitor it closely.

Q&A and Discussion

Bill Persons (TU) Can you talk about Rainbow Trout (RBT)? I know they are being collected in some cases. We are concerned about incidental mortality of RBT, particularly young fish which are the ones most likely to be impacted. Are there any plans to change your protocol to address this? **Melissa**

Trammell We did change our protocol earlier this summer. Originally, we did not capture RBT, but anglers were concerned this exposed them to the electric field for a longer period and requested we capture and return instead. The adults captured have all been returned without mortality. Each trip captures 50 – 100 young RBT (less than 100 mm). Those fish do experience mortality. I will leave it to GCMRC to determine what impact this has on the RBT population. The fish that do not survive are donated to an animal refuge for food. **Bill Persons** It is hard to know if it has a population level effect, particularly if we are not collecting data on what the incidental mortality is. **Melissa Trammell** We do collect that data. It is not recorded in the Quick NNF Database which I have been presenting here because this database was intended to be an early warning system for new NNF or problematic species. We have the data, when we have more time we can dig into it and report out. **Bill Persons** I would be curious to see the protocols as they have been developed, that might answer my questions. **Melissa Trammell** In the netting we record all fish species captured but in electrofishing only those which are target. **Seth**

Shanahan (Chair) Would it be possible for you to dig into more information related to the RBT before the TAHG session tomorrow? **Melissa Trammell** No, I don't currently have access to the information. I can work with them over the next few weeks, however, and provide the information via email. **Seth**

Shanahan Maybe that is the right approach, pushing this to the TAHG agenda.

Larry Stevens (GCWC) These large Walleye seem problematic. Is there any way to get a sense of spawning, entrainment, other processes that brought them into the system? Are we at a point of concern about Walleye that a review of their biology like what we are doing with SMB would be warranted?

Melissa Trammell The short answer is yes. We think there is less entrainment now with the higher lake levels. We suspect they originally came in through entrainment and more monitoring is warranted. But at least we have not seen YoY Walleye anywhere this year. **Drew Eppheimer (GCMRC)** Park Service has provided some funding to GCMRC to develop a walleye model similar to the SMB model. That is on the docket for delivery soon. **Larry Stevens** Walleye tends to run deeper in the river, does that make their detectability by electrofishing more difficult? **Melissa Trammell** Yes, that is probably true. **Larry Stevens** You noted crayfish were being detected, is that another species we need to be concerned about? **Melissa Trammell** Yes, they have detected and preserved crayfish in small numbers. Jeff may have more information.

Bill Persons (TU) I thought protocols were being developed that were species specific to ensure preservation. **Drew Eppheimer** Yes, we have a 2024 sampling plan for specific species. Any of these high risk NNF fish are in the plan and are preserved for analysis. **Bill Persons** I am hearing maybe there are some fish not being preserved. **Drew Eppheimer** GSF are not being preserved due to the high volumes of this fish. But all high risk species are being preserved.

Craig Ellsworth (WAPA) We are doing a lot of things to limit non-native fish. How are we going to sort out the impact of these various actions? Something to think about when we are preparing SBAHG and annual reports. **Seth Shanahan (Chair)** I don't think there is an answer right now. It points to the importance of everyone providing comments to Brian about the SMB report and your thoughts on how to measure success, effectiveness and related impacts in this system. I think it is going to be part of the SBAHG process.

Updates About the -12 Mile Slough Environmental Assessment (Including Information About Springs) and the Brown Trout Incentivized Harvest Program:

Seth Shanahan (Chair) I am going to set the stage for this presentation. As we hear from the Park Service about the EA, we need to understand that they are contemplating a Federal Action. This section of our agenda is not an opportunity for public comment within the context of the National Environmental Policy Act (NEPA) action that they are deliberating on. There may be comments that cannot be made because of that. But we do want to hear from park service about what they are up to. Just remember this is not to be interpreted as public comment on the NEPA nor any sort of consultation for cultural and tribal resources.

Bud Fazio (NPS) Brown Trout Incentivized Harvest The initial project ran from Nov 2020 through Sept 2024 and is now complete. A total of 6,358 brown trout were removed over that period. Harvest in 2024 was lower than previous years, Jeff believes the higher harvest numbers were associated with higher rewards provided to anglers, as opposed to something related to fish populations. They have secured additional funding to continue the program through 2025.

Q&A and Discussion

Bill Persons (TU) Looking at the table, it seems you had a lot of anglers in March 2024. Three times more than any other month. Do you have an explanation for that? **Bud Fazio** That is a good question for Jeff. I would have to ask what is behind that figure. **Cassandra Reed (NPS)** I know in the spring there was an extravaganza where they got higher payouts. **Seth Shanahan (Chair)** Can you confirm if funding is secured through the end of 2025? **Bud Fazio** Yes. **Seth Shanahan** In January during annual reporting will we get an interim report on effectiveness? **Bud Fazio** Yes.

Bud Fazio (NPS) Slough Project Update The Environmental Assessment (EA) has been submitted with detailed slides of the slough modification proposal. NPS is striving to stay on the one-year timeline. We are working on a Finding Of No Significant Impacts (FONSI) with intent to complete it by November. If the FONSI is approved, the project should remain on target for January 2025. We are wrapping up compliance requirements. Consultation with tribes continues. Public review and feedback have been provided through several channels. We hope to have funding secured by mid-November. We were asked to address today specific questions about salamanders and the spring in the slough. Scientists have determined the salamanders found in the slough are native. Based on surveys from the last 4 – 5 years, they believe this is the only population in Glen Canyon or Grand Canyon. We have not yet received the written reports of this analysis. Regarding the spring, in the EA we shared two measures, conductance and comparative water levels for analysis. The initial assessment by the scientist involved is that this is a spring. Further measures of major ions, nutrients and stable isotopes support this conclusion. Water

samples for this spring align closely with water samples from the Leopard Frog Marsh. We are awaiting results for Tritium that may inform age of water in the spring.

Q&A and Discussion

Deb Williams (USFWS) We appreciate that you are looking at the question of the spring and salamanders. One important question is how long has water been ponding in that Upper Slough? Did this area pond water prior to dam construction or prior to the 1980's? That is important for understanding if this project is restoring the slough back to historic conditions. **Bud Fazio (NPS)** I believe those are valid questions which we can ask the scientists. We have a spring, but we do not know how old it is. **Deb Williams** I was under the impression that we do have historical information about that slough. Paul Grams has published work where he looked at that slough. I think it would be good to hear that information again. **Paul Grams (GCMRC)** I can talk about the history of the channel in that reach. I cannot talk about the spring or the source of the water that Bud was talking about. I think it is helpful to understand the context of the whole reach between the dam and Lees Ferry which experienced a lot of change after the dam installation. The high seasonal flows pre dam rearranged the river yearly. In 1965 there was a bed scour done with high flow releases to prepare for dam operations. That section has remained scoured since, with 10 million cubic feet of sand and gravel evacuated from the reach. This lowered the water levels about 6 feet across the reach, which brought sand and gravel bars above the river into permanent land features. **Seth Shanahan (Chair)** Deb, does that answer your question? **Deb Williams** Yes, I think understanding the history of the slough puts into context how the spring interacted with the river over time as well as when the salamander habitat was formed. Would you agree with my statement, that historically, the Upper Slough did not pond water, and the current action would restore it to that pre dam condition? **Paul Grams** Yes, pre dam it was not a riparian wetland ecosystem. It was a scoured area part of the active river channel. If there was a spring there, it fed into the active river channel. I am not going to comment whether that is restoration because there have been so many other changes. **Deb Williams** That's fair, but to make sure I heard you properly, you would say historically this was not a riparian wetland. If this was a spring pre dam, that spring would have been feeding into the active river channel as other springs do along the river. **Paul Grams** Yes, based on the photos and the bed degradation which we documented, we can say the conditions were fundamentally different than what they are now.

Matt O'Neill (BOR) I would like to talk about the impact of this project on the riparian wetlands. First, I will address the spring question. In the proposal, we placed the river channel through the Upper Slough, basically re-excavating the original river channel. We can push the channel a little to the side of the spring, which then should not impact the flow of water from that source. As far as the wetland is concerned, this project will permanently remove wetlands between the Upper and Lower Slough and some from the channel. The wetlands that remain will be about half of the current area. But we have wetland reconstruction planned post this work that may even enlarge the riparian wetland area. **Seth Shanahan (Chair)** I want to re-emphasize a point, these are all proposed plans that are going through a NEPA process. These are just proposals as we talk about them.

Ben Reeder (GCRG) I have observed the green streak of vegetation coming through the porous Navajo sandstone the first few miles below the dam. I am curious if you think the source of the spring might be the reservoir coming through the porous sandstone? **Bud Fazio** The age of the water might be able to help determine the source and what aquifer it comes from. The scientist involved currently believes the spring is functioning separately from the river, but the source is not yet identified.

Emily Young (State of Arizona) I am curious what sampling has occurred for salamanders within the system so far. It seems like a broad statement to make if there have not been any focused surveys. **Bud Fazio** We took direct samples from salamanders at the slough and performed DNA analysis. At the same time, we looked at water samples to see if there were any other traces of salamanders in the canyons. The

direct DNA samples indicate the salamanders are native and the eDNA water samples indicate no other populations of this species exist between Lake Powell and Lake Mead. That is one of the things that has caught our attention, that we have found something special here. **Emily Young** Were those eDNA samples taken in other sloughs in the reach and what was the timeline they were collected? And can you also remind us, what species we are talking about? **Bud Fazio (NPS)** Regarding species, it is the Native Arizona Salamander. Regarding sampling locations, I believe it included Hidden Slough and Leopard Frog Marsh. We have a couple of notes from long ago (2015-2016) that the Native Arizona Salamander was found at Leopard Frog Marsh and the Upper Slough. But with the overall amphibian declines that have occurred in the canyon, we are concerned that we are not finding more. **Seth Shanahan (Chair)** To clarify, it is the Arizona Salamander which is a sub species of the Western Tiger Salamander, which is not a protected species. **Bud Fazio** Yes, those statements are correct.

Kurt Dongoske (Pueblo of Zuni) No particular question, just a few facts to point out. The Colorado River is a registered cultural property. From a Zuni perspective it is a sentient being and is vital to Zuni cultural identity. The impacts to the Upper and Lower Slough need to incorporate that position. Additionally, all springs are traditional tribal properties to Zuni, which needs to be taken into consideration. Also, the salamander, which is a being related to water, will be very important to Zuni. I hope that the NPS will do a more meaningful analysis than what was done in the supplemental EIS and will adhere to the executive orders on tribal knowledge to the full extent. **Seth Shanahan (Chair)** Thank you. I appreciate that. I will reiterate my earlier point that this discussion is not a substitute for tribal consultation on this topic. That is the forum where your comments will be most helpful to be heard.

Larry Stevens (GCWC) My first comment, it was me that found that specimen in 2015. Salamanders were used as bait in the Colorado River up until 2000 and it was our belief at the time this specimen was an adult bait species. I encourage you to get this information on the salamander species into a published form so it will have peer review. My second comment, do you regard the Leopard Frog Marsh Spring as also being a pre dam natural phenomenon? The reason I ask, that spring cuts through all the pre dam sediments down to modern river level. I think the geomorphic data suggest this is a post dam spring. I would like to see an assessment and mapping of all the streams in the system. **Bud Fazio** We have not discussed with anyone the source or aquifer for Leopard Frog Marsh Spring. A lot of the springs in the canyon are pre dam, but I cannot make a statement on that one right now. We do need an assessment of what are native springs in the canyon, we welcome that. Regarding the Salamanders, there is a publication done in the late 1950's that talks about salamanders. It indicates some higher elevation salamanders on the Arizona and Utah sides centered around Glen and Grand Canyon, and they do classify it as a different species. I am not sure if we have something like that here. Regarding publication of our current findings on the salamanders, they will be publishing the results. **Larry Stevens** Perhaps they would be willing to make a presentation at the ARM. It is an important finding if this is a separate sub species.

David Ward (USFWS) I want to comment on the salamander and dragon flies in the Upper ponded slough. There have been a number of management actions in that area in the last 10 years. We have done a number of treatments done to reduce the Green Sunfish population. If we had not been in there doing that reduction, we would not have salamanders or dragon flies because the GSF eat them.

Emily Young (State of Arizona) I know you mentioned that 1967 paper, but I am curious what the closest known populations are and if you consulted with any experts at Game and Fish in this area. **Bud Fazio** In the DNA analysis, references from a population in Arizona and a population in Utah north of the river were used. These are the two closest known populations. That was how the determination of a local species was made. As far as connecting with ADWR, we have tried but have not been able to connect yet. **Seth Shanahan (Chair)** David Ward, perhaps you can help Bud connect with the right people?

Thermal Curtain and Hydroacoustic Study Updates:

Jeremy Hammen (BOR) I have a few updates on the Hydroacoustic project. First, the contract is taking longer than anticipated. We still hope to install the transducers in the spring if the contract can be completed in time. Once the transducers are installed, we plan to do manual data collection monthly for the initial phase of operation. I want to note that the funding for this project is outside of the GCDAMP program. For the Thermal Curtain project, we held a value planning study right after the July TWG meeting. We completed that study over the summer and presented it to Reclamation leadership. That report is still under review. There is a site visit to the Whiskeytown CA thermal curtain scheduled for the second week of November. Note that there are still a lot of hurdles to get through, including funding. This is going to be a long term project.

Q&A and Discussion

Jim Strogon (TU) Are you planning to use the hydroacoustic system to monitor fish populations or deter fish? **Jeremy Hammen** Currently it is just for monitoring, this is not intended as a management action itself. **Jim Strogon** Did you already evaluate this as a potential management tool? **Jeremy Hammen** These sensors are not designed for that purpose. You might be thinking of a sound system or a bubble curtain. Those tools were evaluated in the value planning study. We may look into these tools further in the future, pending review of the study.

Leslie James (CREDA) We have heard several mentions today about the impact of temperature on entrainment. What priority is being put on continuing to pursue thermal curtains to reduce entrainment? Would it be helpful if TWG or AMWG members submitted something in writing to urge prioritizing this activity? **Kathy Callister (BOR)** You are wondering if having our partners submit letters to the department would help support this project? I am confused about what you mean by prioritize. **Leslie James** Maybe support is a better word. I don't know if Reclamation leadership is aware how much the partners support this activity. At least this partner feels pretty strongly about making this a high priority. **Kathy Callister** Wayne has asked us to pursue this project. There are certain steps we have to go through, the value planning study being the first one. The biggest hurdle is going to be securing funding, because we anticipate this is a large cost project. Bill you might want to chime in on the cost. **Bill Stewart (BOR)** Yes, but relative to some of the other options we looked at in the study, this is less expensive. **Leslie James** We are interested to see as much progress made on this as possible. **Clarence Fullard (BOR)** The AMWG truth document from August 2022 directed this work. It is already high priority in the program. I put the link to that document in the chat. **Kathy Callister** Anything the partners can do to let leadership know how important projects are is always helpful. If you feel strongly, I suggest letting Wayne know.

Bill Persons (TU) I agree that the thermal curtain has some promise. Do you think we can implement a thermal curtain in less than 10 years? **Jeremy Hammen** Unofficially, I certainly hope so. But there is a lot that needs to happen before we can judge that. **Seth Shanahan (Chair)** How long did it take the Whiskeytown curtain to go from value planning to implementation? **Jeremy Hammen** We are dealing with a different situation there. It is a small, shallow reservoir. Our depth and canyon walls pose significant challenges. **Bill Stewart** I will just add there is quite a bit of information on the Whiskeytown project out there. There are also other locations, like Shasta Dam, with similar temperature control projects. **Seth Shanahan** The other way of looking at this, the bass flow options expire in the next few years. People are on the record stating the long term solutions need to be in place by the end of that period. Perhaps that gives us a deadline. **Bill Persons** We all appreciate the speed with which Reclamation has been getting things done in terms of environmental compliance. Thank you.

Plans for the Long-Term Experimental and Management Plan 10-Year Review and Updates to the Glen Canyon Dam Adaptive Management Program's Guiding Documents:

Bill Stewart (BOR) This is going to be a bit of a history lesson. I encourage some of the seasoned members to chime in as they see fit. I think it is important to look at this history to help us shape where we go, specifically in regard to the 10-year review. The LTEMP Record of Decision (ROD) specifies execution of the 10-year review in 2027. Back to the history. In July 1996 GCDAMP was launched. There was a transition work group that defined the objectives for GCDAMP. This was also the year of the first TWG meeting. The AMWG Charter followed in 1997 with the first AMWG meeting in 1998. Budget and Work Plan procedures were initiated in 1999. They appeared to have many of the same issues we experienced this year. It was an annual work plan for the first 10 years, then moved to a two-year plan for a few years to reduce and simplify effort. In 2006 it moved to a three-year planning cycle which is where it remains today. The GCDAMP Strategic plan was finalized in 2002 with 12 goals. It also defined a strategy for how to define, quantify and measure if we are attaining each goal. In 2007 USGS published a Strategic Science plan to support the goals. There has been a series of knowledge assessments through the years, perhaps most recently in 2019, to help inform the core processes. The Core Monitoring Plan for GCDAMP was published in 2011 with a goal to provide repeated, long-term methods to measure status of key resources. In 2012 a list of Desired Future Conditions (DFC) was published. In 2016 an Assessment report was done by the AMWG Facilitator at the time which included interviews of many of the members. Then we arrive at the LTEMP, with the ROD signed in 2016. In 2019 we received a Memo of Guidance from Tim Petty, the Secretaries Designee at the time. This is the most recent guidance that we have for the program. The 10-year review is now in front of us. Given the Post 2026 EIS, we may have new annual operating criteria. This is the idea for an LTEMP 2.0 that we have been discussing at the AMWG.

Q&A and Discussion

Leslie James (CREDA) I am struggling with the 10-year program evaluation and how this aligns with LTEMP 2.0. Is this a chicken and egg scenario? **Bill Stewart** I think the intent was, if there were new experiments or alternatives needed they would be brought out in the 10 year review. I think we have already done some of that with the LTEMP SEIS.

Larry Stevens (GCWC) The only element of the history not well represented here is the persistent issue of not having an overall ecosystem model showing what we have accomplished and where we still need to do work. There were 2 models we used in the past, spaghetti diagrams that show the relationship between all the elements in the program. One of the comments during TWP review this year is that such a model does not exist. I think it is a gap for the program. **Seth Shanahan (Chair)** Larry, you were here when they started that method. I thought it collapsed under its own weight, and we moved to individual models for each component. **Larry Stevens** Complicated yes. It is much easier to follow individual objectives at the component level. But understanding the integration of that objective with other elements is key. Structured decision-making works well for individual projects, but it does not address integration. **Leslie James** To Larry's point about the Walters model used previously, I think he is right. I am not sure it collapsed under its own weight. We evolved away from it, and I agree that we suffer by not knowing the interrelations. **Bill Persons (TU)** I think it was called the Walters-Korman model. It was helpful for looking at components independently and then integrating them. But the integration was very difficult. Near the end, I believe Carl's recommendation was that we might be better off building standalone models for specific resources. But I agree, we miss how to integrate the impact across resources. **Seth Shanahan** We have done several knowledge assessments. They also have not gone very far because we have struggled with where we want to be in the future. We have great articulation of goals in the LTEMP, but because they are not quantified with specific targets, we struggle on how to achieve the goal. The metrics work that Helen is leading will be a useful way to measure our information. But we still need what we are trying to get to. There are other programs in the basin, such as the Multi Species

Conservation Program (MSCP) in the lower CR, where they have black and white targets. They can clearly measure achievement of their goals. Something for us to think about here.

Seth Shanahan (Chair) The implicit message in this presentation, if you have not read some of these documents, that could be homework. Please do that if you can.

Brief Review of Historical Documents of Interest and How to Find Them on the Wiki:

Craig Ellsworth (WAPA) The GCDAMP Guiding Documents as defined in section 6.1 of the LTEMP ROD are important. I am going to show you where to find them. This is a good time for us to re-energize the program by updating these documents. First, the Wiki is not my project. It existed before I was part of the program. If you want to contribute, by all means please reach out. If you find broken links to documents, please let me know so I can fix them. The GCDAMP Guiding Documents page has a process chart showing how the documents are intended to be used. It includes a hyperlink to each document. These are the core elements that define the program. I wanted to put the GCDAMP Vision and Mission statement here. This is our pledge, the reason why we are here. We should review this regularly as a group, to remind us of our purpose. The next slide has 5 priority questions from 2004, now 20 years old. These help to inform us where we have really progressed, and where we have made no progress. I think this is where we have an opportunity to update the earlier documents to provide directions based on where we are today. The Operating Procedures are helpful to understand how we run our meetings. I am closing with this picture of the GCDAMP members from 2013, with many of us still present today. We are a group of friends. This should be a safe place where we can work together.

Q&A and Discussion

Larry Stevens (GCWC) Just a thank you to Craig for helping us preserve this critical archive of information. **Leslie James (CREDA)** I wanted to thank Craig for his Wiki work and also give a shout out to Jason Thiriot. **Craig Ellsworth** Jason is the one who started the Wiki many years ago. He passed away unexpectedly. It was a real loss felt by all of us. **Bill Persons (TU)** I will add my thanks to Jason for starting this and to Craig for keeping it going. One of the things I find helpful on the opening page is a quick link to “Hot Topics”. I can usually find everything I need on that page. **Craig Ellsworth** Yes, I update the hot topics as appropriate, building a dedicated page for each. Right now, the newly added pages are for the Slough project, the Thermal Curtain and one for Entrainment. **Kelly Burke (GCWC)** It looks like the link for the tribute to Jason is broken. Also, I would be interested if we could figure out how to preserve links through changes. It is a wonderful source of information that I recommend people poke around and explore. **Craig Ellsworth** I also want to thank Reclamation for allowing us to do this. At one point there was concern about having so much information posted online about the program. There was concern that they were not in control of the information. But they have allowed us to proceed, and I want to acknowledge that. **Seth Shanahan (Chair)** I think one problem we have is the LTEMP ROD envisioned all of these documents would be updated regularly. And yet years have gone by with no updates. Which leaves us with some questions about relevancy now. And some confusion if people reference the historical documents which may not be aligned with current state. **Craig Ellsworth** I have an observation about that. LTEMP came out in 2016, and for a few years we were moving right along. And then COVID hit. I think that really took a lot out of the program. We had a lot of turnovers as well. But I think we are at a point now that people are on board and ready to get going again. **Bill Persons** We do need to be a little careful on the Wiki. We might pull up an old guidance document for instance, which is not being used, which might have you draw incorrect conclusions. **Craig Ellsworth** I think it is important to understand that LTEMP supersedes all documents. But we also have a requirement to update the guiding documents. **Bill Persons** I am not sure who is going to do that. I guess that is us. **Seth**

Shanahan (Chair) Yes, in Bill's presentation, that is the task that is still to be done. We need to make some progress.

Public Comment:

Dave Foster (Angler) I have three points I want to touch on. One, I am happy to see that the TAHG has been formed. I look forward to participating to whatever degree I am allowed to do so. Two, I am extremely disappointed there is no update on the Lees Ferry RBT fishery at this meeting. I think it should be done at every TWG meeting given the condition of the fishery. Finally, I was concerned about the presentation on the mortalities to young RBT presented today. I did suggest putting the fish into a container at first contact, but not into the same container as the non-native fish that are going to be killed. These fish which we want to preserve deserve more delicate handling.

Meeting adjourned at 3:51 PM PDT.

Day 2: Wednesday, October 30, 2024

Start Time: 8:33 AM PDT

Conducting: Seth Shanahan, State of Nevada and TWG Chair

Designated Federal Official: Kathy Callister (Bureau of Reclamation, Acting)

Meeting Recorder: Beccie Mendenhall, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum (16 members)** A quorum was reached.
- **Unresolved Issues from Yesterday's Meeting** Seth Shanahan (Chair) None presented.

LTEMP Experiments Updates:

Description: This agenda item will include a discussion about LTEMP experiments that could potentially be implemented over the next 12 months, the condition of resources, recommendations for implementing a Fall 2024 or Spring 2025 experiment, interactions between a Fall 2024/Spring 2025 and a smallmouth bass flow experiment, procedures for using the Experimental Fund, and other topics.

Bill Stewart (BOR) LTEMP SEIS It has been very busy the last several months and is likely to continue that way into the next Water Year. LTEMP experiments were defined in the LTEMP Record of Decision (ROD) as a flexible, responsive approach to adapt operations to changing environmental conditions. There are three types of experiments defined, two in the original LTEMP ROD and the LTEMP SEIS which was added more recently. The process defined in the LTEMP ROD for coordinating and communicating on these experiments is the Planning and Implementation (P&I) Team. We convene the P&I team as appropriate throughout the year based on timing and resource conditions. The LTEMP SEIS ROD modified the HFE protocol to allow sediment to be carried over into the Spring, adding flexibility to resource management. In 2024, we started the modeling in August to look at Sediment inputs for this fall. P&I conversations were initiated on September 6th. The modeling showed that a trigger had been reached and the P&I team was updated. Tribes and leadership were notified per protocol. The Paria River at Lees Ferry is the Inflow that causes sediment load. Modeling determined that execution if an HFE in the fall would last 72 hours while in the spring it would be 60 hours. We align the execution dates against the dam maintenance schedule to find windows when all the river outlets are online. After analysis of the benefits of a fall versus spring HFE, the P&I team recommendation was made to defer HFE execution until the spring. We expect a decision on this to be returned soon.

Q&A and Discussion

Craig Ellsworth (WAPA) Thinking about the decision or our ability to defer an HFE, I was wondering if that has incorporated another element of uncertainty into this experiment. Are the GCMRC scientists OK with that human decision as it impacts their modeling? **Bill Stewart** I don't know if someone from

GCMRC can speak to that. I know there were assumptions about that included in the LTEMP SEIS as GCMRC was modeling for the new protocol. Is there anyone from GCMRC that can speak to that? **Seth Shanahan (Chair)** Craig, could you explain your concern a little more? **Craig Ellsworth (WAPA)** We could decide to defer based on non-scientific reasoning, which cannot be modeled. Is that going to interfere with our experimental design in any way? **Seth Shanahan** David Topping would say, you should run an HFE every time it is triggered. **Craig Ellsworth** That is my point, does that change anything that they are trying to determine with the experiment. **Jeremy Hammen (BOR)** This is not the first time we have triggered and not executed an HFE. It does add another element of uncertainty, but it is not new. It has always been a component of the LTEMP. **Seth Shanahan** I am going to ask Mark Anderson to answer as well. **Mark Anderson (GCMRC)** I don't have a good answer for the uncertainty question. But when David talks about when we trigger an HFE we should execute, it hits on a long running premise of whether we can maintain that sediment sustainably over the long term. **Seth Shanahan** I suggest we pin this as an Annual Reporting Meeting topic.

Ben Reeder (GCRG) I am really encouraged with this SEIS and the opportunity to execute a spring HFE. I think there is a lot of benefit aligning the HFE with the natural timing of historical flows as well as alignment with the start of the recreational boating season. I just want to be sure this is a top priority in the program and that we will not cancel the flow in the spring. I want to get ahead of some of the reasons that might be presented for cancellation so we can still execute.

Jim Strogon (TU) Can you speak to the potential of low flows in the second 10 years of the LTEMP? **Bill Stewart** The intent of the low summer flows was to try and warm the water and promote HBC growth. There was a requirement for a science review prior to execution of this protocol. **Jim Strogon** Was it related also to the low water level in Powell? **Bill Stewart** I don't think so, I believe it was focused on ways to warm the water. **Seth Shanahan** If you are asking "Is there a trigger for low summer flow based on Lake Powell elevation?", the answer is no, it is only a temperature related trigger.

Larry Stevens (GCWC) Spring HFEs are a win-win for everybody. The critical analysis that needs to be done here is the fall HFE impact from the steep K-curve on the sandbars as compared to the benefits realized from a spring HFE. Also understanding the timing of HFE flows in relation to SMB flows. If we have a trigger, it would be really nice to see this program commit to an experiment. We get a tremendous benefit from saturating this soil if the HFEs are done in the Spring. Remember the vegetation growth along the Paria beach after the last Spring HFE. One question for you, I am concerned that the P&I team does not represent the full concerns of the GCDAMP. How can we expand participation in the P&I? **Bill Stewart** LTEMP created this P&I process. I think that is one of the things we want to think about in the 10-year review. It should be the forum for process review and discussion of how we engage with TWG and AMWG. **Larry Stevens** We will target LTEMP 2.0 for that discussion then. Thanks for all the hard work, this really is a big step forward for the program. **Seth Shanahan (Chair)** I am going to add a few things to this concern. The TWG and our Ad Hoc Groups as well as the formal FACA framework are key components of these recommendations. We traditionally host webinars to review and discuss the recommendations. I think by default that is the framework that we have been using to incorporate voices that are not in the P&I or the tribal consultation discussions. Hopefully you feel your voices are heard in those forums. Also, you made a comment about the K-curve and sediment. I believe the graph Bill shared showed there was lower sand bar volume if executed in Spring versus Fall.

Sinjin Eberle (American Rivers) In the spirit of what Ben Reader was saying, looking at the dam maintenance schedule, there is not an open window for an experiment except the first week of May. **Bill Stewart** Yes, we are talking about 2 – 3 days between scheduled river outlook maintenance. **Sinjin Eberle** What would be cool is if we all make hotel reservations on that date to hold the P&I team to execution. The other thing that could happen is we get a big snowpack in early March that blew sand down in advance of the HFE. **Seth Shanahan** There is an AMWG meeting scheduled for April 14 2025,

Sinjin Eberle (American Rivers) I would encourage us to ambitiously prepare for this rather than just leave it out there as a dream. **Seth Shanahan (Chair)** What might be the planned date for a Spring HFE? **Bill Stewart (BOR)** This is a tentative timeline prepared by Jeremy, (reference slide), which has the recommendation going to the Secretary in March. **Seth Shanahan** What would be the potential HFE implementation date? **Bill Stewart** It would be within that window, not a specific date yet.

Helen Fairley (GCMRC) I think Dr. Topping would point out that the HFE was designed with conservation and sediment in mind. Now that we are bringing in the Spring HFE, it changes the goals and type of experiment that we are implementing. He was clear that the fall execution would add more sand and be longer than execution in the spring. One other point, the timing of the consultation to the tribes does not seem to be aligned with the execution. The consultations are too late in the cycle to offer feedback before execution. **Seth Shanahan** I want to point out that the opportunities expected to trigger a spring HFE in the original analysis have not come true either. Factors have changed, so looking into this topic more generally is important. This needs to be part of the ARM discussion. I also do not think your point about tribal consultation is accurate. I will defer to Reclamation to confirm that the decision is not made before having tribal input. **Bill Stewart** When we send the tribal consultation letters, we are just starting the process. We do not have a lot of information at that point. Maybe we can work on ways to provide updates when environmental changes occur. One storm can trigger a short cycle of implementation.

Rob Billerbeck (NPS) It is odd with the TWG when something comes up that I feel like we have been talking about for years. I feel the need to say this discussion is not new. I would be surprised if GCMRC were unprepared for the HFE being moved to Spring. They were part of the LTEMP SEIS that recommended the HFE protocol change. I have heard many stakeholders talk about the potential benefits of moving to a Spring HFE. The uncertainties are the ones we are aware of. There may be some benefits outside of sediment that we can realize. **Seth Shanahan** Some of this is struggling with the tradeoffs in the program. There are lots of benefits we are trying to achieve.

Leslie James (CREDA) One recommendation I would have on this spring HFE timeline chart is to remove the word optional on the TWG/AMWG webinars. We need to ensure there is a role for TWG and AMWG to provide input at appropriate times in this process. Even if the timing is abbreviated. **Bill Stewart** Thank you for that, the timing may actually align with the spring TWG meeting so we can have a robust discussion.

Kelly Burke (GCWC) I want to add one other perspective. Bill was very clear about the assumptions made in comparing the fall versus spring HFE in terms of differences in sediment build up. But that modeling assumes no additional influx of sand over the winter. Late season cyclone-like storms can contribute quite a bit of sand, which gives us the opportunity for larger sandbars and greater benefits to multiple resources even without the fall HFE.

Bill Stewart (BOR) Smallmouth Bass Flows The LTEMP SEIS ROD was signed on July 3, 2024. The temperature trigger for the Cool Mix Experiment is three days above 15.5°C at RM61. This was hit June 23-25, 2024, just before the ROD was signed. The Cool Mix alternative execution began on July 9. Execution is adjusted weekly based on daily temperature measurements of the preceding week. There are 7 different factors that feed into the modeling for Hydropower Optimization that produce the weekly hydrograph plan. A directive for the week then goes out and we implement. I am going to hand this over to Craig to discuss the chart of Hydropower costs. **Craig Ellsworth (WAPA)** We have been updating this Hydropower Cost chart weekly over the course of the SMB flows. The first column is the worst-case forecast, the second is a median value and the third is a final post-hoc analysis, effectively an actual for the cost. Note that weather, heat, and electrical use are all factors in the cost estimates. **Bill Stewart** Now

that the dam release temperatures are going down, we are putting together experts to assess the biological risks of off ramping. The P&I team will review this assessment and make a recommendation during the Nov 5 call. We are close to the end and are planning to ease into a soft landing for the close of this experiment. Just for reference, in the last 3 years, releases went below 15.5°C on Nov 20 (2023), Nov 8 (2022), and Oct 29 (2021). Current modeling shows us going into the same conditions next year, triggering another SMB flow.

Q&A and Discussion

Larry Stevens (GCWC) I have two David Ward questions. First in terms of the feeding ecology for NNF and the micro crustaceans that are coming through the dam. As these water temperatures warm, we have encountered very high densities of micro crustaceans in the backwaters. Do we have any perspective on that component of the food base? Second, have we considered the impacts of turbidity downstream during these cooling flows? Can these NNF species make a living under turbid conditions? **David Ward (USFWS)** I have no information on the micro crustaceans, maybe Drew may have some input on that. As far as turbidity, we know high turbidity limits predation of the native fish to sight feeding NNF predators. But I do not have a good answer on whether the SMB flows have a significant impact on turbidity. **Drew Eppheimer (GCMRC)** Regarding your first point, there was a Fish and Wildlife seining trip in September 2022 where we captured 10-12 juvenile striped bass. The diet assessment on these fish showed every one of them was full of zooplankton. During this trip the water turbidity was high, and we were seining them out of backwater locations. This is definitely an area for investigation by GCMRC. Regarding your second point, we are in the final stages of getting approval for a small-scale turbidity trial looking at growth of SMB. Our pilot found no difference in survival rates across the turbidity range, but sample size was too small to be conclusive. **Larry Stevens** It will be important to know the starvation rate of these small fish and whether turbidity plays a role.

Betsy Morgan (State of Utah) Does the timeline for off ramping account for meetings with the Leadership team? **Bill Stewart** We are going to ask both to attend the meeting on November 5th. **Betsy Morgan** Looking at the timeline, I understand the SOI has the final decision on how to proceed, can you explain why you state Reclamation will decide how to proceed? **Bill Stewart** This experiment could turn off any week just based on conditions we measure each week. That is what we analyze at the weekly meetings. The November 6th date on the timeline is when we will decide how to proceed based on the recommendation from the meeting on November 5th. **Betsy Morgan** That is helpful. It is just the operational meeting that determines the off ramp.

Leslie James (CREDA) On the chart with RM61 observations, there are a slew of days below the 15.5°C trigger, why haven't we already started off ramping? **Bill Stewart** We are in this weird zone where releases from the dam are warming. Temperatures are starting to reduce as we go downstream. Since there is warm water near the dam where we know bass exist, we are analyzing that risk in the off-ramping recommendation. **Leslie James** Are we using RM61 as the trigger point or are we using Lees Ferry? **Bill Stewart** We have been using RM61, but the ROD allows for adjusting to different river points based on conditions. In light of the current situation with warmer temperatures at Lees Ferry, we are considering other points. **Leslie James** I appreciate that, but every week we continue it is about \$1M dollars of cost removed from the basin fund. I have some concerns about this continuing with a different trigger. **Melissa Trammell (NPS)** With consideration given to the cost of the experiment, it is good that adjustments are made to reduce the costs. But it misses the point of the SEIS. From my perspective as a fish biologist, it would be a shame to allow the water to warm up right at the end and allow spawning in an effort to reduce costs. **Christina Noftsker (State of New Mexico)** I heard there might be a partial off ramp. Is there an idea of going halfway in between and using less water as we start the off ramp? **Bill Stewart** Yes, that is part of the conversation. We are right on the edge, close to being below the spawning level in the whole river.

Seth Shanahan (Chair) Bill, you are welcome to have the last word. **Bill Stewart (BOR)** I can't thank everyone enough, we are in unprecedented times. We will bring all this information to the ARM to give everyone time to review and digest. I am very proud of everyone who has been working on this experiment. It has been a lot of work.

Leslie James (CREDA) I wanted to correct a comment I made about the SMB flows. I was looking at the wrong lines on the RM61 chart in my statements about the first couple of weeks of October. My other request about getting updated information as soon as possible on the most recent modeling and temperatures still stands.

Threatened and Endangered Species Updates: Humpback Chub Recovery Team and Colorado Pikeminnow in the Grand Canyon:

Dan Leavitt (USFWS) Humpback Chub Recovery Team The Recovery Team was convened in January 2023 with a task to revise the Species Status Assessment (SSA). We are working with the Lower Basin and the GCDAMP, there is a separate recovery team for the Upper Basin. This is a 3-part framework consisting of the SSA, a recovery plan and the implementation strategy, which is a roadmap for the recovery plan actions. The SSA is easier to update at 30 pages compared with 120 pages in the Recovery Plan. The current version was last revised in 2018. Version 2.0 will be available sometime in 2025. A lot has changed since 2018, including people, HBC biology and interpretation of the policy and environment. The HBC moved from endangered to threatened in 2021. The current planning process was triggered with this re-classification. We need a new recovery plan as it has not been updated since 1990. The updated SSA will reflect current population and biology of the species and its predators. Anticipated environmental changes will be incorporated as well, such as water levels and temperatures. We created a draft Recovery Vision at the beginning of this work. The species and its populations can be fully sustainable (delisted) when it meets the three criteria. Resiliency is the ability of a species to withstand stochastic influence, redundancy is the ability to withstand catastrophic events, representation is the ability to adapt to changing environmental conditions over time. Once we have completed revising the SSA, we will revisit the draft recovery vision and make any necessary changes for the recovery plan. Since the team was assembled in 2023, we have held 13 virtual meetings and one in person trip. The SSA will be published first, followed by the Recovery plan and Implementation Strategy. By the time of the next 5-year status there will be significantly better structure in place for monitoring this species.

Q&A and Discussion

Larry Stevens (GCWC) The Lake Mead populations are not protected in any way. Should the lake return to full level, this population might be wiped out. How is this uncertainty included in your assessment process? Second, does the recovery team have responsibility for HBC farther downstream? **Dan Leavitt** To the second question, yes, we have responsibility. When the MSCP was developed, conservation measures were put in place related to HBC that resulted in a fund for potential actions that could assist in recovery. Regarding the first question, we have ongoing discussions with Reclamation about this. It is part of the post 2026 operational guidelines. We will be sharing information with Reclamation to find solutions that will address this issue. An interesting paper came out from AZGFD where they evaluated the habitat in Lake Mead sediment beds. According to their data analysis, the HBC does not need the rocky substrate previously believed. **Larry Stevens** If you could post that paper in the chat, thanks.

Leslie James (CREDA) Can you walk through the timetable for completion of these steps and documents? **Dan Leavitt** I would love to, although our timetable has slipped. My understanding is there is a freeze on hiring our team leader, which has impacted the timeline. We were intending a two-year process starting in January 2023, which puts the original completion target in January 2025.

Seth Shanahan (Chair) How does the impact of changing climate on our water system relate to the recovery program system? Can you speak qualitatively about the issue of warming temperatures and less

water? **Dan Leavitt (USFWS)** We know this is happening and we know agencies are going to take management actions. The question is how they are going to handle it. LTEMP SEIS is an example, where we turned the dam itself into a temperature regulation for the water below. It shows the level of action that agencies are capable of. We factor those actions into the future trajectory that we model.

David Ward (USFWS) Colorado Pikeminnow in Western Grand Canyon These were one of the first fish that were impacted by dam building on the Colorado River. This is because they return to their water of origin for spawning. The last one was captured in Lake Mojave in 1972 and in the Grand Canyon in 1978. They have been gone for an entire generation, which makes it more difficult to keep focus on recovery. In the last 50 years there have been over 9 million Colorado Pikeminnows introduced into the Upper Basin. There have been zero introduced into the Lower Basin. One of the reasons is that for a large period of time the water was too cold to support them. Now that conditions are better, it may make sense to reintroduce them. Another reason is that the Upper Basin is a recovery program, and the Lower Basin is a compliance program. Also, there has been concern that increasing the pike minnow in the Lower Basin may have adverse effects on recovery efforts for other endangered fish. At first look, the large mouth on the Pikeminnow makes you think it would be a predator. Minnows are a species of fish that have no teeth. Also remember most of the population of a healthy species are young fish, not large. Compared to other fish the mouth gape on these fish is small relative to the rest of the body. Which means the native endangered species will outgrow the mouth size of a Pikeminnow at 1 or 2 years of age. Finally, the population density for this fish is low compared with other species, only 7 fish per river mile. We looked at predation behaviors in tanks with various species. Results showed the Pikeminnow has less impact on HBC than other species. Also, pike are diurnal, and the HBC are nocturnal. Pikeminnow also prefers Flannelmouth Suckers over HBC. How did the Razorback Sucker avoid predation by the Pikeminnow? They go to the bottom, remain motionless, and live in off channels not habituated by the Pikeminnow. The Pikeminnow did not eat all the HBC or Razorback Suckers in the last 3 million years, why would they do it now? We propose to do an experimental Pikeminnow stocking in the Western Grand Canyon. We are looking at the area around Spencer Creek, a location with lots of juvenile Flannelmouth Suckers. The fish will have sonic tags which allow us to monitor movement through gates of ultrasonic receivers on the river. We have talked with the Hualapai tribe and the park service about this proposal and those discussions will continue as we proceed.

Q&A and Discussion

Larry Stevens (GCWC) I have long advocated for this kind of approach. Your data is very helpful to get this iconic species back into the river system. Two questions. One, you did not present catfish predation. They are quite abundant in that lower reach, what might we expect from that? Two, if the imprinting process is so critical to these fish, where are the fish you are introducing imprinted? **David Ward** I would love to take larval fish and imprint them in the Grand Canyon. These fish were born at Dexter National Fish Hatchery, so they won't have that. As far as catfish, currently we have very low numbers in the western Grand Canyon which is why native fish populations are doing well. We have a window where we could get our native predator back into the system to help stabilize it. If we don't take that action, it could be the non-native fish that become the predators and thrive.

Craig Ellsworth (WAPA) Early in my career I had a project angling for these Pikeminnow, they are an amazing fish. Could you or Dan speak about how these fish would be classified as a non-essential reintroduction? **David Ward** Fish and Wildlife is thinking about that. We do not want to create any additional regulatory burden on our partners. We think we have a good template for the Section 7 consultation we will be undertaking for this action. Your concern is justified, we are trying to figure out the best way to mitigate it. **Dan Leavitt** I agree, that is the hope. **Seth Shanahan (Chair)** You have nonfederal actions under section 10 that will take permits. That would be helpful to include as well. You have potential impact to an experimental population as well as impact to other species with derivative

actions. I would be very excited to see what those risks could look like. **David Ward (FWS)** Yes, I knew we would need that, which is why I have collected this data about impact of Pikeminnow on other fish.

Jim Stroger (TU) Is there any information you have about predation on NNF? **David Ward** Yes, they will eat NNF at small sizes.

Helen Fairley (GCMRC) You mentioned the importance of imprinting and that these fish are being raised in hatcheries. How is that going to affect their behavior? Might it result in them leaving the area to get back to where they were born? **David Ward** We will have some release strategies to acclimate the fish and reduce the probability of leaving, a soft release strategy. They will go looking for someplace like where they were born. We are hoping we learn enough in the one-year post release to get us to the next phase. **Helen Fairley** Is there any thought of using river water from the Grand Canyon in the hatchery? **David Ward** Yes, we discussed that with the Hualapai. We also discussed the idea of bringing larval fish to the canyon for a week and then returning them to the hatchery.

Trout Ad Hoc Group (TAHG) Update:

Ryan Mann (AZGFD) I am filling in for Dave Rogowski who just returned from a 16-day monitoring trip. The RBT fishery has not been meeting goals for AZGFD Fishery Management Plan and LTEMP. Specifically, LTEMP FEIS Section 1.4 goal is to “Achieve a healthy high-quality recreational rainbow trout fishery in GCNRA”. In addition, this fishery is economically and culturally important with an annual economic impact estimated at \$13M. Changing environmental conditions represent an existential threat to the fishery. At the July TWG meeting we agreed to reactivate the Trout Ad Hoc Group (TAHG) to focus on strategies to help achieve the LTEMP RBT Fishery goals. Our first meeting for the new group was held on October 7, where we approved the charge from TWG and discussed next steps. Our next meeting will be November 19 with a plan to discuss structured decision making. We also plan to include subject matter experts in that meeting. Anyone that is interested in participating please contact Dave Rogowski, TAHG Chair.

Q&A and Discussion

Seth Shanahan (Chair) Can you go back to the charge slide? The procedure for charging a TWG ad hoc is asking the membership of the TWG if they support the charge. Since not everyone was at the TAHG meeting, I want to make sure the membership of the TWG also supports the charge. (There were no objections to the Charge).

Seth Shanahan (Chair) Can you also go to the knowledge assessment slide? There is some overlap on this topic with the SEAHG. There may be value in a joint collaboration with Ben Reader and SEAHG.

Ryan Mann I would be open to that and will pass that along to Dave. **Seth Shanahan** I will connect the dots even further. Leslie, you shined a light on the need to learn about Value of Information as a tool. I suggest joining this meeting to sit in on learning about that tool as it will be useful in other areas of LTEMP, not just the trout fishery. **Ryan Mann** Yes, the concepts are not tied to this fishery. We just felt the tools would be useful for our goals. **Seth Shanahan** We have a long history of using knowledge assessments in this program. I would encourage the TAHG to look at the most recent two, particularly the one done right after LTEMP, as a format that could be used for framing the assessment of information. We have this existing defined template and procedure. We don't want to recreate the wheel. **Ryan Mann** Sure, that makes sense. I will pass that along to the group.

Seth Shanahan For the folks participating in the TAHG, this group has a long history of having non GCDAMP participants which is very important for the exchange of information. At the point of recommendation, however, only the TWG members can participate, following the normal TWG voting procedures. **Ryan Mann** We did discuss that in the first kick off call. Thank you for the summary.

Bill Persons (TU) We have concerns about the way RBT are being handled in Lees Ferry related to the electrofishing. It seems lots of small RBT are being netted, which is OK as long as they are properly cared for (aerated tanks, separated from other fish). I have asked several times to receive the netting protocol to have some confidence that everyone is handling fish the same way. I will keep requesting that.

Jim Stroger (TU) We also need better data collection on the mortality of RBT to determine if additional protocol changes are needed.

Melissa Trammell (NPS) I just want to reiterate what Brian Hines reported yesterday that the rainbow trout and suckers are put into aerated containers on the boat separate from the NNF fish. We do report all the mortalities, they are included in the weekly trip reports. The problem is, the RBT fish that are alive, we release as soon as possible. Which means we do not have accurate counts on the live fish that are returned. The TAHG is a great place for these discussions, and I look forward to participating.

Bill Persons I understand you are using battery powered bubblers for the tanks. Would it be possible to use a small oxygen tank instead? We have found that works better than the bubblers.

Melissa Trammell Yes, that is probably an area that we could improve. Emily wants me to share that if they encounter a large cloud of RBT they halt electrofishing and move to a different area.

Bill Persons I understand there is also interest in trying to keep track of how many brown trout are out there. If the fish are little fingerlings, you need to get them in your hands to identify them. I understand that adds time to the whole process. But anything you can do to help RBT would be greatly appreciated.

Melissa Trammell Understood, and we can certainly continue to have these conversations.

Seth Shanahan (Chair) Ryan, filling in for Dave, it sounds like November 19th will be the next place where these conversations can happen. If you can add some of this new information to that meeting, in particular the handling protocols as requested by Bill.

Requests for the Annual Reporting Meeting:

Bill Persons (TU) I am concerned about overloading GCMRC staff with these ARM presentations while simultaneously tasking them with activities related to SMB and RBT. Sounds like we are having a separate workshop for SMB, maybe we can move the annual reporting for SMB to that separate meeting.

Seth Shanahan We heard concerns about the effort for written reports, which I believe Bill Stewart is working on.

Jeremy Hammen (BOR) The written reports are very time consuming when prepared in full detail (150 pages). If we can focus on the presentations and a shorter summary document.

Seth Shanahan Good point, although I think the format may be dictated by the GCMRC organization itself.

Larry Stevens (GCWC) While I share Bill's compassion for the GCMRC staff, these are science professionals. Presentations are common practice and are an important process to bring forth the scientific information. We should focus on short presentations, avoid compliance related presentations. We need to add integrated panel discussions to get us to the broader 10-year review coming up. If we limit presentations to 15 minutes, it forces the presenter to focus on the key points. Then follow with an integrated panel discussion.

David Ward (USFWS) The ARM could and should take on different flavors depending on where we are in the work plan process. Last year, the scientists wanted to present their work in detail in order to prepare for the next TWP plan. This year it can be more about synthesizing the work. It may be more work for the scientists, but it is helpful as we look to the future.

Bill Persons (TU) In the past it seems like we have had individual PI give an annual report based on what they said they were going to do in the TWP. I think the synthesis is key. The one Maria did in 2023 presented most if not all of the fish information in a single presentation and helped tie those projects together. Anything that can be done along those lines will be an improvement.

Seth Shanahan When you talk about synthesis of information, there is broad level – are we meeting the GCPA, or a lower level – are we meeting the HBC goal. Are you suggesting we focus results around the specific LTEMP goals?

Larry Stevens Great point, I am hoping we can take it up one level to address how we integrate across the goals. For example, how do food base goals interrelate to fish survival rates.

Bill Persons I agree with Larry. I would like to see a synthesis of all the aquatic resources. I do not care which species or resource. I want to see the summary across the ecosystem.

Betsy Morgan (State of Utah) It looks like historically the Annual Report came out the day before the meeting. I think it would be helpful if the TWG got this draft earlier, to have more time to review prior to the meeting. Also, Jeremy prepared some TWP project briefs last year that I thought were a helpful resource to have while listening to the presentations. Reflecting on last year's agenda, I agree it seemed tight, the day felt crowded. Leaving enough time for robust conversation while we are together with the scientists is important, perhaps through longer breaks. In regard to the Annual Report, I think a story map might be a great tool to condense the material for different audiences, leveraging pictures and maps.

Seth Shanahan (Chair) I want to dig into creating more time for dialogue discussion. One of the ways we could achieve that is not having every resource discussed in the meetings. Select a subset of them that we will discuss. We struggle with that because then there isn't equity between the goals. **Deb Williams (USFWS)** I like the idea of trying to prioritize things at the ARM but with the 10-year review kicking off, we really need to hear from everything. Another idea is to put out a survey to get input on what people value if we try to limit the number of presentations. Or, if there is a topic that doesn't get as much attention at the ARM, we could dedicate time for that at the next TWG. I want to hear Bill's thoughts here. **Bill Stewart (BOR)** My thought specific to the ARM is that information presented there is to help make any adjustments required to the workplan. What did we learn this year that we did not know and how would we use that to adjust the workplan. The ten-year review is going to be more in depth, and a different time scale. It is going to be more extensive workshops, over a period of time, longer than the timeframe for the annual reporting meeting.

Ben Reeder (GCRG) I think it is useful to hear representation from all aspects and resources of the workplan in order to see changes that may need to be made in the following year. It is useful to at least have a check in with each PI and program. I love the poster sessions. They are really useful and offer one on one time. I would like to see a robust presentation ahead of the deferred Spring HFE. I also think it is useful to hear cultural perspectives, what different tribal members are thinking, that helps inform the GCDAMP.

Jim Strogon (TU) We would like to see information on Reclamation visits to the California dams for thermal curtain reviews and what next steps are for long term solutions. **Seth Shanahan** Thank you, that particular item may be a better presentation for the TWG agenda on day three of the meeting.

Seth Shanahan (Chair) The ARM presentations are mini knowledge assessments, collectively what have we learned. I would advocate more generally that we use some of our knowledge assessment tools and the performance metrics Helen is working on to frame some of this information. To Betsy's point about story maps, adding graphical information and formats that can be easily understood to a wide audience would be helpful. **Craig Ellsworth (WAPA)** I agree with what you just said. Some of the topics cross resources. Let's spend our time talking about things that are really important to the program and the canyon and the actions we are doing there. We could use the poster session more for the presenting resource updates.

Larry Stevens (GCWC) We have been working on the diatoms in the Glen Canyon reach above Lees Ferry and would like to give a presentation on that topic if there is room. Also, I would like to offer to do a presentation on the biography of the river corridor, the way biology is affected by configuration of the canyon. **Seth Shanahan** Yes, and you also mentioned Lake Mead water quality, so maybe that fits into the TWG component of the agenda.

Seth Shanahan (Chair) We have started the list. I think we are circling on the idea of more synthesis and ways of utilizing our time more effectively. The next steps will be for the Steering AHG to develop the

agenda. If you are interested in contributing to the agenda, please participate. Mark, we will be reaching out to your staff soon, so you have adequate time to prepare. Did you hear all that, do you have anything you want to add? **Mark Anderson (GCMRC)** Yes, I did hear all that. I have two pages of notes, I don't have any questions at this time.

Socioeconomic Ad Hoc Group (SEAHG) Update:

Ben Reeder (GCRG and SEAHG Chair) We had a meeting on September 30 to brainstorm on topics for the hydropower workshop. We are hiring a facilitator for this workshop and hope to schedule it prior to the ARM. We will be breaking down the differences between the GTMAX modeling and the GCMRC modeling. That is really the basis of this workshop. Looking at the benefits, uncertainties, how they differ in evaluating costs, hydropower performance metrics, optimization of flow experiments. Also, how can this workshop help with the LTEMP 10-year review, future management solutions impact to hydropower and impacts to other resources. The question came up yesterday about Project J. Originally Lucas' work with Project J was going to hinge on this hydropower workshop. We need a little more clarification on that. Maybe we are also looking for a question or Charge for a future SEAHG meeting around structured decision making. I need a little direction on where we move forward in meetings leading up to that workshop.

Q&A and Discussion

Craig Ellsworth (WAPA) Apologies for not reaching out earlier and connecting on our points from that call on September 30th. We talked about how to focus the workshop on the prep for LTEMP 2.0 and the 10-year review and spending less time on delving into the mechanics of the two models. **Jeremy Hammen (BOR)** I think there were definitely discussions around that. But I think there were also conversations around these models. There are some outstanding things that not everyone has a full understanding of related to the models. We are trying to find that balance. We need to get everyone on the same page about where we are first, then look at where we go forward with hydropower. **Craig Ellsworth** I agree, but we want to keep it at a high level on the models. Not get down into the mechanics. Talk about the difference between GTMAX and a screening tool model, and why WAPA uses one over the other. **Ben Reeder** You are right, that was brought up and will be an important part of this workshop. But let's not forget the whole reason we initiated this charge to begin with. There has been a disconnect for a long time between GCMRC and WAPA on these models. Trying to bridge that gap is the whole purpose of this effort.

Shane Capron (WAPA) The differences in modeling are really not that big, especially if you are looking out into the future. What you use for pricing is the biggest difference. Future pricing is complex and has many uncertainties. The key discussion is for us to talk through those uncertainties, how we look at prices and the key drivers in those models. The two models are for different purposes. We have a model that is very specific, looking at hourly data to operate the system. When we do a post hoc analysis to look at what the costs are, it needs to be very accurate. We look at what happened by hour, what prices we paid for each resource by hour, something that can only be done with a complicated model that keeps track of every detail of information. The GCMRC model is looking at rough ideas of costs over time. Another difference is the estimated costs of the experiments. What is it likely to cost in a given year is different than what is the cost of this experiment over a longer time frame. These things are part of the conversation we need to have in that workshop. **Seth Shanahan (Chair)** That is very useful Shane, it sounds like there are a few things the workshop intends to do. One of those is just level setting, getting everyone on the same page about how things are done. Isn't it also the goal to develop a consensus approach for future actions? **Shane Capron** On the price uncertainty issue, we are working with GCMRC on that with the goal that our estimate of future prices is roughly similar. **Lucas Bair (GCMRC)** I will

echo Shane and Jeremy and Ben. The framing and the assumptions that go into the modeling are really important and is where in the past differences occurred.

Seth Shanahan (Chair) Who is generating the agenda for the workshop? That might help to ensure the right topics are on the agenda. **Jeremy Hammen (BOR)** I think at this point it will be Reclamation. We are trying to engage a facilitator that can help us build the agenda by reaching out to the stakeholders. **Seth Shanahan** OK, that is helpful to hear the approach. **Ben Reeder** Maybe that is the topic of our next meeting. The brainstorm meeting brought out a lot of ideas in a different direction from I originally thought. I am not sure if it is better if the facilitator reaches out to stakeholders independently or if we as the SEAHG provide the topics we want to include. **Jeremy Hammen** The SEAHG was tasked with understanding this modeling last January. But as this developed, we feel like this hydropower workshop grew into something bigger than the SEAHG can manage. **Rob Billerbeck (NPS)** It has become clear over this year that it is important to get quicker and easier estimates from GCMRC that can be used as a screening tool. If there is going to be a hydropower workshop, it seems it would be helpful to know the assumptions used in these different methods. We have discovered some limitations with the Argus pricing. It seems like all of these things are topics for a workshop. **Craig Ellsworth (WAPA)** I agree, understanding those things is very important to understanding how an LTEMP 2.0 is going to be evaluated using these models. But again, I believe understanding at the higher level is the key, not getting into the nuts and bolts. Those reports have already been published. I don't see the utility in digging into that again. We have more important things to be working on. **Shane Capron (WAPA)** Another topic to talk about. The landscape of the hydropower system is changing quickly. Screening tools will give you smears of cost over a long period of time. When you get into weekly operations, you have a whole different level of detail. Even for us, it has been surprising how things are changing, when customers need the power and when it is available. We need to consider what we learned this summer on the bypass flows.

Seth Shanahan (Chair) Ben, I think what you are hearing is your next meeting agenda needs to be putting some of these workshop ideas on paper to start building out the agenda. We have heard 4 or 5 topics that people want to discuss. I want to add another one, just reviewing the description of the work effort in the workplan, identifying approaches for understanding status and trend generation is alone its own goal. Helen's work with the performance metrics and the knowledge assessment framing are two pieces of information to bring into the conversation as well. Ben, I will pause and see if that gives you good input? **Ben Reeder (GCRG)** Yes, I think that makes sense, build out the topics and then go from there. We need that in the next few weeks so we can offer it to the future facilitator. I am hesitant to abandon the original reason we created this workshop. I think that needs to be the first agenda item, then these other topics can be added as equal value. **Seth Shanahan** I support your comment, I think the original concepts for the workshop should still be included. There are just all these additional topics people want to add. **Shana Rapoport (State of California)** I appreciate Ben wanting to keep us on track here. We stumbled a lot in the BAHG process this year because of the different perspectives on this. It's my understanding that the workshop came out of that, in hopes that we have better process in the future.

Seth Shanahan (Chair) Regarding structured decision making and the Value of Information (VOI) topic that you wanted more input on. I think this tool would be useful to discuss and understand in the SEAHG. Then, after understanding or level setting on this tool, a deep exploration on how it might be used. I would suggest that is a standalone topic for SEAHG members to think through, maybe the next meeting after the workshop agenda. Also, the suggestion I made for you to collaborate and join the TAHG meeting on this topic. **Ben Reeder (GCRG)** That makes sense to me. It seems structured decision making and

VOI are connected. **Lucas Bair (GCMRC)** A lot of the work we have been doing with the screening tool related to hydropower costs associated with experiments has been done from a Value of Information decision point. It is all interrelated. It would be good to add the VOI into the hydropower workshop as well. **Seth Shanahan** Thanks for that input, maybe it is all within the framing for the workshop. I will leave it to you Ben and the SEAHG to sort that out.

Budget Ad Hoc Group (BAHG) Update:

Erik Skeie (State of Colorado and BAHG Chair) I want to give everyone here another opportunity to provide input on what needs to be improved in the process. I will start by walking through the feedback that has already been submitted. My hope is to have a planning meeting in mid-November to decide how we are going to address this list.

Q&A and Discussion

Larry Stevens (GCWC) I am concerned that the next TWP discussion will take place in the midst of the 10-year review process. Can we actually improve this system in the face of that review? **Seth Shanahan (Chair)** That's a great point, three years from now is January 2026. Certainly, anticipating all the pulls on people's time would be very useful.

Shana Rapoport (State of California) Did we have a point about the document itself? Making it more concise and easier to track? **Erik Skeie** More concise drafts of the TWP document itself? **Shana Rapoport** Yes, the document itself keeps expanding, is bulky and difficult to work with. A report that helps us track results for the annual reporting. **Seth Shanahan** If I can offer, is there a way the workplan can integrate some of our guiding documents, which might tie our program together better in one place. **Shana Rapoport** It was tricky on both ends because of the volume, if we had something more concise to work with it would help. **Seth Shanahan** The time expected from the TWG to review these large documents is a standalone item. The effort and commitment to re-read a 200-page document multiple times. Having revisions in strike through may be helpful to reduce effort. Speaking on behalf of GCMRC, there is also a need to understand the limitations of the resources drafting this document.

Bill Persons (TU) I will share a comment one of the science advisors made. The TWP reads like a compendium of individual projects. There is no attempt to tie the work together to provide an Adaptive Management Plan. I am not sure how GCMRC might do that, but it would be helpful to have a view of the entire research program.

Craig Ellsworth (WAPA) Can we revisit the expectations or definitions of some of the process terms? What constitutes a first draft or second draft? I think there was some misalignment of what GCMRC thought versus our expectation. They thought they were meeting the deadlines. Another thought, instead of having the first draft be a list of projects coming from the PI, maybe it should be a list of questions or concerns from the stakeholders. Then the PI have something to respond to in developing the first list of projects. **Seth Shanahan** Erik, we may want to just reference the original budget operating workplan process as it was approved by the TWG back in 2016. There may be some text there that allows us to update.

Shane Capron (WAPA) The BAHG process got cut down a few times since we started. Goals and objectives work when everyone is on the same page. Over time, with all the new players things drift. I think we need to start over in defining the agreement. **Seth Shanahan** There is some missing information if you have not been here for a long time that makes it harder to understand.

Seth Shanahan (Chair) Thanks to Erik for taking on this last task. What I envision would be things like a new schedule, descriptions of what different items are (so expectations are clear), specific tools – like

surveys. Does that jive with what you were thinking? **Erik Skeie (State of Colorado)** Yes, thank you for putting it so eloquently.

Seth Shanahan (Chair) I want to bring up a question Kelly Burke asked at the SCAHG in preparation for one of the meetings. She made a comment that there is Upper Basin B2E funding available which may work for some of the projects not funded in the TWP. There is a request for GCMRC to share the information on projects that you are proposing to submit for funding. Mark, can you walk through that?

Mark Anderson (GCMRC) I apologize but I don't have that information. **Seth Shanahan** Could you at least explore Paul's efforts? **Mark Anderson** I am really not prepared. **Kelly Burke (GCWC)** I do have an email from Paul Grams where he outlines two projects submitted. One is a revision of TWP B4, the second is looking at environmental impacts of low level elevations in Lake Powell. **Seth Shanahan** I will note that Paul was also requesting letters of support if anyone wants to chime in. **Sinjin Eberle (American Rivers)** I believe the deadline for these letters is fast approaching **Kelly Burke** The deadline for submission is November 22. Also, a heads up, GCWC and the Navajo Nation are collaborating on a proposal for riparian restoration on river left in the Glen Canyon reach. We will be reaching out to TWG members for letters of support on that project as well.

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:

Larry Stevens (GCWC) We are proposing research on the distribution and water chemistry of springs in the Lees Ferry area. That may help clarify some of the ongoing concerns there. We are also willing to look at spring mapping in the Blue Springs area or other locations, please let us know.

Seth Shanahan (Chair) We can also discuss agenda item requests in the STAHG, so if you are interested in helping with the agenda for future meetings please join us there.

Public Comment:

None

Meeting adjourned at 3:25 PM PDT.

Participants

TWG Members, Alternates, and Leadership

Ben Reeder (GCRG)

Betsy Morgan (State of Utah)

Bill Davis, (TU)

Bill Persons (TU)

Brian Hines (BOR)

Bud Fazio (NPS-GLCA)

Christina Noftsker (State of New Mexico)

Cliff Barrett (UMPA)

Colleen Cunningham (State of New Mexico)

Craig Ellsworth (WAPA)

Dan Leavitt (USFWS)

Dani Collins (State of Nevada)

David Ward (USFWS)

Deb Williams (USFWS)

Emily Omana Smith (NPS-GRCA)

Emily Young (State of Arizona)

Erik Skeie (State of Colorado)

Erik Stanfield (Navajo Nation)

Hannah Chambless (NPS-GRCA)

Jakob Maase (Hopi Tribe)

Jeremy Hammen (BOR)

Kelly Burke (GCWC)

Kurt Dongoske (Pueblo of Zuni)

Larry Stevens (GCWC)

Leslie James (CREDA)

Mel Fegler (State of Wyoming)
Michelle Garrison (TWG Vice-Chair)
Rob Billerbeck (NPS-GLCA)
Rudy Keedah (BIA)
Ryan Mann (AZGFD)

Seth Shanahan (TWG Chair)
Shana Rapoport (State of California)
Shane Capron (WAPA)
Sinjin Eberle (American Rivers)
Ted Rampton (UMPA)

Other GCDAMP Members and Interested Persons

Alan Kasprak (EPA)
Alex Pivarnik (BOR)
Alyx Richards (UCRC Commission)
Amy Schott (NPS)
Beccie Mendenhall (SeaJay Env)
Bill Stewart (BOR)
Cassandra Reed (NPS)
Christina Kalavritinos (DOI)
Clarence Fullard (BOR)
Craig Dengel (WAPA)
Craig McGinnis (SRP)
Daniel Picard (BOR)
Dave Foster (Grand Canyon River Guide)
Dave Speas (BOR)
Dave Worthington (Grand Canyon Conservancy)
Deborah Shirley (BIA)
Drew Eppheimer (GCMRC)
Gail Bates (CRCNV)
Harry Lodge (Fisherman, Lees Ferry)
Heather Patno (BOR)
Jamescita Peshlakai (BOR)
Heidie Grigg (NPS)
Helen Fairley (GCMRC)
Jamescita Peshlakai (BOR)
Jan Balsom (NPS)
Jeff Arnold (NPS)
Jeffrey Woner (KR Saline & Assoc)
Jen Pelz (Grand Canyon Trust)
Jess Gwinn (USFWS)
Jess Newton (USFWS)
Jim Stroger (TU)
Joe Duncan (Wyoming SEO)
Joel Sankey (GCMRC)
John Barry (Resident)

John Gerbich (NPS)
Josh Korman (Ecometric Research)
Joshua Caster (GCMRC)
Julie Carter (AZGFD)
Kate Behn (GCMRC)
Kathy Callister (BOR)
Kerri Pedersen (BOR)
Kevin Bulletts (Southern Paiute Consortium)
Kevin Garluck (UMPA)
Lucas Bair (GCMRC)
Lyndee Hornell (Hualapai)
Maddy Kelley (GCMRC)
Marc Wicke (Salt River Project)
Maria Dzul (GCMRC)
Mark Anderson (GCMRC)
Matt Kaplinski (GCMRC)
Matt O'Neill (BOR)
Melissa Trammell (NPS)
Melynda Roberts (BOR)
Michelle Kerns (NPS)
Mike Fischella (GCMRC)
Nicki Gibney (NPS)
Paul Grams (GCMRC)
Sarah Haas (NPS)
Sheri Farag (CREDA)
Sterling Selana (Hualapai)
Tara Ashby (BOR)
Taryn Preston (NPS)
Ted Kennedy (GCMRC)
Teo Melis (BOR)
Teri Lynn
Tildon Jones (USFWS)
Thomas Gushue (GCMRC)
Warren Turkett (State of Nevada)
Zachary Nelson (BOR)

Acronyms

ACHP - Advisory Council on Historic Preservation	LCR - Little Colorado River
ADWR – Arizona Department of Water Resources	LTEMP – Long-Term Experimental and Management Plan
AHAHG – Administrative History Ad Hoc Group	MAF - Million Acre Feet
AHG - Ad Hoc Group	mm – millimeter
AMWG – Adaptive Management Work Group	MOU – Memorandum of Understanding
AZGFD – Arizona Game and Fish Department	NEPA – National Environmental Policy Act
BAHG – Budget Ad Hoc Group	NMISC – NM Interstate Stream Commission
BIA – Bureau of Indian Affairs	NPCA - National Parks Conservation Association
BO - Biological Opinion	NPS – National Park Service
BOR – Bureau of Reclamation	NPS-GLCA – NPS Glen Canyon National Recreation Area
C° – degrees Celsius	NPS-GRCA – NPS Grand Canyon National Recreation Area
CBRFC - Colorado Basin River Forecast Center	P&I Team – Planning and Implementation Team
CFS – Cubic Feet per Second	PDT – Pacific Daylight Time
CRBC – Colorado River Board of California	RBT - Rainbow Trout
CRCNV – Colorado River Commission of Nevada	Reclamation – Bureau of Reclamation
CREDA – Colorado River Energy Distributors Association	RM - River Mile
CRSP – Colorado River Storage Project	ROD - Record of Decision
CWCB – Colorado Water Conservation Board	SC - Specific Conductivity
D.O. – dissolved oxygen	SEAHG – Socioeconomic Ad Hoc Group
DOI – Department of the Interior	SEIS – Supplemental Environmental Impact Statement
DROA – Drought Response Operations Agreement	SHPO - State Historic Preservation Office
DSA - Deliverable Sales Amount	SMB – Smallmouth Bass
DWR – Department of Water Resources	SNARRC – Southwestern Native Aquatic Resources and Recovery Center
EA – environmental assessment	SNWA – Southern Nevada Water Authority
EIS – environmental impact statement	SWE - Snow Water Equivalent
FACA - Federal Advisory Committee Act	TRGD – Trout Recruitment and Growth Dynamics
FLAHG – Flow Ad Hoc Group	TU – Trout Unlimited
FY – Fiscal Year	TWG – Technical Work Group
GCD - Glen Canyon Dam	TWP - Triennial Work Plan
GCDAMP – Glen Canyon Dam Adaptive Management Program	UCRC – Upper Colorado River Commission
GCMRC – Grand Canyon Monitoring & Research Center	UMPA – Utah Municipal Power Agency
GCPA – Grand Canyon Protection Act	USFWS – United States Fish & Wildlife
GCRG – Grand Canyon River Guides	USGS – United States Geological Survey
GCROA - Grand Canyon River Outfitters Association	USU – Utah State University
GCWC—Grand Canyon Wildlands Council	WAPA – Western Area Power Administration
GSF - Green Sunfish	WY - Water Year
HBC - Humpback Chub	YoY – Young-of-Year
HFE – High Flow Experiment	
KAF - Thousand Acre Feet	