Glen Canyon Dam Adaptive Management Program
Technical Work Group Meeting
April 12-13, 2023

Wednesday, April 12, 2023

Day 1: April 12, 2023
Start Time: 9:53 AM Pacific Daylight Time (PDT)
Conducting: Seth Shanahan, Southern Nevada Water Authority (SNWA) and Technical Work Group (TWG) Chair] and Daniel Picard, Bureau of Reclamation (Reclamation), Designated Federal Official
Meeting Recorder: Carliane Johnson, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum:** A quorum was reached.
- **Adoption of Prior Meeting Minutes:** The January 2023 meeting minutes were adopted.
- **Next Meeting Date(s): June 14-15, 2023: [Seth Shanahan, SNWA]** This meeting is to be held in Phoenix but have heard interest in visiting the canyon such as at -12 Mile Slough and potentially meeting in Flagstaff.
- **Ad Hoc Group Membership and Updates: [Seth Shanahan, SNWA]** Members should review the list on the TWG website. Any changes should be sent to Clarence Fullard. Sinjin Eberle is the new Flow Ad Hoc (FLAHG) chair. The Steering Committee Ad Hoc Group (SCAHG) Is active and continues to meet. The Budget Ad Hoc Group (BAHG) will make progress when Reclamation provides information on how to address capacity concerns, which will be heard later on the agenda. **[Craig Ellsworth, WAPA]** The Administrative History Ad Hoc Group (AHAHG) Wiki is still active and is updated with meeting presentations. Contact Craig if anyone would like to learn about Wiki programming. **[Seth Shanahan, SNWA]** The AHAHG Wiki is the go-to place for much information.
- **Review Action Items, Motions, and Votes Form: [Seth Shanahan, SNWA]** Completed actions: a link to this document is now part of the agenda, Martina Dawley had requested a visit to the Southwest Native Aquatic Resource and Recovery Center (SNARRC), and another visit was requested from Reclamation to Zuni leadership. **[Clarence Fullard, Reclamation]** Martina Dawley, Hualapai Tribe, had coordinated with Kerry Pedersen, Reclamation, on the visit to SNARRC. **[Daniel Picard, Reclamation]** Wayne Pullan and Bill Stewart, Reclamation, visited the Zuni Tribe on March 15 to talk about the Colorado River. **[Edward Wemytewa, Pueblo of Zuni]** It was important for the tribal council to have a conversation with the Secretary's Designee on how Zuni can support the TWG and the annual updates.
- **Update on Monitoring and Research Trips to Occur From Today Until Next Meeting: [Scott VanderKooi, GCMRC]** The slide shows trips that have occurred or are planned from January 1 through November 2023. Anyone interested in volunteering for a trip should contact Andrew Schultz or Ann-Marie Bringhurst.

Update on Hydrology, Glen Canyon Dam Operations, and Water Quality Conditions in Lake Powell and Below Glen Canyon Dam. **[Heather Patno, Reclamation]** The forecast for April is 1.3 million acre-feet (maf) with a current release volume of 910,000 acre-feet (af). Should see an increase in elevations by the end of April. There are still some areas in the system that did not receive a lot of precipitation and are still dry as well as some areas that are now starting to dry. Precipitation was near normal, peaking on April 7 at 167% of medium, which is the new maximum that will go on the record. From March to April 1, there was a 3.3 maf increase into the system; however, also seeing some

variation in hydrology. Part of that is spring variability, but also not seeing as much runoff because of low soil moisture from the last three years. We need to continue to focus on minimum probable because of this uncertainty while Reclamation uses the most probable forecasts to operate the reservoirs. Reclamation is currently working on the April 24-month study.

[Continued]

[Robert Radtke, Reclamation] showed the March model run. The maximum discharge temperature by September 30 was forecasted to be 16.5 degrees Celsius (ºC). This dropped to 15 ºC under the most probable hydrology. Maximum temperatures with higher flows of 9 maf are forecasted to be 20 ºC at Diamond Creek, and 17 ºC at the Little Colorado River. At the forebay with modeled discharge projections of 7.8 maf versus 9 maf, temperatures are forecast to be about 8.4 ºC and 8.7 ºC, respectively, on April 15. Dissolved Oxygen (D.O.) changes only a little in the reservoir. On the outflow of Glen Canyon, D.O. is projected around 5 to 8 milligram per liter (mg/l) with a low D.O. plume right at the base of the dam. Based on historical trends, we might expect this year to have similar temperatures as what occurred in 2005. Also expect to have more oxygen demand with high inflows and a lot of sediment resuspension.

Q&A and Discussion

[Seth Shanahan, SNWA] A slide was included in prior presentations that correlated unregulated inflows to Lake Powell with its releases. What would that look like with the current forecasts? **[Heather Patno, Reclamation]** That graphic changes monthly because of elevation changes, the assumptions about water supply and demand, and the upstream reservoirs having different operational compliance requirements at different hydrologies. The current estimate using the March assumptions shows that anything above 10.4 maf (April through July), would be a 9.5 maf release. **[Seth Shanahan, SNWA]** On slide 17 of the presentation, does September show some volume that exceeds power plant capacity? **[Heather Patno, Reclamation]** The blue diamond is white with a red outline because 9.5 maf flow is power plant capacity; however, annual maintenance on units 1 and 2 generally occurs in September. That has been changed so that all six units are now going to be available (refer to the table below the graph). **[Bill Persons, Fly Fishers International (FFI)/Trout Unlimited (TU)]** What plans are in place to try to mitigate the low D.O. problem? There should be some effort to develop a plan to deal with it. **[Robert Radtke, Reclamation]** Nothing is in place because Reclamation does not know exactly where low D.O. might occur in the reservoir. A low D.O. slug is expected with high inflows. But not much can be remediated to change that when it goes through the penstock. In 2005, there were problems with the equipment when Reclamation tried to aerate the system. There is a lot of potential dilution with higher D.O. water mixing with lower D.O. as it gets close to the dam. **[Clarence Fullard, Reclamation]** Recall that a D.O. State of Practice was developed. Nothing can be done that is not extremely expensive or technologically infeasible; however, Reclamation is still monitoring and trying to figure out if there are steps that can be taken. There was low D.O. last year and the trout fishery was monitored in Lees Ferry. Reclamation continues to discuss ideas about the low D.O. slug. **[Charles Yackulic, GCMRC]** How would higher release volumes affect temperatures if all inputs to the model are the same? The only difference is a change in reservoir elevations. Did something else change? **[Robert Radke, Reclamation]** The changes were both inflow and outflow volumes with changes in hydrology while everything else basically stayed the same with the two model runs. **[Heather Patno, Reclamation]** The 24-month study will be published on April 17.

Status Report for Resolving Potential Adverse Effects According to Section 106 of the National Historic Preservation Act

[Zachary Nelson, Reclamation] When a federal agency takes an action it needs to consider effects on "historic properties." A Programmatic Agreement (PA) was developed to mitigate effects on historic properties under LTEMP. Some agency actions are ongoing, while others happen a single time. Reclamation held its Annual Meeting on cultural resources last week. Some effects are related to the sheer number of visitors while other effects are from gullies. Reclamation needs more time to develop its recommendations. A meeting will be held this fall meeting to include upcoming river trips. Rather than using a third-party negotiator for sensitivity training, Reclamation and GCMRC are going to help the tribes with individual presentations on their cultural values. Projects D6 to D12 in the Triennial Work Plan (TWP) were delayed due to COVID but they are now moving forward. Notifications about consultations on cultural resources will also go out earlier.

Q&A and Discussion

[Erik Stanfield, Navajo Nation] Vast progress has been made and it was nice to pick up dropped projects over the past couple of years. There is now a schedule to move forward.

Status Report for Developing a Plan to Amend the HFE Protocol

[Sinjin Eberle, American Rivers] on the Flow Ad Hoc Group's (FLAHG) development of an outline plan of action with a full proposal planned for June. Activities conducted to date include discussing the new ad hoc charge with Rod Smith, Solicitor with the Department of the Interior (DOI), and areas of compliance concern. There have been many discussions outside of these formal discussions that are starting to fill in the gaps in the proposed plan of action.

Q&A and Discussion

[Seth Shanahan, SNWA] There were two deliverables: to prepare an outline, which was shown in the presentation, and then prepare a more fleshed-out plan from this outline. Today's discussion will help with that second deliverable. *(TWG members then word smithed the outline/proposed plan of action.)* **[Ben Reeder, GCRG]** Made a motion to accept the six bulleted items as the TWG's deliverable to AMWG. **[Erik Stanfield, Navajo Nation]** Seconded. **[Seth Shanahan, SNWA]** Motion passed with no objections.

Monitoring Metrics

[Helen Fairley, GCMRC] provided an update on the revisions made in the draft performance metrics report. First is to note that monitoring for surveillance and validation are not the same as monitoring for effectiveness (i.e., the performance metrics). LTEMP goals are not aspirational but focus on specific resources of concern to the Glen Canyon Dam Adaptive Management Program (GCDAMP). In the draft monitoring metrics plan that is currently under DOI review, there are 41 metrics, 20 of which are related to fish, which seem too many. It would be better to have fewer, high-quality metrics. The TWG might want to consider how to define metrics for the tribal resource goals. None has been developed at this time because it was too difficult to write metrics for a goal that is so broad such as "maintain integrity of sacred sites." The final draft will be prepared for the June TWG meeting.

Q&A and Discussion

[Erik Stanfield, Navajo Nation] What would it look like to remove some of the metrics? **[Helen Fairley, GCMRC]** Don't know. In some cases, they could be combined such as with sandbars. But have also received input to add more metrics. **[Erik Stanfield, Navajo Nation]** Maybe prioritize them such as for the 20 fish metrics. This might imply that everything other than fish is of secondary importance. Could there be a more balanced assessment? Maybe that is part of the tribal metric. Natural processes are

probably larger representations of whole ecosystem health. **[Helen Fairley, GCMRC]** There are four fish-specific goals in LTEMP so that is why there are a lot of metrics on fish. **[Laura Dye, CRC]** Maybe the next TWG review can include ranking the top metrics or finding ways to combine metrics? **[Helen Fairley, GCMRC]** Will consider this. **[Clarence Fullard, Reclamation]** For next steps, the DOI bureaus will come to consensus on what has been developed. This is a big report with a lot of content so everyone should come prepared for that discussion at the next meeting. The metrics dashboard will provide a snapshot to quickly help members understand what is happening in the program. The dashboard will be placed on Reclamation's LTEMP website. Reclamation will seek TWG input when that is ready.

Informational Updates

- **Green Sunfish Status and Incentivized Harvest Program Implementation** **[Jeff Arnold, National Park Service – Glen Canyon National Recreation Area (NPS-GLCA]** NPS dewatered the upper slough twice last year. There were mechanical issues in April so went back in September to complete the dewatering, but it was very mucky. Was able to remove 150 green sunfish, which were quarantined and put in Lake Powell. The upper and lower slough was treated in September. Believe there has been complete removal. Fifty to eighty fish were caught in the first year of the Incentivized Harvest Program, then there was one angler last year who caught 270 brown trout. At the time, the award system for that one month was $70,000 with this person collecting $30,000. Total fish caught in January, February, and March were over 600, 700, and 800, respectively. NPS is rapidly running out of funding, so the reward system was changed to $33 per fish and $15 for each Passive Integrated Transponder (PIT) tag. It is hoped this will cover the program through the end of September.

Q&A and Discussion

[Craig Ellsworth, WAPA] Have you looked at brown trout modeling numbers to see if the Incentivized Harvest Program is having a population effect? **[Jeff Arnold, NPS-GLCA]** No, but Charles said there were 10,000 fish in the system last year and 2,000 to 4,000 have been removed in the past four months by the program.

[Jeff Arnold, NPS-GLCA] Lucas is going to look at the angler aspects and develop a questionnaire. After the award was lowered, the angler numbers decreased. **[Scott VanderKooi, GCMRC]** That was the intent of Margaret's work to evaluate the program's effectiveness. **[David Ward, GCMRC]** Mariah's trip is currently on the water. AZGFD will have updated data on rainbow and brown trout numbers soon to start evaluating that.

- **Paria Beach Restoration** **[Kelly Burke, Grand Canyon Wildlands Council (GCWC)]** showed before and after restoration images. Paria Beach is important to 11 indigenous tribes and the original stewards. Zuni traditional knowledge helped in placement of the burn debris parallel to water flow to increase sand deposition. Also found out from the state that there was not a water right to use that water for the plants. This was all dry land farming. Students from Paige High School were part of a learning lab that assisted in the planting and the spreading of native seeds. A second planting had to be done this year because of a delay in the timing of the burn so only 22 of 145 plants survived that first planting because it was so dry and hot.
- **Lees Ferry Herpetology Study** **[Jakob Maase, Hopi Tribe]** The Hopi Tribe has been working on a draft of this study to survey (catch and release only) of herpetology populations at Lees Ferry and create a model for the rest of the canyon. Might also do some DNA sampling but awaiting feedback from Hopi elders on that. Once the draft is finished, and funding options are addressed, will present this at the December meeting and start first survey in summer 2024.

Q&A and Discussion

[Helen Fairley, GCMRC] Have you considered surveying these restored areas from 20 years ago that have mature vegetation to compare herp species in restored versus unrestored areas? **[Jakob Maase, Hopi Tribe]** Maybe that could be worked in. Also want to involve youth. **[Kelly Burke, GCWC]** GCWC can offer resources at these sites. Can also assist with the youth and high school connections.

- **Possible Experimental and Management Actions in the Next 12 Months [Clarence Fullard, Reclamation]** The P&I team does not have the same membership as TWG and AMWG. Reclamation has promised to provide a webinar during the P&I process on what the team is considering. Spring HFEs are not triggered by sediment but by releases from high volume. The implementation window only lasts a few more weeks under the LTEMP protocol. The accounting window includes May and June, which must be included in the sand budget model. Sand inputs into the Paria were around 100,000 metric tons. Depending on the snow melt, another 200,000 to 500,000 more metric tons of sediment is now anticipated. The PI Team looked at sediment inputs on an annual basis to determine if exceptional conditions exist for an HFE.

Q&A and Discussion

Did the P&I team not come to consensus? How does this impact a fall HFE? **[Clarence Fullard, Reclamation]** The majority recommended an HFE while a minority abstained because of concerns about setting precedent to consider experiments outside of LTEMP as well as the timing to consider the supplemental information. It did not sound as if the ones who abstained had concerns about the resources. This has no effect on a fall HFE because it is a different accounting period. The clock resets on July 1. **[Seth Shanahan, SNWA]** SNWA was one of the agencies that abstained because we were not satisfied with the explanations for justifying the potential action and needed more time to get to that point. About half of the P&I team had to abstain because of the time crunch for working through these difficult issues. **[Ben Reeder, GCRG]** What is the difference between the process of consensus versus abstaining? **[Seth Shanahan, SNWA]** It is how this group might function for anyone who might abstain because they are saying they are not going to stand in the way of the remaining members. **[Ben Reeder, GCRG]** Clarence's explanation for the difference between the accounting period and the implementation window helps clarify the process in the FLAHG. **[Erik Stanfield, Navajo Nation]** What were the vote numbers? The tribal governments are not represented. In absence of this, the tribes expect the states to vote in our interest or at least consult. **[Seth Shanahan, SNWA]** Eight voted for the spring HFE and seven voted to abstain. **[Kathy Chandler, Reclamation]** The P&I process as defined in LTEMP generally takes two to three months. Getting to a decision in a month is spectacular. It was a huge effort.

[Craig Ellsworth, WAPA] WAPA requests that the P&I team, and the Leadership Team, reconsider making their votes more public. Would appreciate hearing their ideas. Not sharing that information seems disconnected in a program like this. **[Clarence Fullard, Reclamation]** Reclamation will bring this up for discussion next time the P&I team meets.

[Craig Ellsworth, WAPA] There are also concerns about so much sludge in the sloughs and whether the HFE will improve smallmouth bass and spawning habitat. Will anyone do surveys for that after the HFE? **[Jeff Arnold, NPS-GLCA]** NPS is probably not able to do that before the HFE. **[Clarence Fullard, Reclamation]** This was brought up in the P&I team. Smallmouth bass have probably already spawned. This would give them only marginal habitat. There are resource tradeoffs, and this might be one of them. **[Craig Ellsworth, WAPA]** WAPA has asked NPS and USGS to reconsider that especially when bypass was being discussed over the summer. Assessing what the HFE might do to smallmouth bass in the slough is an important factor. **[Scott VanderKooi, GCMRC]** GCMRC has thought about this. Spawning habitat

is not limited in the canyon. Scouring of the slough is not likely to change available habitat. GCMRC is well positioned to observe what is happening. **[Rob Billerbeck, NPS-GLCA]** NPS staff went out of their way to bring information forward on this effort. This HFE fits well with the intent of the Grand Canyon Protection Act to protect downstream resources. It also fits with the intent of LTEMP to have frequent HFEs to rebuild beaches. A lot of conditions occurred in the last two years that were not expected, which made this harder. There may have also been operations that increased erosion this summer. NPS is comfortable with the risks. **[Kelly Burke, GCWC]** This proposal highlights what has been learned from the first equalization flow, which was devastating to the beaches. The unexpected circumstances that happened this year and how quick the response was reflect well on the adaptive management process. **[David Ward, GCMRC]** One of the limiting things when these areas are clogged with vegetation is the ability for biologists to see trout spawning and scouring could help that.

Bugs Pay for Days of Steady Reservoir Releases to Reduce Costs to Hydropower Customers and Sustain Funds to Maintain Infrastructure

[David Rosenberg, Utah State University (USU)] a study to determine how hydropower revenues would be affected by higher flows. This is an operational model to provoke discussion. There was a lot of stress from people who had their data challenged. To reduce this conflict, the idea was to move days of steady flows from summer months to the spring and fall months. Another idea is to create an ecosystem fund for ecologists to decide the best month to do bug flows and then pay hydropower to do this. The model suggests lower lost hydropower revenue during the spring and fall months than during the summer months. Twelve different combinations were created. Next steps will include an update on the 2023 energy prices particularly for Saturdays, and to validate with the GT-Max model, which considers several other factors that were not included in this study. For more information go to: https://rosenberg.usu.edu.

Q&A and Discussion

[Shane Capron, WAPA] A number of statements need to be corrected such as "revenue," which means hydropower value. This is important because it affects the cost of buying hydropower. Typical costs for a bug flow for five days are $1-3 million. It would help if bug flows were moved away from the peak months to the shoulder months. **[David Rosenberg, USU]** It was not possible to get into all the details of costs versus revenues. This model was looking at revenues being driven by market prices. **[Shane Capron, WAPA]** Requests that revenue be changed to hydropower value to be more accurate. **[Shana Rapoport, CRBC]** Not seeing how the proposal would affect the scientific purpose of the experiment and how the bugs would be affected. Have you discussed this with Ted Kennedy? **[David Rosenberg, USU]** Yes, we did discuss it with him. There needs to be more discussion about the ecological benefits of moving the flows from summer to fall. A fund would allow the ecosystem managers to determine the best months to influence insect productivity. **[Helen Fairley, GCMRC]** Part of the reason to do these bug flows in summer was when they would be most productive and would affect the food base. It is important to understand the costs, but we also need to factor in the benefits. **[Bill Persons, FFI)/(TU)]** The whole purpose of bug flows was to enhance egg laying. That is the most important parameter in terms of timing. Was the timing part of the analysis? **[Laura Dye, CRC]** How would the ecosystem fund be funded? **[David Rosenberg, USU]** It would need to be funded by someone other than WAPA. The funds would not come from hydropower revenues. **[Erik Stanfield, Navajo Nation]** Was there any consideration of using the ecosystem services model to quantify some of the benefits? Natural capital accounting might be a way to fill out the model. **[David Rosenburg, USU]** Ted helped to describe the number of days of steady flows as a high-level metric of ecosystem function. This could be looked at further. **[Kelly Burke, GCWC]** Could there be a partnership to allow the funding to come to the agency from another source such as a conservancy or foundation? **[David Rosenberg, USU]** Getting more partnerships involved

would be a really good idea. **[Craig Ellsworth, WAPA]** WAPA has a system to develop a fund to pay for experiments. It puts the expense of the experiments back on the U.S. taxpayer. The Grand Canyon Protection Act specifically directs WAPA to do that to protect power customers so they are not held to the cost of these experiments. That has all worked because the Basin Fund has been relatively healthy. While WAPA has a joint stewardship with Reclamation, to make sure the Basin Fund stays healthy, it is what pays for the Colorado River Storage Project. There have been a lot of stressors on the Basin Fund the past few years, especially with big experiments such as the smallmouth bass bypass project. The Basin Fund has not been able to support that kind of impact. Historically, it has been able to absorb relatively small, $1-2 million projects and use the non-reimbursable ability to charge back to the Treasury so that taxpayers are not paying for it.

Public Comment

None heard.

Meeting adjourned at 4:43 PM PDT

Thursday, April 13, 2023

Start Time: 9:04 AM PDT
Conducting: Seth Shanahan, SNWA, and Daniel Picard, Reclamation
Meeting Recorder: Carliane Johnson, SeaJay Environmental LLC

Welcome and Administrative

- **Introductions and Determination of Quorum**: **[Seth Shanahan, SNWA]** A quorum was reached.
- **Unresolved Issues from Yesterday's Meeting:** **[Bill Stewart, Reclamation**] presented on the Draft Supplemental Environmental Impact Statement (SEIS) for Near-term Colorado River Operations, which was released on April 11 and was posted on the website. The Federal Register notice is expected to be published on April 14, which starts the 45-day comment period (through May 30). Scoping meetings will be held on May 4, 8, 10 and 16. The Final SEIS and ROD are expected this summer before the August 24-month study. Please provide comments.

Evaluation and Discussion of 2022 Nonnative Fish Detections and Response Activities

[David Ward, GCMRC] presentation on smallmouth bass depletion efforts. Over the last 10-12 years, probably half a dozen smallmouth bass have been caught in the Grand Canyon. Generally, these have been large adults that have been found right up next to the dam except for a couple in other places. No small fish or reproduction had been found until last year, which was alarming (~22 fish). Lees Ferry is phenomenal habitat for smallmouth bass. The only thing that was keeping the population from exploding was the water temperature. Very small early life history bass (20 millimeters [mm] range) were caught. At this size they are very hard to find because they hide. How much reproduction was going on needed to be determined. This can be determined by depletion sampling, which is done in multiple passes to determine effectiveness and distribution. High smallmouth bass numbers were found near the dam then the numbers decreased downstream. That could indicate either spawning is occurring right below the dam or there was entrainment of fish that then moved downstream. The sampling was done over 15 miles of river consisting of six trips as well as other monitoring trips. Altogether, a total of 345 smallmouth bass were caught. A pattern in the numbers caught could be related to water temperature (not moving down so catchability will decrease) or to the depletion effort (e.g., if catch probability was 10% and five passes were done, that would represent 50% of the population). Catchability was highly variable. The most

important piece was the size class. Other than two adults next to the dam, everything else was small (mean size 80 mm). Could not tell from the pattern if they came through the dam or were produced below the dam. Kate Vain, who works with Ted Kennedy, also did a diet analysis on a subset of the fish. The juvenile smallmouth bass are mostly eating Gammarus, which is a highly nutritious item and will allow them to grow quickly. Large numbers of green sunfish are also being caught, all very tiny and ten times as many as smallmouth bass. Also caught large numbers of bluegill, a lake species that don't spawn in rivers, which suggests entrainment. All these non-natives have impacts. There is also a large population of brown trout, which are highly piscivorous. The smallmouth bass at this size is a great snack for brown trout. That is probably keeping the population in check.

Q&A and Discussion

[Larry Stevens, GCWC] Was the sampling over the whole reach? **[David Ward, GCMRC]** No, only short sections were done. The idea is to only do passes when the fish are behaving normally. **[Seth Shanahan, SNWA]** How does catchability change with temperature? **[David Ward, GCMRC]** Don't know that. The fish probably hunker down as the temperature decreases. Had set up an experiment with different temperatures and electrofishing, but the data were all over the board. The pattern is subtle and there were not enough replicates. The temperature effect is probably masked by a myriad of things. Also did a lab experiment using a small box, and in no case were all the fish caught. **[Seth Shanahan, SNWA]** What do we know about growth rates in the literature to infer size? **[David Ward, GCMRC]** The first juvenile smallmouth bass was caught June 30. They typically spawn in the spring. Under ideal conditions there might be a fish of 80 mm in the first year, but some biologists don't think this could happen. Temperatures were still suboptimal in May and June for 2021 and 2022.

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[Skyler Hedden, AZGFD] showed data collected between the dam and Lees Ferry, which is the best area related to tailwater monitoring. It has been extensively monitored with a long history. Standardized sampling was done in March, July, and October, which shows the number of warmwater fish caught over time. In March 2022, there were only two warmwater nonnatives caught. The nonnatives started to increase in July closer to the dam, then there was an explosion of fish right near the dam in October. The data suggests entrainment. So far in 2023, very low numbers were captured at -12 Mile Slough. The long-term dataset goes back 30 years. Nonnatives still represent a relatively small number compared to natives, but it is very early in the invasion. Lees Ferry data is similar with most nonnatives near Pearce Ferry close to Lake Mead. In April 2023, no smallmouth bass were caught and only one green sunfish.

[Jeff Arnold, NPS-GLCA] A lot of carp, green sunfish, and flannelmouth suckers are caught in the lower slough. Discussed the chemical treatment in the upper and lower slough. Did one night of electrofishing before the treatment but no large fish were caught. The chemical treatment involved many agencies (Reclamation, NPS, USGS, AZGFD, WAPA, etc.) and treated with the maximum amount because there was a lot of organic matter, which absorbs a lot of the rotenone. Only caught one smallmouth bass in the lower slough. Results: 3,211 small carp and 1 adult carp, about 500 green sunfish, two bluegill, and 4 rainbow trout. There was a low DO event before the treatment, which was causing a lot of fish to die. Some had probably been dead for several days before treatment. Some rainbow trout were caught outside of the slough. A turbidity curtain was installed to keep rotenone from moving out of the slough. However, the curtain failed after one treatment because of a drop in river elevation of about 2 inches. The curtain was reinstalled that night and then potassium manganate was applied to detox the river.

Q&A and Discussion

Potential Glen Canyon Dam Operational Modifications to Address Smallmouth Bass Establishment

[Wayne Pullan, Reclamation and Acting Secretary's Designee] There had been questions about operations for the remainder of 2023 because this wet water year was not expected and that gives us flexibility. Because of this, Reclamation will need to do a balancing with the 24-month study. That will be announced on April 18. That will include the 7 maf already planned to be moved as well as deliveries that were held back early in the year that will be released later this year. There is an agreement to release 480,000 af of lower basin water that was held in Lake Powell, that was part of the balancing amount; it will be combined but not in addition to the balancing. Can Reclamation deliver all the water that needs to be delivered this summer, plus a balancing amount of 500,000 af that was held back? It is believed to be possible without using the bypass tubes. As part of that release, Reclamation plans to do an HFE as a one-time combination spring HFE and a proactive-like HFE. The memo to operationalize the HFE is being reviewed now and will be released soon.

Smallmouth Bass EA

[Wayne Pullan, Reclamation] Last August, Reclamation knew it would be difficult to get through the National Environmental Policy Act (NEPA) in time to disadvantage smallmouth bass. Received 7,000 public comments. With that level of controversy and the potential impacts of smallmouth bass flows, Reclamation was not able to issue a Finding of No Significant Impact (FONSI). The other thing considered is that smallmouth bass in the river last year were all Young-of-the-year and were not going to be mature and reproducing until another 3-4 years. Taking actions to avoid propagation when that is not possible is not justified. Experts from GCMRC and elsewhere were asked whether there were smaller actions that could be taken to reduce the smallmouth bass population, disadvantage them, or reveal other information for the future. None of the shorter, small-term efforts were deemed to be sufficient. Reclamation is unlikely to sign off on a FONSI under the smallmouth bass EA. Preference is to morph that into an EIS effort with the goal to have a ROD by May 2024. In the meantime, the plan is to continue with monitoring this summer and if there are changes to the population, could still take some action. Whatever may be done is likely to have a significant impact on hydropower revenues, which affects Reclamation's funding of operations and maintenance work. With the changing power conditions under lower water elevations and the potential to use bypass to disadvantage smallmouth bass means there needs to be a new approach to power. The power interests need robust alternatives to avoid impacts that smallmouth bass may require. It would be good for Reclamation, WAPA, and CREDA to look at energy alternatives that have not been considered before.

Q&A and Discussion

[Craig Ellsworth, WAPA] Would other alternatives beyond what was included in the EA be considered in the EIS? **[Wayne Pullan, Reclamation]** This is the time to consider any alternatives to assess potential effects. **[Seth Shanahan, SNWA]** Include a net or other deterrent device in the list of potential actions. **[Laura Dye, CRC]** Agrees with this, too. **[Ben Reeder, GCRG]** Would turbines in the bypass count as a deterrent? **[Wayne Pullan, Reclamation]** If energy could be generated from the bypass that could reduce the impacts on Lake Powell. Maybe a lower elevation intake to ensure release of colder water. Reclamation has looked at a range of options. The best one is also the costliest. Some options are concerning but would not cost nearly as much. That effort is moving ahead. **[Seth Shanahan, SNWA]** Some of those ideas should consider lost power generation. Would those procedures to get to an answer be a much longer timeframe? **[Wayne Pullan, Reclamation]** Don't want to presume the answers, but the whole Colorado River system relies on generating and marketing power. To change that is a huge lift. It may require Congressional support.

[Larry Stevens, GCWC] Wil there be a synopsis of the 7,000 comments and the timeframe? **[Kathy Callister, Reclamation]** That is being developed. Will see about making that available. Reclamation will have to do a Notice of Intent to prepare the EIS and would like to incorporate those comments into the scoping process, so people don't have to resubmit them. **[Seth Shanahan, SNWA]** Maybe some of the assessments that could be considered might be shorter periods of bypass, different temperature triggers, different locations, and lengths?

Discussion of 2023 Nonnative Fish Detections, Monitoring Activities, Potential Response Capacity Building Needs, and Other Nonnative Fish Planning Topics

[Clarence Fullard, Reclamation] Fish exclusion project update. Reclamation is looking at a forebay barrier. The process included a subject matter expert panel that had looked at all the options, The barrier makes the most sense. The panel and Reclamation engineering team will visit Glen Canyon Dam on April 26. Still many issues to resolve such as how does this get mounted to canyon walls? What kind of biofouling might occur with quagga mussels. Reclamation will then work up a 30% design on a net and thermal curtain concept. This will allow for managing the cold water while reducing fish passage and entrainment. A thermal curtain also has less surface area than a net so it will reduce biofouling. Reclamation has also identified partners for Department of Energy funding that will help with the hydrodynamic modeling of the thermal curtain and what temperatures might be achieved. Still working on the funding aspect because the GCDAMP cannot support it.

Q&A and Discussion

[Shana Rapoport, CRBC] What is the installation timeline? **[Clarence Fullard, Reclamation]** Planning for 2024 but there is no design in place yet. It is a big infrastructure project. It will take a lot of time to consider how to seal the edges, how to keep it buoyant, reduce biofouling, the dam safe aspects, etc. No timeline on the installation date, but everyone knows it is needed as soon as possible. Maybe 2025 is more realistic. **[Shana Rapoport, CRBC]** When the Smallmouth Bass Ad Hoc Group (SBAHG) was looking into options, it came up with material to deploy to measure biofouling. Should that occur sooner rather than later? **[Clarence Fullard, Reclamation]** That was discussed for this spring. Had hoped to get some leftover netting from a reservoir in Colorado. Had gotten permission to do a pilot study but was not able to get the material to put that in this spring. Reclamation is also consulting with its invasive mussels lab in Denver. **[Seth Shanahan, SNWA]** If it is like Lake Mead, there is a lot of understanding about other materials and colonization rates. This could be available for Lake Powell. **[Ben Reeder, GCRG]** Are there other reservoirs that have these systems in place? **[Clarence Fullard, Reclamation]** Yes, there are. There is a large net in Northern Lake Michigan that manages the mussels by power washing the net each year. There is a lot that can be learned from to choose the best one. **[David Ward, GCMRC]** There had been an idea such as a pressure canyon to kill fish. Is that still being considered? **[Clarence Fullard, Reclamation]** The panel considered it but don't recall the assessment. The panel moved passed it because of the timing and needing to have proven technology, which were two of the criteria they wanted to focus their energy.

[Seth Shanahan, SNWA] What is the cost estimate for the installation? **[Clarence Fullard, Reclamation]** It is hard to say. Reclamation has a construction feasibility timeline and can't really determine costs until the 30% design. The initial estimate is about $15-20 million. A lot of the cost is in ensuring a tight seal along the canyon wall. We know that 90% of the fish are along the walls. That is the hardest part and most expensive to engineer, but it is not insurmountable. **[Seth Shanahan, SNWA]** Does the net need to be close or is there a combination of technologies that would work along the edges? **[Clarence Fullard, Reclamation]** It cannot just be a net along the wall. If the water elevation goes up, the net needs to do that, too. One idea is to scribe a rail system onto the wall from which the entire

assembly can rise and fall. One other thing has been uncertainty about where the fish are coming from – entrainment or spawning down river. Management needs to know where these fish are coming from. Reclamation is working on a study to determine that. Did a sensor fish deployment to measure pressures through the dam. Next steps include ideas on a study to: 1) monitor with acoustic cameras, and 2) place a sock at the end of the dam to filter out whatever comes through. **[Seth Shanahan, SNWA]** Are the socks more permanent? **[Clarence Fullard, Reclamation]** The sock would not be permanent. This is more an idea of sampling. It has been done at Shasta, or maybe Blue Mesa, in the past. **[Kelly Burke, GCWC]** If the installation moves up and down would that impact quagga mussels? **[Clarence Fullard, Reclamation]** Probably. Anything that goes in the water is going to biofoul.

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[Barret Friesen, Utah State University (USU)] In 2022, sampling was only done outside the chains where the public is limited at the dam. The 2023 sampling will be done inside the chains next to the dam where there is shallow habitat. This will include larval traps, minnow traps, and gill nets. In March 2023, caught green sunfish and bluegill but no smallmouth bass, which were not expected this time of year. A sensor fish that measures pressure and acceleration was also deployed 21 times to assess possible effects through the turbines. There is a dramatic drop in pressure and high acceleration as it exits the turbine lasting about one second. No evidence of turbine strikes.

Q&A and Discussion

[Mike Horn, Reclamation] If the reservoir level is deeper is that more likely to cause higher mortality? **[Barrett Friesen, USU]** That would be the main point with higher effects from higher water level. Could likely guarantee gas bladder rupture. **[Seth Shanahan, SNWA]** What is known about rupture values in smallmouth bass? Is there something in the literature? Is there a lab component to measure this? **[Barrett Friesen, USU]** There is 2 to 2.5 expansion in salmonid, and 4 times is the most liberal value found (maybe from bass). This is all preliminary. Still digging through the data and existing literature but there is not much other than from salmonids. **[Clarence Fullard, Reclamation]** Reclamation has facilities to measure this if there is interest in doing this in the future. Was there grey literature found on centrarchids? **[Barret Friesen, USU]** No, but there is a paper on smallmouth bass and angling effects, which is still relevant. Not much has been found. **[Craig Ellsworth, WAPA]** Is gas bladder rupture always fatal? **[Barret Friesen, USU]** Probably not, but there could be significant hemorrhaging if it explodes. **[David Ward, GCMRC]** A swim bladder is mostly an impermeable membrane, like a balloon. The same thing can happen in a fish. It can expand beyond normal, and the gas will seep out. Whether it ruptures or not, there could be damage, but the fish can recover if it is not too severe. Some tremendous pressure changes do not mean that they can't be OK. Any angler knows striped bass at depth will die while other bass species will be fine. Different species have different tolerances. **[Scott VanderKooi, GCMRC]** This will also affect behavior of fish through their buoyancy control. Exothelium means the eyes bug out. It might not kill the fish but might make it more difficult to survive. **[David Ward, GCMRC]** Several large, dead catfish were seen up there last fall that probably happened because of ruptured swim bladders. Size of the fish probably matters, too. **[Barret Friesen, USU]** Even if 100 fish survive, that could still be a problem. **[Dan Leavitt, USFWS]** At 84% mortality, that is still 16% entrainment. Can you describe the habitat near the dam to the penstock where those fish were caught? How would fish be prevented from going there? **[Barret Friesen, USU]** It is steeply sloping so there is not much warm water habitat, and it is quite close to the dam. If smallmouth bass are spawning where the bluegill and green sunfish are, it's reasonable to assume the YOY and juveniles can become entrained. **[Melissa Trammel, NPS]** There is variable survivability but if an average of 25% fish means there is plenty of that will survive for the downstream population. **[Scott VanderKooi, GCMRC]** Have also observed a lot of new nonnatives coming through

with lower reservoir levels that had not been seen before. **[David Ward, GCMRC]** From the recent trip, Josh Korman said there was a largemouth bass caught right near the dam. Those fish are coming through. **[Skyler Hedden, AZGFD]** Keep in mind that the dam is allowing 75% removal when electrofishing is not 50% of removal. **[Seth Shanahan, SNWA]** The findings suggest spawning is happening close to the dam walls. Could some habitat disturbance be done there? **[Clarence Fullard, Reclamation]** The thermal curtain is only going to block fish up to a point. At the shallow water habitat (the old cement plant), which is under water with higher lake elevations, the curtain will change thermal conditions to make it too cold to spawn. There has been talk about disturbing the habitat but there is not a lot of it. It is steep canyon walls except for that one area.

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[Mike Horn, Reclamation] a study that was designed to complement Barrett's. This one looked at overall fish numbers and where they are in the water column. A transect typically zig-zags across the site with the acoustic monitoring device but it can't go all the way down to the dam. Similar pattern is done at the confluence and at Wahweap. There were a lot of small (4-6-inch) individual fish seen in the forebay during last year's sampling in March. In March this year, there was absolutely nothing in the water column except for one larger fish (12-15 inches) in the middle. It is not known whether this was from water temperature or hit the wrong week, or it was a bad year for fish. The same was seen at other sampling locations. When looking at individual fish seen in the 2022 survey, most of them were spread across the water column. This year, a few were spread across the water but almost all targets were along the canyon walls. Fish densities were highest at the confluence in 2022 while they were overall very low at all three areas in 2023. Higher numbers occur in Wahweap primarily because it is a nursery area, which is good for small fish. In the confluence and the forebay, densities increase as fish get larger and because of seasonal movements. By August, start seeing water quality problems with lower D.O. and higher temperatures in the upper 10 feet of the water column, which may cause larger fish to start moving away. October water quality is better when they are probably starting to be detected again.

[Andrew Shultz, GCMRC] Were releases similar during the two March periods? **[Mike Horn, Reclamation]** Don't think so. Maybe it had to do with temperature differences. Shad don't like cooler temperatures. **[Barret Friesen, USU]** It was cooler this year than last year. **[Mike Horn, Reclamation]** Shad also go through huge boom and bust cycles so this could have just been a bust year.

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[Emily Omana-Smith, NPS-GRCA] Provided a table of detections reported in 2023 so far. All cooperators can now upload captures to a SharePoint site for nonnative detections. To date, all nonnatives have been in Glen Canyon because downstream monitoring is starting soon. The presentation shows early detection sampling done for high-risk invasive fishes in Grand Canyon National Park this year. Potential hotspots have been identified from the strategic plan and will also be sampling in backwaters and tributaries. A rapid response will happen if smallmouth bass are detected; however, funding is not currently available. Also added a sampling trip from Lees Ferry to Diamond Creek, which will occur in June, and will include backwaters and hotspots from the strategic plan. This has been funded by Grand Canyon Conservancy, which funded two sport boats that are fully outfitted for electrofishing and will be used for the first time during the HFE. Other monitoring trips based on the strategic plan will occur on Bright Angel and Havasu Creek to augment the surveillance sampling. NPS is getting prepared to meet its compliance requirements if a rapid response is needed. Any fish removed will be put to beneficial use. NPS continues to seek funding and has also developed a flyer to commercial river operators. This is so important because 90% of the humpback chub are in the Grand Canyon.

[Betsy Morgan, Utah Division of Water Resources (Utah DWR)] Are there any updates on grass carp? **[Clarence Fullard, Reclamation]** No information. Utah Department of Natural Resources manages that in Lake Powell. **[Seth Shanahan, SNWA]** Can the sport boats go all the way downstream? **[Betsy Morgan, Utah DWR]** They were designed to do it all, similar to the GCMRC sport boats. **[Larry Stevens, GCWC]** In the sampling from the Paria River to Badger, is sampling also being done at the mouth of the Paria? It is unique habitat and will expand to a large pool during the HFE. **[Emily Omana, NPS-GRCA]** Yes, the plan is to sample there depending on safety. **[Kelly Burke, GCWC]** What is the status of the helicopter analysis for a rapid response? Is there an opportunity to put out another article for all river guides?

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[Jeff Arnold, NPS-GLCA] Presentation on the Glen Canyon 2023 monitoring and rapid response at Lees Ferry. This year, NPS has a boat and 10 technicians to do the work. First thing is a pre- and post-HFE electrofishing trip using two boats on each side of the river around Honey Draw to the dam where most smallmouth bass were found last year. Will be doing more intensive sampling every two weeks, dividing the river into five segments (each about 5.2 miles). NPS is coordinating all work with GCMRC and AZDFG to make sure there is no overlap.

Q&A and Discussion

[Seth Shanahan, SNWA] Part of the Steering Committee Ad Hoc Group's (SCAHG) role is to help facilitate information sharing. If something happens and a rapid response needs to be stood up, please rely on the SCAHG to get that information out. **[Jeff Arnold, NPS-GLCA]** Also talking with Emily about meeting every two weeks to get updates if anything is found. **[Bud Fazio, NPS-GLCA]** It is a large workload and NPS needs all the support it can get. Some portions of Emily's and Jeff's work have funding, but other portions do not. Once the charter is finalized, NPS will talk with Reclamation and others on how to be prepared for rapid response effort and how to address invasives into the summer. **[Bill Persons, FFI/TU]** What is the size of the gill netting proposed, and is that size sufficient to not get any trout? **[Jeff Arnold, NPS-GLCA]** Thinks the net is .75 inches up to 2 inches so it would catch trout. Would like to put these near the dam but have not given it much thought yet. Definitely don't want to have trout by-catch. **[Bill Persons, FFI/TU]** How would mortality be avoided? Trout would not survive overnight. With AZGFD and NPS both doing electrofishing. How will this not create impacts on the trout population? If AZGFD and NPS are both sampling, it seems this would cover the entire river. This is an area of concern by the trout fishermen. **[Jeff Arnold, NPS-GLCA]** The intent is to mainly sample the hotspots but don't know how extensive they are because they have not been visited yet. An entire reach would not be electrofished over an entire summer. **[Craig Ellsworth, WAPA]** In the modeling data, is there a layer on substrate to be able to home in on possible spawning areas? **[Jeff Arnold, NPS-GLCA]** There is not. During the surveys, will get more information on these sites to see if there is suitable substrate for smallmouth bass. Can update the model if there is not. **[Erik Stanfield, Navajo Nation]** Heard earlier that electrofishing is not always effective for eradication but now hearing a lot of electrofising activities for this year. How is NPS balancing the costs, and the ethical and cultural concerns? It seems there is some conflict between what is known and what is happening. **[Jeff Arnold, NPS-GLCA]** There is no way to eradicate smallmouth bass. Electrofishing is one of the best tools to be able to remove (but not eradicate) smallmouth bass. Netting is not as effective but can capture the small smallmouth along the shoreline. NPS needs to know what is going on to be able to respond. **[Skyler Hedden, AZGFD]** That is a concern for AZGFD, as well, but don't really know what the term "rapid response" means. Everyone should understand what it is, and that quality data is collected to know what is going on. **[Seth Shanahan, SNWA]** Wayne said that the smallmouth bass EA will not be an option this

year. Clarence has also talked about longer term plans with other devices that are not available this year. With the strategic plan, some of the better tools to use are probably not available right now. Maybe we need to look at the remaining tools as a timing response to get through this year to push back on the invasion curve. Maybe that is not satisfying, but it needs to be done in a smart way to learn as much as possible. **[Josh Korman, Ecometric]** There has been strong rainbow trout recruitment in the past with HFEs and equalization flows of 20,000 cubic feet per second (cfs). That is good for the fishery, which is below the target for angling catch rates. Have also seen these big water years lead to downstream dispersal. We seem to be ignoring this past data with rainbow trout. It looks as if the conditions this year might create a large cohort of trout through the canyon and into the Little Colorado River. **[Seth Shanahan, SNWA]** One correction is that this is either a balancing flow or an "equalization-type" flow. **[Dan Leavitt, USFWS]** Not hearing much talk today about humpback chub, which is surprising, because smallmouth bass and other warmwater nonnatives are the largest threat to this federally listed species in the Grand Canyon. This perspective is needed. Ninety percent occur within the Grand Canyon. Humpback chub struggle to occur alongside predatory nonnative predators. They are struggling to survive in those conditions. If smallmouth bass become established, it may be impossible to eradicate them. If monitoring to determine smallmouth bass abundance and occurrence in the Grand Canyon is not done and we are poised for a response, then we are not doing our due diligence to address the problem.

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[Skyler Hedden, AZGFD] Presentation to continue monitoring that has been going on for past 20 years. Will be able to track detections. What is the rapid response plan? AZGFD understands the risks and concerns, but it did not have a solid plan last year. The response plan needs to benefit humpback chub. **[Craig Ellsworth, WAPA]** Regarding the tools available this year, rotenone and electrofishing need to be assessed if they are effective and if there are other tools that could be used. The last time there was this situation was in 2011 when trout were impacting chub. That was when the trout management flows (TMF) were developed under LTEMP. Are there similar tools like TMF that might work for smallmouth bass? What have we learned in the past that can be applied now? Maybe habitat, like the slough, can be altered or removed? **[Seth Shanahan, SNWA]** Reclamation was looking at physical modification of the slough. Is there a follow up? **[Clarence Fullard, Reclamation]** Kerry Pedersen can update the group on this. There are some short-term options. Don't know the status of this on the Glen Canyon National Recreational Area because it requires modifying their lands. **[Bud Fazio, NPS-GLCA]** That describes where GLCA is right now. There are other shallow waters near the dam that need to be better understood. NPS is interested in hearing recommendations about these areas and the slough. It is time to come together to determine what can be done in 2023. The sooner these tools can be identified and how they can be applied, the better.

[Seth Shanahan, SNWA] Is there a need for more frequent meetings among state and federal management agencies? That seems to be needed to help generate these ideas on a rapid response. **[Emily Omana-Smith, NPS]** Bimonthly calls were done in the past, but there had been a break. It might be necessary to meet more frequently. NPS is going to restart these bimonthly calls to share information. If you would like to be added to the call list, please contact Emily. **[David Ward, GCMRC]** These meetings would be held every two weeks, which will help. **[Scott VanderKooi, GCMRC]** GCMRC has evaluated the effects of trout and other factors like temperature and turbidity on humpback chub at the Little Colorado River confluence. This is the factsheet. The study looked at humpback chub abundance versus rainbow trout density and when it makes sense to do cost-effective removals. A lot of this work has been done and it is something that can be considered for other predators. The relationship will be different for smallmouth bass, but it can be developed to help make informed decisions.

Discussion of Budget and Work Plan Adjustments

[Bill Stewart, Reclamation] showed a table on the Reclamation Budget. During the AMWG meeting, the discussion was to move forward on budget workplan in Fiscal Year 2024 (FY24) by carrying over the funding amount from FY23. Many of the line items are management related and will seamlessly carry over for FY24. For Project D, cultural resources, Reclamation is planning to increase the Tribal Participation funds for FY24. By FY25, that project should have a steady amount of funding for that.

Q&A and Discussion

[Shana Rapoport, CRBC] Is the BAHG going to be involved and what are the timelines? **[Bill Stewart, Reclamation]** Yes, the intent was to have Reclamation take the first stab and the BAHG will be more involved in the GCMRC side. **[Seth Shanahan, SNWA]** What will be the role of BAHG this year? It is currently waiting on further direction. **[Bill Stewart, Reclamation]** The federal agencies need more discussion on that. **[Craig Ellsworth, WAPA]** What is the final timeline for TWG to take that up? **[Seth Shanahan, SNWA]** The next meeting in June. **[Bill Stewart, Reclamation]** There might not be many changes for FY23, or they would be minor. **[Shana Rapoport, CRBC]** The BAHG just needs adequate time to review if it is being asked to weigh in on something. **[Craig Ellsworth, WAPA]** There might not be big changes in the budget, but there are big changes on the river with the HFE and then balancing flows. That could be a big change for GCDAMP. Are the projects in place and are they suitable to answer those questions? **[Ben Reeder, GCRG]** It might be worth scheduling a BAHG call right after the AMWG. **[Seth Shanahan, SNWA]** The realities on the river have changed and there are only two months to provide input. How can TWG be helpful to the agencies? **[Craig Ellsworth, WAPA]** The BAHG should also have a discussion about this. **[Shana Rapoport, CRBC]** This year is not expected to be a normal process and that things will work differently. The BAHG needs to understand what that will look like.

[Scott VanderKooi, GCMRC] showed a table with the plan to move forward in FY23, as it was proposed with some small tweaks. One is related to river trip activities if an HFE occurs, which would be requested from the Experimental Fund. That is moving forward. Other changes are more complicated. A potential new facility has been canceled, which had projected higher overhead rates. Those lease costs will now remain low into FY24. On the other side, logistics and salaries are more expensive. There was also a recommendation about priority projects in FY23, if funds are available. (e.g., juvenile chub monitoring in Western Canyon, continue trout monitoring at full scale, riparian vegetation monitoring, and a couple other things). These probably need to be discussed to ensure the perspectives have not changed.

Q&A and Discussion

[Larry Stevens, GCWC] This is the first time since 2008 that the rate of decay of beaches can be assessed after an event, and it's among the largest with this level of sediment. Many things need to be looked at including vegetation, fish movements, spawning runs, and other questions. The Adopt-A-Beach program trip is also just finishing. **[Scott VanderKooi, GCMRC]** There is monitoring in place to look at the progression of these events during high flows. On fish movement, there are many PIT-tagged fish with many of the antennas having been replaced with newer systems. This is essentially a 4 -to 5-month-long bug flow. GCMRC is in a much better position to monitor. We should discuss the need to prepare a synthesis report of this work. **[Seth Shanahan, SNWA]** How steady will the high flows be from May through September? **[Shane Capron, WAPA]** It would be maximum power plant production if the flow is 9.5 maf, which means there won't be fluctuations from regulations, and it will remain steady. If it is at 9 maf or below, there would be a little room for fluctuations, but that is where we can discuss what to do for

summer flows that might fit in with hydropower value and with learning under an experiment of some kind. Either way, there won't be much fluctuation. Might be able to consider modifications if the flows to learn from the flows and energy production. **[Craig Ellsworth, WAPA]** Those steady flows are what is released from the dam. They will fluctuate going down the canyon with additional flow from the tributaries. It might be 8,000 cfs in the Little Colorado River during monsoons. **[Scott VanderKooi, GCMRC]** Those influxes look quite different than hydropower operations. **[Seth Shanahan, SNWA]** Does this mean that daily fluctuations might not be expected during the winter but there might be some spikes during the summer? **[Scott VanderKooi, GCMRC]** That can happen. It is not often there would be 7,000 to 8,000 cfs in the Little Colorado River. **[Josh Korman, Ecometric]** There are two conflicting issues with respect to bug flows and trout recruitment. One is that it may be very difficult to decide which of the two flows (HFE and balancing) caused the effect. Secondly, because the water is higher in Lees Ferry, it will inundate dry areas that have grasses, and that will improve more bug production and trout production. It may be difficult to separate out these effects this summer. **[Seth Shanahan, SNWA]** This group has high expectations, but it might be a tough year to figure out some of these things.

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

[Ben Reeder, GCRG] It would be good to hear from David Topping or Paul Grams on a potential spring HFE. **[Larry Stevens, GCWC]** There has not been a bridge from riparian zone to habitat, which is a fundamental question for management actions that might be affecting habitat. It might be useful to think about that relationship. Another topic is flotsam. High flows have been linked to transporting invertebrates and floating wood is very rich in the eddies. It might be worth exploring how to model flotsam, which could be a citizen science program to track floating wood. **[Scott VanderKooi, GCMRC]** What is the habitat for? **[Larry Stevens, GCWC]** Different things can use vegetation to create nesting structure and open space for shorebirds. It might involve taking the dominant guilds and understanding what their needs are. **[Scott VanderKooi, GCMRC]** A lot of work has been done in the Northwest about marking wood. **[Jakob Maase, Hopi Tribe]** Reclamation and the tribes have had cultural sensitivity training on the back burner for a while. What does Reclamation envision on that such as workshops or videos? **[Larry Stevens, GCWC]** Interested in hearing more about the Hopi vegetation monitoring and the status of amphibians. **[Seth Shanahan, SNWA]** Other items include D.O., smallmouth bass response, rainbow trout and brown trout response and status update, humpback chub recovery plan update, and budget items. **[Dan Leavitt, USFWS]** The humpback chub recovery team has only had three meetings so far so won't have any updates other than the timeline. **[Seth Shanahan, SNWA]** The June 14-15 meeting will be held in Flagstaff at the USGS facility and then there will be an optional third day (on Friday, June 16) in Paige for some field-based activity. Thursday night would be on members' own cost and would not be part of the TWG meeting. October would be a webinar only, which is why this is proposed for the June meeting.

Public Comment

None heard.

Meeting adjourned at 4:31 PM PDT

TWG Members, Alternates, and Leadership

Cliff Barrett (UMPA)
Rob Billerbeck (NPS-GLCA)
Daniel Bulletts (Southern Paiute Consortium)
Kelly Burke (GCWC)
Shane Capron (WAPA)
Colleen Cunningham (NMISC)
William (Bill) Davis (CREDA)
Kurt Dongoske (Pueblo of Zuni)
Laura Dye (CRCN)
Sinjin Eberle (American Rivers)
Craig Ellsworth (WAPA)
Buddy Fazio (NPS)
Mel Fegler (State of Wyoming)
Charlie Ferrantelli (State of Wyoming)
Clarence Fullard (Vice Chair and Reclamation)
Emily Higuera (ADWR)
Rudy Keedah (BIA)
Sara Larsen (Upper Colorado River Commission)
Dan Leavitt (USFWS)
Jakob Maase (Hopi Tribe)
Scott McGettigan (State of Utah)
Betsy Morgan (Utah DWR)
Christina Noftsker (State of New Mexico)
Emily Omana Smith (NPS-GRCA)
William "Bill" Persons (FFI/TU)
Ted Rampton (CREDA)
Shana Rapoport (CRBC)
Ben Reeder (GCRG)
Seth Shanahan (SNWA)
Erik Skeie (State of Colorado)

USGS

Lucas Bair
Drew Eppehimer
Helen Fairley
Andrew Schultz
Scott VanderKooi
David Ward
Charles Yackulic
Bryce Mihalevich

Reclamation

Tara Ashby
Amee Andreason
Becki Bryant
Kathy Callister
Jenny Erickson
Mike Horn
Dave Isleman
Riley Martin
Zachary Nelson
Heather Patno
Jamescita Peshlakai
Daniel Picard
Robert Radtke
Ernie Rheaume
Dave Speas
Bill Stewart
Alex Walker

Other GCDAMP Members and Interested Persons

Jeff Arnold (NPS)
Rob Billerbeck (NPS)
Kevin Bulletts (Southern Paiute Consortium)
Julie Carter (AZGFD)
Barrett Friesen (Utah State University)
Fryer (WAPA)
Alicyn Gitlin (Sierra Club)
Emily Halvorsen (State of Colorado)
Gerry Nealon
Jess Newton (UWFWS)
Daniel Picard (Acting Designated Federal Officer, Reclamation)
Michael Pillow (USFWS)
Sara Price (CRCN)
Wayne Pullan (Acting Secretary's Designee, Reclamation)
Shana Rapoport (CRBC)
Drheinheimer (CRBC)

Skyler Hedden (AZGFD)
Carliane Johnson (SeaJay Environmental)
John Jordan (FFI/TU)
Christina Kalavritinos
Hunter Kennedy (University of Chicago)
Josh Korman (Ecometric Research)
Kevin McAbee (USFWS)
Scott McGettigan (State of Utah)
Beccie Mendenhall (SeaJay Environmental)
Peggy Roefer (CRCN)
Dave Rosenberg (USU)
Elyssa Shalla (NPS)
Jim Strogen (FFI/TU)
Melissa Trammell (NPS)
Arturo Vale (USFWS)
Edward Wemytewa (Pueblo of Zuni)
Heather Whitlaw (USFWS)
Pilar Wolters-Rinker (USFWS)

Acronyms

ºC – degrees Celsius
af – acre-feet
AMWG – Adaptive Management Work Group
ADWR – Arizona Department of Water Resources
AHAHG – Administrative History Ad Hoc Group
AZGFD – Arizona Game and Fish Department
BAHG – Budget Ad Hoc Group
cfs – cubic feet per second
CRBC – Colorado River Board of California
CRC – Colorado River Commission of Nevada
CREDA – Colorado River Energy Distributors Association
CWCB – Colorado Water Conservation Board
D.O. – dissolved oxygen
DOI – Department of the Interior
DROA – Drought Response Operations Agreement
DWR – Department of Water Resources
EA – environmental assessment
FLAHG – Flow Ad Hoc Group
FFI – Fly Fishers International
FONSI – Finding of No Significant Impact
FY – Fiscal Year
GCDAMP – Glen Canyon Dam Adaptive Management Program
GCMRC – Grand Canyon Monitoring & Research Center
GCRG – Grand Canyon River Guides
GCWC—Grand Canyon Wildlands Council
HFE – High Flow Experiment
LTEMP – Long-Term Experimental and Management Plan
mg/l – milligrams per liter
maf – million acre-feet
mm – millimeters
NEPA – National Environmental Policy Act
NMISC – NM Interstate Stream Commission
NPS – National Park Service
NPS-GLCA – Glen Canyon National Recreation Area
NPS-GRCA – Grand Canyon National Park
PDT – Pacific Daylight Time
P&I Team – Planning and Implementation Team
PIT – Passive Integrated Transponder
PA – Programmatic Agreement
Reclamation – Bureau of Reclamation
ROD - Record of Decision
SBAHG – Smallmouth Bass Ad Hoc Group
SCAHG – Steering Committee Ad Hoc Group
SEIS – supplemental environmental impact statement
SNARRC – Southwest Native Aquatic Resource and Recovery Center
SNWA – Southern Nevada Water Authority
TMF – Trout Management Flows
TU – Trout Unlimited
TWG – GCDAMP Technical Work Group
TWP – Triennial Work Plan
USFWS – United States Fish & Wildlife Service
USGS – United States Geological Survey
USU – Utah State University
WAPA – Western Area Power Administration