Glen Canyon Dam Technical Work Group Meeting
June 11-12, 2019

Date: June 11, 2019 **Start Time**: 9:30 am
Conducting: Seth Shanahan, TWG Chair
Meeting Recorder: Rosana Nesheim
Attendees:

Committee Members/Alternates Present

Melinda Arviso-Ciocco, Navajo Nation
Jan Balsom, NPS, GCNP
Clifford Barrett, UAMPS
Peter Bungart, Hualapai Tribe
Shane Capron, WAPA
Bill Davis, CREDA
Kurt Dongoske, Pueblo of Zuni
Craig Ellsworth, WAPA (Alternate)
Charlie Ferrantelli, Wyoming State Engineer's Office
Paul Harms, New Mexico Interstate Stream Commission
Brian Healy, NPS, GCNP
Ken Hyde, NPS, GCNRA
Leslie James, CREDA*
Vineetha Kartha, ADWR
Stewart Koyiyumptewa, Hopi Tribe
Ryan Mann, AZGFD
Craig McGinnis, ADWR
Jessica Neuwerth, CRBC
Emily Omana Smith, Reclamation
Ben Reeder, GCRG*
Peggy Roefer, State of Nevada
Dave Rogowski, AZGFD*
Seth Shanahan, Southern Nevada Water Authority
Jim Strogen, Trout Unlimited, IFF
Kirk Young, USFWS

USGS/GCMRC

Helen Fairley
Michael Moran

Reclamation

Tara Ashby
Bill Chada*
Heather Patno*
Lee Traynham

Interested Person

Rob Billerbeck, NPS
Kelly Burke, GCWC*
Winkie Crook, Hualapai Tribe*
Michelle Garrison, Colorado DNR*
John Jordan, Trout Unlimited & IFF
Amy Ostdiek, Colorado Attorney General's Office
Theresa Pasqual, Joint Tribal Liaison*
Bill Persons, Recreational Fishing*
Sarah Rinkevich, USFWS
Connie Svoboda, TSC*

Denotes attendees participating solely via Webinar

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Summary of Motions

- Seth called for comments or changes to the March 14, 2019 and May 1, 2019 meeting minutes. None were received. The minutes are considered approved.

Presentations and Discussion

Welcome and Administrative
Presenter: Seth Shanahan, TWG Chair & others, as assigned
Presentation & Discussion Summary:

- Quorum Established with 16 members or alternates present.
- *Seth Shanahan and Paul Harms provided comments on the March 14, 2019 and May 1, 2019 meeting notes prior to the meeting. Kurt Dongoske provided clarifying comments on his presentation.*
- Future Proposed Meetings for 2019:
    - *October 21-22 TWG meeting*
    - *Seth stated that in previous meetings TWG members requested that the October 21-22 meeting be in person. To avoid Sunday travel, the first day of the meeting, which is a Monday, will be held later in the day.*
- Ad Hoc Group Updates
    - *Seth announced that Craig Ellsworth would volunteer to chair the BAHG.*
    - *Vineetha Kartha asked for an update on AHAHG activities. The AHAHG appeared to be making a lot of progress. Vineetha and Craig thought the AHAHG could coordinate with Paul Hurst to keep the project moving forward. Seth stated the TWG should identify Paul's administrative history work as an outreach of the AMWG's ad hoc group, this should include ensuring Craig has a connection so the material they are producing is represented in the wiki. Seth asked that Craig and Larry think about whether the AHAHG charge needs to be modified. Craig requested that more stakeholders participate in updating the wiki page. Emily Omana Smith stated she has been following up on the agreement AMWG has with Paul and she also agreed to participate in the TWG AHAHG. Seth asked that other members who are interested in participating contact Seth, Lee Traynham, or Tara Ashby.*
- Seth reminded the group that the Action Item Tracking Form was originally developed for tracking action items but that the TWG is considering adding other important items to it.
- Ken Hyde said the PA for the Expanded Non-native Aquatic Species Management Plan went to all the tribes and to the SHPO for signatures. Ken expects to receive the signed PA or hear back from the tribes by the end of the week and to have the FONSI by July. Bill Persons asked about the scope of the plan and whether it included non-native species in Lake Powell that might be passing through the dam. Ken responded that it does not include non-native species but that it remains in the TWP.
- Michael Moran provided and update on upcoming monitoring and research trips and tribal cultural monitoring trips. See Attachment 1 for additional information.
    - *Seth asked about the new logistics coordinator who is helping to organize the trips. Michael responded that Ann Marie Bringhurst has taken over as the new logistics coordinator.*
    - *Craig McGinnnis expressed appreciation to Michael for putting the list together because it helps TWG members to understand all the work GCMRC does. Craig added that it was important in TWG's planning for understanding how GCMRC works. Michael said there were some minor changes to the list, and anyone with questions should contact GCMRC.*
    - *Seth asked if TWG or AMWG members should contact Michael if they were interested in participating in any of the trips. Michael responded in the affirmative and stated the GCMRC could always use help, especially with the fish trips.*

- TWG members provided an update on possible experimental and management actions, as well as budgeting issues, for the next 12 months. TWG slightly modified the language on the agenda to account for a rolling 12-month update and included additional text about budgeting items. This was a result of a BAHG discussion on whether the TWG was thinking about budgeting considerations for experiments and management actions.
    - *Seth Shanahan stated that fall HFEs could be triggered, adding that the extended duration fall HFE could also be triggered this fall. There is also potential for a triggered spring HFE. He stated that a potential bug flow experiment and a potential trout management flow experiment could be implemented in May 2020. For management actions, Seth brought up the riparian vegetation management activities, which are ongoing.*
    - *Ken Hyde mentioned the potential experiment on whether incentivized harvests will work. TWG is seeking NPS funding through different mechanisms. There was also discussion with the BAHG. TWG might not be able to fund one or two of the components, but NPS has some funding available for the tribal youth trips or for the incentivized harvest restoration rewards. Ken was unsure whether one or both would be set up this year, but it could happen once funds are assigned.*
    - *Seth stated it was good to learn the TWG was leaning toward the LTEMP experiment and management actions, but that it is also important to recognize there are other experiments or management actions that might not necessarily be within the LTEMP description.*
    - *Jim Strogen stated he had seen a document about funding sources and was unclear about one that involved money for looking at the idea of trying to understand research implications and another that was the actual funding for the incentivized harvest and asked if those two were different. Ken responded that the TWG presented a three-year budget proposal to the NPS. The BAHG asked Ken to only provide a one-year budget proposal in case funding became available in 2019 or in 2020, which was why Jim saw two different numbers. The TWG wants to confirm in the first three years whether the tool is viable in the Colorado River system and whether enough there would be enough participation to allow the TWG to set up a program to get tribal youth on some of those trips while also removing some brown trout. Ken added this tool has never been used for such a long period of time.*
- TWG members provided an update on items of interest that are in consideration for implementation before the next TWG meeting.
    - *Peter Bungart asked how management flows might affect trout populations and how trout management flows would affect bug populations and vice versa. Seth responded that Ted Kennedy and Jeff Muehlbauer would be presenting some preliminary observations about the 2019 bug flows, and that Ted and Jeff would be able to respond to Peter's questions at that time. Seth added that Josh Korman would be presenting remotely about trout management flows and would be able to respond as well. Michael agreed that would be a good idea but was unsure of how much Josh has thought about the bug flows in terms of trout.*
    - *Sarah Rinkevich stated that Region 6 in Denver would be proposing to delist the Kanab amber snail based on a taxonomic error. Sarah expects the proposal to be on the Federal Register soon and added that outreach letters are going to the tribes.*

TWG Chairperson and Vice Chairperson Election

Presenter: Lee Traynham, Reclamation

Presentation Summary: Lee thanked Seth Shanahan and Vineetha Kartha for their service as TWG Chairperson and Vice Chair person and for their efforts to keep the group on track, organized, moving in the right direction, making solid recommendations, and for keeping AMWG moving forward.

The TWG Chair and Vice Chair positions are one-year terms served from October 1 to September 30. The Chair attends all TWG and AMWG meetings when possible, facilitates TWG meetings by leading discussions, and organizes and disbands ad hoc task groups. The Vice Chair does a similar set of supporting activities. If only one person is nominated for each position, there will be a motion to appoint the nominee by unanimous consent. The TWG will hold a vote for multiple nominees.

Discussion:

- *Peggy Roafer nominated Seth Shanahan as Chair and Vineetha Kartha as Vice Chair, in light of the wonderful job they have been doing.*
- *Seth accepted the nomination and stated he enjoyed the position and helping to facilitate the process. Seth asked that members who did not think he had done a good job let know so that he could fix his behaviors. Seth informed the group that his organization does not accept funding for him to take the position, so that item in the budget would always be zero. Vineetha agreed with Seth and stated that she had come to love the TWG and all the people associated with it. Vineetha added that she had formed strong, durable relationships with everyone and considered it an honor to be allowed to serve as Vice Chair. Vineetha mentioned that she hired Craig McGinnis and stated she would occasionally step back so Craig could participate and be fully engaged in the program. Vineetha added that she looked forward to serving the TWG for another year.*
- *Lee asked if there was a motion to appoint Seth as Chair and Vineetha as Vice Chair of the TWG. Someone seconded the motion and Lee congratulated Seth and Vineetha on their positions.*
- *Kelly Burke congratulated Seth and Vineetha and thanked them for the work they did for TWG.*
- *Shane Capron thanked Seth and Vineetha and recognized their work in setting up the steering committee and the ad hoc groups and for having those meetings. Shane stated the meetings were helpful and that he appreciated Seth and Vineetha for that and for leading the process and allowing members to have input. Seth expressed his appreciation to Shane and added that he felt the SCAHG was helpful for bringing up ideas for agenda items and talking through presenters and content but that it was a previous Chair who set up the SCAHG.*

Update on Hydrology, Operations, and Reservoir/Release Temperatures

Presenter: Heather Patno, Reclamation

Presentation Summary: The year 2018 was the third driest year on record for the Upper and Lower Basins, and the dry weather continued through February 2019 with water storage expected to be 65% of average. The area experienced a series of snowstorms and a lot of precipitation through February, March, and April, so the SWE peaked at 132% of median on April 15. Reclamation was not expecting to fill the Navajo, Morrow Point, or Blue Mesa reservoirs, but each is now above average and expected to fill. An increase in precipitation in the previous six weeks has helped to increase inflow and has triggered a spring HFE. Reclamation is currently working on the 24-month study, but the process has slowed due to incoming ESP values from the RFC.

Reclamation updates the most, minimum, and maximum probable for inflows in January, April, August, and October. Currently, the May most probable shows the area at 12maf. Reclamation expects storage to go up somewhere between 50% and the current maximum probable of 156% of average. Lake Powell elevation is above 3,575 and Lake Mead elevation is below 1,075, so Reclamation is now operating within balancing of 8.23 and 9.0maf. Under most, minimum, and maximum probable scenarios, Reclamation expects volumes to be at 9.0maf and the differences in elevation to be in the range of 3,582 to 3,631. The area was balancing under the drier conditions, and at one point anticipated 8.2maf for the year. The pattern has changed slightly and now looks similar to the LTEMP pattern through the end of the year. Most, minimum, and maximum scenarios all show movement into the water year 2020

to be in the upper elevation balancing tier. Continued increases in elevations and inflows increase the probability of an April adjustment to equalization. The minimum probable does decrease elevation to the mid-elevation release tier for water year 2020, but the minimum probable also has a balancing release at the beginning of water year 2019, which is at 8.2maf.

Reclamation is updating the original transformers and has unit maintenance and replacement outages scheduled for water year 2020. Reclamation expects to meet the requirements for the minimum, maximum, and most release projections. Reclamation is currently undergoing the first transformer replacement and expects to begin maintenance on units three and four in November 2019. Reclamation anticipates having all eight units available at the beginning of November for a potential fall HFE. There will be overlap when maintenance on units five and six starts in the spring. Reclamation was able to release all 12.8maf within the current water year without needing to go into carryover for October, November, and December 2019.

With the previously expected 65% of average inflow, the most probable anticipated a level one shortage and the minimum probable anticipated a level two shortage. The most probable now anticipates normal conditions in water year 2020. Temperature predictions in January 2019 were similar to 2004 temperatures with some of the warmest weather coming downstream. The increased snowpack and colder, wetter conditions have changed those predictions. See Attachment 2 for additional information.

Discussion:

- *Leslie James asked if Reclamation was consulting with WAPA regarding the summer times to see if adjustments could be made to miscellaneous amounts. Heather responded that Reclamation has not consulted with WAPA because it is a 9.0 maf year, which is very close to the LTEMP pattern. Reclamation is discussing what bug flow patterns would look like if the area continues to receive more water and if it were under maintenance for those terms. Leslie stated that going into the summer, she assumed there would be ongoing discussion on whether Reclamation could make some minor adjustments.*
- *Jan Balsom asked about the predictions for potential equalization that were modeled. Heather responded that the May projection for an April adjustment to equalization was about 40%. Heather stated the midterm operations model is using the 24-month study to look at probability into the future. May probability was 9.2 maf coming into the reservoir, and it is now 10.3 maf coming into the reservoir. Heather expects that probability to go up to about 50% or higher to an April adjustment to equalization. Currently, Reclamation is not showing traces starting in equalization but it is still showing all traces will begin in the upper elevation balancing tier. Jan asked how TWG would go about recognizing the modeling done in the LTEMP, which took into account the various equalization and balancing tiers with 40-50% confidence of what it could be.She asked how TWG is implementing the parameters included in the LTEMP with the possibilities for different experimental flows, with the inflow volumes that have to be released, and with the maintenance schedule. Jan asked how Reclamation balances those things in its balancing tier to come up with reasonable projections for the future. Heather responded that in terms of the experiments, Reclamation continues to work with Lee Traynham to discuss potential for experiments. For the maintenance schedule, Reclamation is trying to create a situation where all units are available for a fall HFE. Reclamation has not replaced the transformers since building the dam, so Reclamation does need to take care of that. Reclamation is discussing the possibility of moving maintenance schedules around, but that could be expensive. Heather said Reclamation will continue to work with the TWG and to the AMWG to determine what experiments to conduct in water year 2020. Reclamation continues to regularly work with WAPA ensure Reclamation is maximizing the amount of hydropower available.*

- *Lee stated that, for the TWG, if Reclamation sees a potential equalization coming, and there are experiments that might lend themselves to those types of conditions, Reclamation would communicate that information to its operating crews and to the planners at WAPA. Lee thanked Heather for pointing out that equalization is a possibility for water year 2020, and that it is something for the TWG to think about when considering experiments.*
- *Jan stated the TWG had an opportunity to start thinking about this. The area has not seen current water conditions in a while, but now that those conditions exist, the TWG has direction through the LTEMP ROD to conduct environmentally responsible experiments that could improve conditions. Jan suggested the TWG schedule those experiments ahead of time before it becomes too late. Seth asked Heather to put up the slide five of her presentation to determine how timing might relate to the issue Jan noted. Seth said that if the proactive spring HFE is in August 2019, there is a most probable projection of an equalization in release that might trigger a proactive HFE ahead of that. That would initiate the discussion for hardcoding in April when there would be enough information to know whether it was actual equalization tier conditions which could trigger additional decision making for a corrective HFE to occur in April, May, of June 2020. Lee added that, as Heather noted, Reclamation is looking at a situation where it will be in the upper elevation balancing tier and will set the tier determination in August 2019; however, the adjustment to equalization would not happen until April, which makes timing tricky. Reclamation does not know if current conditions will persist or whether it will move into equalization until that window of opportunity opens up for the spring HFE. Reclamation will need to coordinate between August 2019 and March or April 2020 to make the proactive HFE feasible.*
- *Vineetha followed up on Jan's question and asked whether Reclamation expected to go into the equalization tier in August or if there would be an adjustment to equalization tier for Reclamation to start releasing its monthly volume in January 2020. Heather responded that getting the adjustment to equalization tier through the power plant in water year 2019 was Reclamation's first goal. Currently, Reclamation can release 12.8 maf of water through the power plant in water year 2019 without having to go with carryover. Vineetha thought Jan was asking whether the TWG would need to plan ahead so there would be enough water to plan for monthly releases for an HFE to work. Heather responded that Reclamation does not know what 2020 snowpack will be. Reclamation can have a potential plan in place if there Is a large snowpack in February and the most probable shows an April adjustment to equalization. Reclamation can start working on that in January and February if the conditions warrant it, but Reclamation will need to wait until that time to determine anything.*
- *Jan stated that the hydrology is unpredictable, but the TWG set goals through the LTEMP and through the ROD for certain resource conditions. If the TWG has the opportunity, Jan wants to ensure early planning to avoid losing that opportunity. There are a lot of experiments and unknowns that depend on the hydrological conditions that could occur in the next two years.*
- *Seth asked if Jan was thinking of a different experiment besides the proactive Spring HFE. Jan said it could be the extended HFE and another that require differences in how Reclamation schedules water releases. The proactive, the spring, and the extended HFEs all require some shifting of water between the months to be able to achieve the goal. Seth stated he thought those were sediment triggered.*
- *Jim Strogen said the Release Scenarios chart on slide fivepoints to the continual need for the TWG to consider overflow tubes as a power source because of the number of turbines that are expected to be down during the time of year the TWG would need access for these experiments. Having access to overflow tubes could make it easier to conduct some of those experiments.*
- *Craig McGinnis asked about the change in release temperature modeling and whether that change was a result of the large inflow of cold water coming into the reservoir or if that change was driven by elevation and increasing distance between the pit stocks and the thermocline. Heather responded*

that it was a little of both, but that most of the change was because of the cold water coming from the above average snowpack.

- *Peter Bungart asked whether the information on the slide that shows the snowpack relative to the average is based on a moving average or if it includes historic date. Heather responded that it is median for a 30-year period from 1981 to 2010.*
- *Shane Capron stated there was a lot of good discussion about the potential for various experiments within a high-water year, adding that the 2011 equalization flows were likely a significant driving force into high trout recruitment, and the TWG needs to think about whether there is potential for going into an equalization year and what the implications might be for trout recruitment.*

Movement of Stocked Rainbow Trout in Lees Ferry

Presenters: Ryan Mann, AZGFD

Presentation Summary: Ryan provided an update to the recent Lees Ferry trout stocking events. Ryan acknowledged Devin Alver, the lead research biologist working on the project. The purpose of the trout stocking was to address low catch rates at Lees Ferry. AZGFD's goal is for one fish per hour but that goal has not been reached in recent years. AZGFD began the trout stocking in November 2018 with about 525 fish and continued with two stockings in May and another in early June with a total of about 1,500 triploid rainbow trout that averaged about ten inches in length. AZGFD anticipates additional stocking on June 24. AZGFD wants to know the persistence of Rainbow Trout stocked at Lees Ferry with regard to mortality, harvest, and immigration. AZGFD used acoustic telemetry and discussed looking at a mercury capture with pit tags; however, the low numbers of fish that would have been there made sampling for confidence intervals on estimated logistically unfeasible. Acoustic telemetry was selected because AZGFD has a well-established SUR Ray for tracking brown trout and for observing movement.

AZGFD planned to tag about 80 of the fish that AZGFD was releasing in the stockings, then use fixed and mobile tracking techniques to assess movement and possibly quantify mortality, harvest, and immigration. AZGFD stuck to a threshold of less than two percent of the transmitter to the fish's body weight to avoid impacting behavior. AZGFD has been tracking the tagged fish by boat and by foot on a daily basis the first week and then weekly. AZGFD added four SURs at Cathedral Wash to monitor downstream movement in areas that are inaccessible to anglers. The year-round creel monitors the fishery at Lees Ferry. AZGFD found that the SURs are extremely sensitive and they pick up a lot of ambient noise, in addition to the tagged fish. There is better detection in larger, calmer areas, and AZGFD had to turn down the SURs to about five percent of capacity in smaller areas with more turbulence. The SURs are still able to catch the tagged fish from about 180 meters.

Preliminary results have shown that about half the fish are moving downstream into the pre-riffle area where anglers regularly fish and where the fish can forage for food. This area is, however, much noisier than areas upstream, making it harder to track the fish. AZGFD has 5,000 to 9,000 records of fish movement in the pre-riffle area. Although no upstream movement was detected during the first month, AZGFD did observe one fish that moved about three miles upstream from the boat dock, which is an area with a lot of trout spawning.

AZGFD plans to build a multi-state model for analysis of these results because there have been some differences in detection probability between the different sites. AZGFD hopes to calculate detection probabilities between the pre-riffle and the upper stocking zone and to look at movement probability between the two sites. Additional details are in Attachment 3.

Discussion:

- *Jim Strogen asked whether there was any movement below Cathedral Wash or if the fish were locked in at Cathedral Wash. Ryan responded that AZGFD won't know until they are able to download the sites. The SURs in the upper reaches were all switched over to detect the AZGFD tagged fish and the brown trout that are currently in the system. The results from the June 3 download showed about five fish, but AZGFD will need to wait until summer for the results.*
- *Jim asked if AZGFD had any sense of what happened to the 20 unaccounted tags. Ryan replied there were not necessarily 20 tags, but that 20 fish moved down into the pre-riffle and some of those popped back out. The number of lost tags was about five or six of the total group of fish that went out. Ryan speculated that some of those fish might still be in the pre-riffle, and AZGFD can't detect them unless they move downstream, and some might have been harvested but not reported.*
- *Jim asked if the fish had some marking that an angler could identify on a tagged fish. Ryan responded that there was a surgical mark or surgical staples within the body of the fish. Additionally, all of the stocked fish are clipped.*
- *Bill Persons asked whether Josh Korman had attempted to get a handle on the downstream movement of trout to try to work with that set of data to better see how this information might fit in. Ryan replied that Josh included the original values calculated for immigration rates in the Biological Opinion that was used to get clients for stocking; but, those values are with the wild populations, so AZGFD wanted to get a sense for exactly what was happening with the stocked fish, which was the reason for initiating tis research project. Bill asked if the 14 or 15% of fish that went downstream seemed like a high number. Ryan stated that in some larger river systems, other researchers have observed more downstream movement from stocked fish than with wild fish. Projects that Ryan has been involved with in smaller systems and radio telemetry result in little movement overall. This is the first time AZGFD has conducted a project like this on a system this large.*
- *Peter Bungart asked what the anticipated tag life was and whether AZGFD was doing any lab studies for when tags fail to account for survival versus failure. Ryan explained that the tags have a warrantied life of about 100 days. AZGFD expects to stop the surveys at the 90 days because AZGFD will not be able to determine whether the tag died, an angler removed it from the fish, or if the batteries died.*
- *Peter asked if AZGFD had a sense of what causes downstream movement and whether there was competition, and if so, was there a difference in competition between wild trout and stocked trout. Ryan stated that most of the stocked trout movement occurs within the first days after stocking, but that could be because the stocked trout might be seeking areas that are familiar or they might be looking for food or shelter. Ryan added that the trout move downstream with their heads pointed upstream, which means the trout are pushing down or taking time to move through the river system.*
- *Helen Fairley asked whether the release of 37 fish was only for the tagged fish, or if those 37 fish were part of a bigger release and if part of a bigger release, how many fish were released. Ryan responded that the 37 fish were the acoustic tagged fish and were part of a bigger release. AZGFD has released 4,500 to 5,000 fish and anticipates putting out another 1,500 at the end of June.*
- *John Jordan asked whether AZGFD was considering the effect that habitat has on trout locations considering that all water is not equal, and that trout tend to gravitate to areas where food comes to them. John speculated that the trout might like those areas and they move there in pursuit of suitable habitat for feeding. Ryan agreed and relayed that type of movement was likely, at least into the pre-riffle area. Trout are attracted to flow and will congregate in higher flow areas.*
- *Ryan stated the next major detection array was at Badger Creek and that a pit tag array was previously installed at 30 Mile. AZGFD has been concerned that because of fish passage through Cathedral Wash, those fish were no longer accessible to anglers. AZGFD was trying to target anglers at the walk-in area with the trout stocking.*

- *Brian Healy said NPS does not know when someone will pull data from the downstream SURs next, but he will get that information from Bob Shelly. Seth asked whether there was a set schedule that NPS has for visiting SUR sites. Brian replied that Bob has been trying to do it once a month because of staffing shortages. NPS is also relying on GCMRC staff to be available, which has also been difficult. When possible, NPS has the Razorback group download the SURs. Ryan added that AZGFD has picked up information from brown trout tags and will be able to supply some of that information for the brown trout project. Seth asked whether codes were updated for all SURs for the stocked rainbow trout and the stocked brown trout. Ryan responded that this was his understanding but thinks Bob has tried to get AZGFD codes on SURs that are specifically for razorback suckers downstream.*
- *Heather asked whether the Biowest SURs were being downloaded on a monthly basis during the winter. Ryan responded that he is not sure how often Biowest downloads the SURs, but Ryan's understanding was that the SURs reading for razorback suckers was picking up tags outside the 75 kilohertz, which is the same as the brown trout. Biowest may not need to do anything to detect the AZGFD tags. Heather stated that the monthly March through September trips would be helpful for this study. Seth asked Heather to double check if the contract could be run for Reclamation.*
- *Jim asked whether the data Ryan reported was for the May tag and if Ryan had information from the tags in the initial stocking. Ryan responded that all the information was from the fish released on May 1. Jim asked if the fish in the initial stocking were tagged, and Ryan responded that the 37 acoustic tagged fish were part of that initial May stocking. AZGFD did not add additional acoustic tags for the other two stockings in late May and early June. Ryan added that AZGFD conducted another stocking in November 2018 with 525 pit-tagged fish, but with no acoustic-tagged fish. That information has been slower to retrieve because it is through pit-tagged records, and AZGFD has seen those fish pop up in several areas, including the creel.*

Preliminary Observations from Bug Flows Experiment
Presenter: Ted Kennedy and Jeff Muehlbauer, GCMRC
Presentation Summary: The first-year bug flows in GCMRC's citizen science bug traps saw an encouraging caddisfly bloom, which had not been previously observed. Reports show that in the first week of May 2018, during the first bug flows, there was a lot of insect activity. GCMRC used sticky traps to catch insects in the Lees Ferry reach and saw high numbers of midges that tailed off quickly. The area was coming off a dry, warm winter, which may have caused midges to emerge earlier. GCMRC also conducted weekday/weekend studies in August 2018 and saw more divergence on weekends than on weekdays, which GCMRC did not expect. The larger number of bugs on the weekends are laying eggs, which GCMRC hopes results in more larvae.

GCMRC continued the bug flows from May to August 2019 but is now doing the H-750, which means the weekend flows are designed to be 750cfs higher than the weekday low. In 2019, citizen science groups will monitor the adult life stages of the aquatic insects. GCMRC also conducted a drift river trip in April and plans another in September to collect invertebrate drift samples throughout the Grand Canyon and Glen Canyon every three to four miles for a canyon-wide assessment of invertebrate abundance in the drift. Weekend/weekday bug flows will occur in June and in August 2019 at Glen Canyon. During the May 2019 river trip, GCMRC set up at two locations to track invertebrate response. Foul weather likely played a role in the low to modest bug activity. GCMRC observed that weekday bug catches were not significantly different from weekend bug catches at the LCR and at Fall Canyon. GCMRC did observe a lot of midge egg lays at RM 61 and 61.3. Midges appear to be active in Glen Canyon, especially on warm days, with fish moving to feed on the emerging midges. May 2019 showed a new high point for midges, based on sticky trap monthly monitoring. GCMRC anticipates working with Craig Ellsworth, John Jordan,

and John Hamill on the upcoming weekend/weekday study in Glen Canyon. Additional details are in Attachment 4.

Discussion:

- *Jim Strogen asked Ted to discuss caddisflies further. Ted stated that GCMRC does not have new data on the caddisfly for 2019, but Ted did see some hatching on the river trip, especially at the LCR. The 2018 result in the presentation was for several species of caddisflies. Some caddisfly species are much bigger than the midge, and the four-fold increase of caddisflies seen in 2018 is a positive sign.*
- *Ben Reeder asked how the bug flows affects the ecosystem. Ted responded that GCMRC is ramping up on the citizen science monitoring. GCMRC purchased ten IPads and loaded software that makes the IPad an acoustic monitoring device. This started in 2017, prior to bug flows. GCMRC started to work on 2018 data and saw an increase in bat activity compared to 2017. The abundance of one bat species increased dramatically. GCMRC has been working with NPS on different approaches to monitoring bat activity and to share data to potentially track a bat response to the bug flow experiment. Ben Reader wondered whether any of the NPS monitoring data on the flycatcher would be relevant. Ted responded that it potentially would be relevant. Ted expected flycatchers to target the emergent aquatic insects. GCMRC is also discussing opportunities to collaborate with NPS to determine how the ecosystem is responding to bug flows, including terrestrial wildlife.*
- *Bill Persons asked Ted to describe water clarity differences between 2018 and 2019. Ted responded that the clear winter in 2018 lead to many months of clear water for the bug flows for 2018, and that the area has experienced many months of muddy water in 2019, which resulted in more activity.*

The Drought Contingency Plan (DCP)

Presenters: TWG Members

Presentation Summary: The DCT is a set of agreements that include a companion agreement and two separate programs, the Lower Basin DCP and the Upper Basin DCP. The Lower Basin DCP includes the Lower Basin DCP Agreement, operational provisions, and interstate agreements in Arizona, California, and Nevada. The Upper Basin DCP includes a DROA and a DMSA. Federal legislation allows the DOI to implement the DCP in an expedited manner, and the Companion Agreement is an agreement between all the basin states. The DCP was initiated in the early 2010s in response to hydrological risks of Lake Mead falling below 1,025 feet in 2026. Those risks were six times higher in 2015 than in 1988. Once Lake Mead's elevations get to 1,000 feet, Reclamation will not be able to fulfill the demands of high priority users. The Pilot System Conservation Program and the MOU allow the states to store additional water in Lake Mead to keep elevations from falling. DCP ICS involves borrowing water to avoid stranding conserved water. The DCP also allows interstate banking during shortage years. Under bi-national waters contingency plans, Mexico committed to store 41 kap, and negotiations between the Lower Basin states and Mexico are ongoing. Under the 2007 guidelines, California does not have to take shortages when Lake Mead is above 1045 feet. The DCP is an overlay of the 2007 guidelines. The DCP is just one component of a basin-wide approach that includes Mexico's bi-national water scarcity plan and the Upper Basin's DCP. Senator Martha McSally (AZ) and Representative Raul Grijalva (AZ) introduced federal legislation that Congress passed on April 8, and which the White House signed into law on April 16. The DCP agreements were executed on May 20.

The DCPs were motivated by Lower Basin needs and the recognition that the inter guidelines did not have large enough storages during shortage conditions. Lake Powell is also low, so there is also risk to the Upper Basin. The Upper Basin DCP includes provisions to help reduce the risk of Lake Powell from reaching critically low elevations and to reduce the risk of involuntary curtailment and to ensure fulfillment of compact obligations. The four dams authorized in the initial Colorado River Storage Project after 1956 are Flaming Gorge, Aspinall Units, Navajo, and Lake Powell. As with the Interim Guidelines

and the Lower Basin DCP, the DROA relies on Reclamation's monthly 24-month study to forecast reservoir elevations and to alert the need to start forming a plan that is consistent with relative compacts, RODs, BOs, and water contracts. If adjustments in monthly volumes at Glen Canyon Dam are insufficient, adjustments at all the upstream CRSPA Initial Units would be considered. The DCP would facilitate coordination with factors like spring flows to minimize effects on natural resources or power. The Secretary of the Interior and Reclamation have authority to operate the dams in emergency actions with or without a formed plan. Public outreach would include notifying tribes, local governments, interested stakeholders, and workgroups such as the TWG.

The second part of the Upper Basin DCP is the DMSA does not set up an actual demand management program but puts in place the structure to start talking about developing a demand management program in the Upper Basin. The DMSA is free of charge and is invisible to the 2007 guidelines. Any water put into this storage pool would be subject to release only at the direction of UCRC, and it is not subject to balancing. This is just the beginning of this conversation, and the Upper Basin states are just starting planning. The question of how to set up a demand management program and whether it would be feasible and desirable in the Upper Basin remains. The Upper Basin also needs to consider funding and whether enough water would be created to make a measurable difference. The Upper Colorado River Commission will kick off efforts with a June 21 workshop in Salt Lake City. Additional details are in Attachment 5.

Discussion:

- *Bill Persons commented that because the DCP is about the Grand Canyon program, it seemed the speakers should have addressed the implications to the TWG. Paul Harms responded that it would be mostly positive for the TWG. The goal is to keep Lake Powell elevations higher; the DROA shifts some of the risk onto the upstream reservoirs. It's a concern for New Mexico because the Navajo Reservoir is important for New Mexico's water supply. The DCP would keep Lake Powell generating hydropower, keep elevation higher, and likely keep temperatures a little lower. Amy Ostdiek added that the DROA would keep everything operating within existing compliance, which is a good thing. Amy also thinks demand management would create synergistic benefits to existing programs. Amy clarified that no decisions have been made about how that would operate, and she thinks questions of existing law and existing programs and how they all fit together are appropriate for the feasibility investigation. Amy stated that having members at the workshops and pointing those things out to initiate discussion would be beneficial. Seth stated that the overlay does not affect the coordinated operations part, but if one assumed that the goal is for more water in Lake Powell and more water in Lake Mead, then potential coordination could be affected.*
- *Peter Bungart asked WAPA's views on the DCP and how it affects power production and whether WAPA had a seat at the table. Paul replied he was unsure about a seat at the table, but that while the DCP group has been looking at some of the potential effects to power production, they can only speculate at the moment. Paul stated that the objective was to keep Lake Powell and other reservoirs from falling below the point for producing power, which would be beneficial. There are also some negative impacts for how the system might be operated, including higher releases at other facilities and keeping Glen Canyon from going below power plant. Paul hopes to keep producing power at Glen Canyon, which would have a huge impact. Vineetha added that the group also looked at all the water releases and potential impacts on downstream dams like Davis and Parker. The impact would be to have water flowing through the system, which is the goal of the DCP, by storing more water in Lake Mead so it does not go into elevations that would prevent water from being released. There may be negative impacts to hydropower during the first two years due to reductions.*

- *Jan Balsom asked how the effects to NPS units are incorporated into how the DCP is implemented. She also asked how consultation with stakeholders might occur. Paul responded that it's hard to know for sure, but the group would try its best to have public outreach to consult with anyone, including NPS, and would coordinate with different stakeholders. Amy added that the framing in Colorado includes conducting aggressive outreach and having stakeholder input processes. Seth added that the group is not proposing to do whatever it wants, but would follow the existing rules. The group would follow consultation requirements for tribal interactions and for other federal interactions. Brent Rhees previously informed TWG that Reclamation could do the DROA without legislation because Reclamation already has the authority within the existing LTEMP; however, it was part of the negotiated package, and TWG wanted to memorialize it. Jan stated that almost all the agreements relate to some NPS management and presumed that the SCP considers other relevant compacts. Vineetha responded that she, Peggy Roefer, and Jessica Neuwerth were all working on the compliance with MSC, which includes signatories like NPS. The group also looked at all the refuges because MSC authority goes up to Lake Mead. The group is looking at what would happen with decreased flow below the lake. Vineetha added that the DCP just stores additional water in Lake Mead, which is better for habitat and recreation. The group does need to work on MSC compliance with the NPS and the tribes. The State of Arizona is unique because it needs less federal pull for the Director to sign off on the agreements, and for that the State needed to start a public process, which was conducted over the previous three years. This involved meeting with the CRIT, who volunteered to conserve water in Lake Mead and to create ICS through funding from the federal government and from the State. Several tribes in Arizona have been a part of the intra-Arizona deal, and Arizona Governor Doug Ducey signed off on it on January 31.*

Report Out and Recommendation from the Budget Ad Hoc Group for the Fiscal Year 2020 Budget and Work Plan

Presenters: Shane Capron, WAPA; Lee Traynham, Reclamation; Scott VanderKooi, GCMRC

Presentation Summary: The BAHG proposal is to help facilitate the discussions between the TWG, GCMRC, Reclamation, and all other cooperators. The BAGH held four meetings in an effort to consider budget tables from the third year of the TWP and to make a recommendation to AMWG to make a recommendation to the Secretary of the Interior.

The third year of the TWP is easier because the TWG already has a framework from which to start. In meetings, the BAHG discussed financial measures and issues related to the new GCMRC building, which was pushed out and resulted in the availability of additional funds. Discussions revolved around what projects needed extra money. The BAHG discussed Reclamation's experimental fund and how to potentially allocate those funds this year. New projects were identified and discussed for potential consideration. The BAHG also heard about tribal projects that went unfunded during the TWP process. The BAHG came together around these changes to the budget tables and was in general agreement to bring it to the TWG for consideration. There are two GCMRC projects that were proposed for 2020, as well, which added up to roughly $200,000 of the larger experimental fund.

Not much has changed for Reclamation's proposed budget for 2020. A lot of the risk and uncertainty in the budget process is due to appropriations. Reclamation was tasked with reviewing the TWP budget to determine whether any adjustments are needed, then review, revise and make a recommendation to the Secretary of the Interior for the FY2020 budget. The landscape has changed since TWP put together the TWP, starting with the use of appropriated funds rather than power revenues in FY2019, and potentially going into FY2020. Reclamation requested over-target appropriations funding for FY2020 in the amount of $11.36 million, which was the same amount requested in FY2019. The biggest difference

between appropriated funds and power revenues is that power revenues come with more flexibility and allow the TWG to carry funds over from year to year. If condition dependent experiments, like HFEs, are not triggered, Reclamation would have those funds available. With power revenues, those funds would carry over, and Reclamation would move those funds to the Native Fish Contingency Fund. With appropriated funds, Reclamation would need to assign those funds to other proposals. For cultural resources, Reclamation hoped to carry over excess funds into the D10 Contingency Fund for NHPA Section 106 compliance.

Mike Moran provided a review of the various projects GCMRC planned for FY2020. GCMRC expected to move into a new building in Flagstaff in April 2017, which has not yet occurred. An occupancy agreement was signed between USGS, the city of Flagstaff, and GSA in April 2019, so GCMRC will move into the building upon its completion. The funding bill for the building was signed in May, and GCMRC anticipates moving into the new building around October 2020. GCMRC originally anticipated incurring additional occupancy costs during the second half of the FY2018. GCMRC can now allocate those excess funds to projects. GCMRC expects overhead for GCD AMP to rise form about 16% with a pass-through rate of 3% to about 26%. GCMRC has used some of the excess funds to increase salaries and to retain key staff for projects. GCMRC also expects to increase cooperative agreements to partially offset previous reduction to AZGFD for several fish projects. Additional details are in Attachment 6.

Discussion:

- *Seth Shanahan thought the BAHG discussions went well because there was ample opportunity for everyone to have a good conversation.*
- *Seth asked what "over-target" meants Lee explained that Reclamation had to request "over-target" funds, which are in addition to the funds Reclamation would typically ask for due to extenuating circumstances. Peggy Roefer added that the in-house budget is now zeroed out and funding would now come from WAPA, if the Senate agrees. Peggy asked if the TWG could be stuck with no funding again. Lee responded that the President needs to sign an appropriations bill into law after it has been passed by both bodies of Congress sometime between March and September. The Energy and Water appropriations bill the House of Representatives drafted includes language that would potentially allow the program to go back to being funded by hydropower revenues; however, the Senate needs to agree, and the President would need to sign it into law. Peggy asked whether that would be for only one year. Lee responded it would only be for the FY2020 appropriations cycle.*
- *Peggy asked if Reclamation would continue to ask for appropriations, and if it goes back to WAPA funds, would Reclamation ask and see what happens next. Lee responded that she hoped there would be a more long-term resolution, but that, barring other information, the answer is yes. Reclamation needs to ensure funding for the program, and if there is no guarantee from year to year, needs to ensure all options are explored. Someone commented that this was all speculation, and Reclamation still needs to follow OMB guidance. If the appropriations language authorized required WAPA to provide more money to Reclamation for one year, then the next year the TWG would go back to OMB guidance and ask for appropriations to fund the program. Lee stated it was competing guidance with matters of interpretation. Lee added that there was still a lot that needs to be settled through legislation, which causes a lot of uncertainty.*
- *Peggy asked that if the federal government decides WAPA will pay the TWG directly, would the President still need to sign an appropriations bill for that to be true. Lee responded in the affirmative and added that if Congress does not pass an appropriations bill, the program would continue to be funded through appropriations like in FY2019.*
- *Someone asked Lee to explain why Reclamation feels that those previous power revenues can't be spent now. Lee responded that it was to be as consistent as possible with the OMB directive stating*

that Reclamation cannot use power revenues for this program unless the directive changes. Someone asked if that meant that if WAPA pays in FY2020, the TWG could use the money. Lee said she could not make any promises but hopes that will be the case if Reclamation gets has clear direction from the federal government that it could go back to using power revenues as a funding source.

- *Leslie James commented that it seemed there would never be certainty in with the budget situation. Shane responded that there needs to be rationale for not using those funds because Reclamation thinks WAPA has a different interpretation. Shane added that WAPA would try to resolve the issue with Reclamation soon, but that it is still Reclamation's decision whether or not to spend the money. WAPA's opinion is that those funds were available to be spent because they were given prior to the OMB guidance. Leslie clarified that she was commenting on how much OMB requires that departmental requests have specific language in appropriations bills. Shane responded that WAPA's interpretation of that language is that it stands until WAPA is directed otherwise. Leslie stated this was unfortunate because these programs never had to have specific directive language because of the Grand Canyon Protection Act in the RIP, which everyone assumed provided that direction. Leslie added that this was not a good precedent. Lee responded that she hoped a long-term solution and long-term clarity would happen soon. Those conversations are happening in higher levels at Reclamation and Lee hoped WAPA was doing the same. Leslie agreed that WAPA should also be having those conversations.*
- *Melinda Arviso-Ciocco asked Bill Chada for updates on where some of the funding went for the D5 Documentation project and some of the other projects Melinda and Bill previously reviewed. Melinda wants to get a better grip on what was happening to provide more technical assistance to the TWG. Melinda wants to keep the conversation that started with Bill moving because there are some projects that came from the tribes that did not get funded. Bill said that Reclamation was hoping to fund some of those projects with the contingency fund, but because Reclamation cannot access those funds at the moment, Reclamation had to put that funding on hold. Bill added that Reclamation is not writing off those projects and is keeping those as additional projects than can be done as Reclamation has the funds. Bill said the money for the D5 Documentation is still available and suggested talking with Melinda later to start using those funds. Melinda asked what the difference was between using the contingency funds and what Bill suggested. Lee responded that, previously, Reclamation thought it could pool and compile those funds, but there is still a $30,000 line item in the FY2020 budget that Reclamation wants to use. Lee said that if there is an opportunity for projects, that the tribes should propose for those funds; Lee would like to move forward with that.*
- *Melinda stated that the tribes submitted three proposals that were changed to fit the scope of how budgets are done. The tribes also requested updates, but Melinda understood that was based on reports that needed to be submitted. The DC Office has those, so everything has been submitted, and the tribes are waiting for a response. Melinda added that some of those projects were proposed and approved prior to her involvement in the TWG, but Melinda has not seen the list change. Bill responded that the FY2019 funding for the Navajo Nation has been approved and the reports submitted and accepted. The notification to provide the Navajo Nation with the FY2019 funding has moved forward and the money is now available to the Navajo Nation. Reclamation was still waiting for some additional information from the Navajo Nation, including the scope of work for the PCP documentation. Reclamation needs to have an idea of exactly how the Navajo Nation plans to spend the money. Once Reclamation has the scope of work for the project, Reclamation can modify the existing agreement and provide the Navajo Nation with that funding. Melinda said she understood that and was referring more to the three projects that the tribes proposed that did not get funded. Those are projects that the tribes wanted to do, but Melinda's understanding was that those projects were not within the scope of land boundary that the tribes wanted to use, which the tribes do not*

agree with. Bill responded that the tribes would need to modify those proposals, so the scope is applicable to the LTEMP and to the TWG. Melinda asked if the group could move forward on getting the project status updates in relation to the cultural resources budget line items, including what has been completed, what has not, and what is still needed. Melinda thought the direction that Reclamation and the tribes discussed was for participation funding justification, and she asked if Reclamation had made a decision. Lee responded that the participation funding was still on Reclamation's radar and that Dr. Tim Petty was interested in talking through that request. Reclamation has conducted some research on how the participation funding originated and how it was intended to be used. Lee anticipated having an update for the tribes during the August meeting.

- *Melinda said there have been communication issues and requested more direct communication regarding budgets, conversations on projects and statuses, and on reports and updates. Melinda thought more direct communication would prompt faster responses from the Navajo Nation. Because it is such a large tribe, it can take a while for communication to filter down to where it needs to go. Lee agreed and stated that Reclamation has committed to regular monthly calls to keep dialogue open and to ensure everyone is on the same page. Lee asked that anyone who does not feel in the loop should let her know. Lee is willing to have more regular direct communication.*
- *Seth said he heard Melinda bring up the same topics a few times. Seth wanted to ensure that the TWG was setting up the process to be able to answer those questions. Seth pointed to the monthly meetings as one solution but did not expecs to see any changes to the currently proposed budget.*
- *Lee stated one question was in regard to the process and how Reclamation is tracking when money is moved over and put to use. The TWG has discussed including an introduction to how the budget works during the August meeting, either as an agenda item or as a side discussion. Another question was regarding the report out process. The TWG is interested in having some of its partners who are using funds report out on how the work is going. Melinda suggested having Bill do some reporting at the monthly meetings.*
- *Peter Bungart commented that because of the federal government shutdown, the TWD did not receive funding until two or three months ago. Peter asked if there was no carryover into FY2020, what would happen to excess funds at the end of the fiscal year. Tara Ashby responded that when the funds are obligated at the beginning of the agreement, those funds sit until the end of the agreement, which is usually five years. The TWG should be spending those funds each year during that five-year process. In theory, those funds stay there for five years, but Reclamation looks at how much has been spent. Someone who is completely out of funds would get paid prior to someone who has not spent all their funds.*
- *Stewart Koyiyumptewa stated he was asked to provide comment on the Hopi Tribe's budget, and a key point the Hopi Tribe made was that the tribe is stuck with funding that has been allocated to the Hopi Tribe since the 1990s. Stewart wondered where that budget was and whether there was a possibility of raising those budgets to better fit current costs. Lee responded that there has been a request to increase tribal participation funding, which has been $95,000 per year for each tribe since 1999. Meanwhile, Reclamation and GCMRC have been capturing CPI and inflation impacts that the tribes have not received. Lee stated the tribal participation budget is a concern that Reclamation and DOI have been taking seriously. Discussions on the history of tribal participation finding and how that figure was established are ongoing.*
- *Melinda requested a timeline for when tribes could expect a response or further the conversation. The Navajo Nation has not submitted formal comments because the tribe wants to have an idea of where the projects are to determine how much more staff the tribe would need to implement those projects and to be able to calculate how much funding the tribe would need based on that information. Melinda informed Bill and Kathy of this during their call. Lee stated that having those*

comments and justifications would help to inform conversations with Water and Science. Lee excepts Dr. Tim Petty to report a decision by August. Melinda again requested status updates on each line item she had discussed with Bill. Lee suggested a follow-up call to walk through that information.

Development of Budget Recommendation to the AMWG

Presenters: TWG Members

Presentation Summary: This was an opportunity for TWG member to further discuss budget recommendations to the AMWG.

Discussion:

- *Seth asked if the members would like to bring up any concepts or projects for the 2021-23 process. Lee asked if new project proposals would be part of the new triennial workplan process and if so, when would the planning start for the 2021-23 process. Seth said that for the next triennial budget, the process would start this fall after this budget is approved and implemented. Then in January, once the annual reporting meeting kicks off, there will be quite a bit of development of activities and thoughts for the next budget, there will be a lot of discussion in the January to April timeframe.*
- *Bill Chada agreed with Seth, adding that if there was a contingency fund, additional projects could be considered as they come in, but without that fund, projects are pushed to the next triennial workplan.*
- *Ken Hyde mentioned that, as discussed earlier, there is a proposal for 2020 amounting to a little over $100,000 which would cover all three components of incentivized harvest including the tribal youth program, guided trips, the restoration reward, and also one fishing tournament meant to initiate developing in the angling base for catching brown trout. Jim Strogen asked for clarification on whether this request is about researching the way to make those things happen effectively or for implementing those plans for water. Ken said it is meant for implementing those plans, but it would be done under a research proposal that would yield numbers of fish that would be turned in and the numbers of participating anglers. This could also show how well the tribal component was working. Jim noted that it seems a lot of details that need to be worked out before it is ready to be implemented effectively.*
- *Ken responded that since this is 2020 funding, it allows time to have everything in place. He added that his group is seeking National Park Service funds for some of this work, which would help to have everything fleshed out and ready to go November 2020 through January 2021 when the brown trout are the most catchable.*
- *Melinda Arviso-Ciocco mentioned that she had forgotten to make a request to Bill for projects and information that was outlined in the HBP. It was discussed briefly in a previous call that the cultural resources ad-hoc group is meant to carry out and then compare projects now that we have the HBP in place. She added that there are a lot of different components at play; the request from Bill and BOR includes updating the status of the two. Bill committed to discussing the various components on the next call.*
- *Jan Balsom said she didn't know if there had been any signatory meetings on the HBP, given her understanding that Bill has had some specific conversations with Navajo and perhaps other tribes, but she didn't believe the NPS has been involved in those. She added that the NPS needs to be better engaged in any discussion regarding planning out projects in upcoming years. Bill agreed, adding that NPS will be involved in conversations concerning the HBP.*
- *Bill Persons asked Ken if he was saying the AMP program should be providing the revenue to help incentivize fishermen to catch fish. Ken responded that the native fish contingency fund, as well as other funds, were available when this proposal was first being considered. The hope is that this work would be considered as a research tool for addressing and alleviating non-native fish issues,*

specifically to avoid ever having to conduct expensive fish removal programs in the LCR. This is being proposed as a potentially useful research tool regardless of how it is funded.

- *Melinda Arviso-Ciocco asked Ken to clarify what he meant when he referenced the tribal youth fishing trips. Ken said that, based on comments from tribes during the planning process, it seemed the tribes, especially the Zuni, were more comfortable with an incentivized harvest where fishermen would remove the fish and be able to use them in their homes. But it was noted that tribal members would have very limited access to this program, so a component was added to the program that would fund up to ten youth and a couple of elders from each tribe to go on a fully guided trip. The intent is to discuss traditional harvest while they are catching fish. Melinda suggested that Lucas follow up with the Chapters he visited about this project. Many of them have questions about how this will help their communities, so it would be useful to involve them in the proposal planning and youth outreach. The focus should be on the Chapters that are directly associated with the river. Melinda added that it is important to follow up on outreach from the previous meetings where there were good discussions about the cultural significance of the fishery. For example, there was discussion about the background of why some Navajo tribal members do not eat fish; it is important to consider the information that is heard.*
- *Stewart Koyiyumptewn said that the Hopi Tribe supports Ken's plan to have an elder and tribal youth go out on the river to talk about the Hopi's connection to the river. It is a once in a lifetime trip; a recent school trip was wonderful, despite the pouring rain. This program is another means of respectfully harvesting the fish instead of using other methods that have been used in the past.*
- *Kirk Young asked for clarification on the level of funding available for projects and whether funding for new projects would come at the cost of existing projects. Lee Traynham said the discussion is focused on the FY20 experimental fund. She added that this is just the start of discussions and the group won't be in a position to make any decisions about how to spend any remaining end of year funds until the middle of FY20. Time sensitive proposals may not be good candidates for these funds. If those funds become available and have not been spent on conditional type experiments that may or may not come up in 2020, they should be put to use. Lee added that there are several good ideas on the table. Not all of them can be funded with the $400,000 up for discussion, but these conversations are helpful. That is especially true for folks who are getting feedback on their proposals; this provides them an opportunity to identify stakeholder concerns. Reclamation is less likely to fund projects that don't have consensus, so this is a good opportunity to discuss if proposals are consistent with the ultimate priorities and goals, meeting scientific research and monitoring efforts, and leveraging the existing triennial workplan dollars with work that's been contemplated.*
- *Craig Ellsworth asked for clarification on line 6 of the incentivized harvest worksheet, noting that it appeared the removal would be closer to 500 than the 250 in the cell. Ken directed Craig to the 1-year tab, noting that the payout per fish for the first 1,000 fish would be $33, but it would drop to $25 after that. Craig thanked Ken for the clarification.*
- *Melinda reiterated the Navajo Tribe's support for Ken's proposal and offered to provide a letter of support. Mike Moran said that Lucas is planning on going back to the Chapters to follow up, adding that he is hoping to also attend some of those visits. The plan is to give the Chapter members a sense of survey results and to convey why these surveys are important.*
- *Cliff Barrett mentioned that that while incentivized harvesting may be a very good idea, the power community is having a hard time seeing it as an appropriate use of the very limited amount of funds available to address the goals of the Grand Canyon Protection Act.*
- *Brian Healy noted that there are about 55 miles of new riverine habitat due to the dropping water levels in Lake Mead. There have been efforts to increase sampling in that area to assess fish communities in the area, but supplemental funding is needed to look at potential fish passage above*

and below Pearce Ferry rapid. Brian proposed potentially funding installation of some pit tag arrays in the area to get some information about upstream movement. He added that this is important because the increase in Humpback Chub seen in the western Grand Canyon may be related in part to this increased river system buffer zone. While Brian did not have a cost estimate for this study, he indicated it might be minimal compared to some of the other projects. This would be a proposal for consideration under the experimental fund.

- *Seth asked if Brian Healy knew the closest pit array that's already in this area. Someone said that the figure from Bob's report just shows but those are sonic receivers. Similar sensors are installed at the inflow for the San Juan and they have been getting several detections for Razorback Suckers within that area. This provides valuable information about how the waterfall at the inflow of the San Juan River might be inhibiting upstream movement. It is worth looking at both potentially inhibiting passage of Razorback Suckers from the spawning population in Lake Mead, but this also might prevent passage of some of the non-native fish species coming up from Lake Mead. That is why there have been efforts to conduct some of the fish sampling, but additional funding is needed to supplement that effort.*
- *Bill Persons ask how it could be funded if Pearce Ferry is outside of the AMP. Someone said there is a concern that non-native fish are moving upstream impacting Humpback Chub populations in the western Grand Canyon; the study would assess the threat to the population that exists within the Grand Canyon. Bill Persons noted that this group has debated where the line is drawn for funding projects for years. The line was drawn at Lake Powell at the fore bay to avoid funding all the fish studies within Lake Powell, although they do come down from Lake Powell into the lower river. It isn't clear how the group could fund a project in Lake Mead, not knowing where to draw the line there. Melinda said that culturally, the line should be where the gulf extends into the ocean. Bill suggested contacting that the MSCP, since they might be interested in doing something like this. Seth said this should not be considered for funding right now, but it should be a topic for future discussion.*
- *Jan Balsom reminded the group of the goals of the program which are resource preservation, improving conditions, and reconnecting history and culture and species for the benefits of the future. The Grand Canyon Protection Act specifically references natural, cultural, and recreational resources and improvement of conditions within those areas from the dam downstream to Glen Canyon National Recreation Area and Grand Canyon National Park. With changing water levels, the river has become a river again below Separation Canyon. Indeed, it outflows into upper portions of Lake Mead where a rapid is forming its own barrier. Jan asked the group to consider the goals and whether proposed projects will actually improve resource conditions and improve the conditions within the river and the canyon. The history and culture and the tribes and tribal relations are specifically outlined in virtually every group document. NPS, Reclamation, and the tribes have been encouraging that kind of connection between tribes and elders through ethnographic work and other efforts within this program. She added that an opportunity to form a closer stewardship between current populations and the elders is an important aspect of this program. The best way to do that may be through partnerships with the MSCP, so it is a shared opportunity. It is important to consider a proposal for a shared opportunity to address native species conservation issues between the NPS and this program in the context of what the group is trying to achieve and what are the tools available to get there. Kelly Burke agreed and asked the group to remember the adaptive management aspect of the program and that this new rapid is a major change in the landscape. She offered support for Ken's proposed project, adding that looking at catch rates might be able to provide some useful perspectives.*
- *Lee said this conversation has been helpful for hearing perspectives, concerns, and level of support. It is an ongoing conversation and something Reclamation would be willing revisit between October and*

March. She encouraged those who brought up proposals to incorporate the feedback they received from the group. She also encouraged submittal of additional proposals for future conversation.

- *Kirk Young presented a proposal to look at what's happening with Grand Canyon from below Diamond down to Pearce Ferry, noting there are probably as many chub there as there might be in the Little Colorado River. There is no baseline or quantitative information to really support that. Also restoring capacity is a priority; after a long time of going backwards, capacity is starting to increase. This is reflected in the budgets presented by Mike. Kirk proposed an additional project to cost share some quantitative assessment of a Chapman, Peterson, Mark recapture, working West Grand Canyon below Diamond, with MSCP. The cost would be about $20,000 a year. Kirk presented a third proposal for an environmental project that would filter water for DNA to determine occupation. There is some third-party funding, but additional funding is needed to look at all the aquatic invasive species. The study would target Smallmouth Bass, Brown Trout, Razorback Sucker, and Channel Catfish distributions throughout the canyon. This technique can be used to look at distribution of rare species throughout the canyon, just by collecting water samples. All the species can be analyzed with the same water, but additional funds are needed to reach the $150,000 level that was originally in AMP but had to be reduced to $40,000 or $50,000. Kirk's last proposal focuses on temperature control. With everything happening in the Upper Basin, it is important to make sure that Reclamation has funding needed to continue some of the feasibility work, specifically on a cold-water treatment for the system, perhaps for hydropower and bypass tubes.*
- *Craig McGinnis stated that the group could really use some guidance from Reclamation about just what Reclamation is looking for in proposals and how past discussions play into how proposals should be designed, including whether it applies to operations at Glen Canyon dam and specifically for the experimental fund. Can experiments be broadened beyond the LTMP? This would help I review. Lee said Reclamation is not far enough along in the process to have a set of criteria, aside this effort being similar to the triennial workplan process. She said the process should be consistent with the LTMP, the EIS, and goals. This is a one-time availability of funds that can perhaps be leveraged with the rest of the triennial workplan budget. The low hanging fruit are things that the group has already committed to with the standing budget and the triennial workplan. Augmenting these efforts is the easiest thing to check off since it has already been reviewed and agreed upon. Let's go ahead and put additional funds in to maximize this effort. As far as the criteria of some of these experiments that are not fitting directly into LTMP, this conversation is helpful. Proposals should not be limited to those that have been discussed previously or are in the triennial workplan. Lee recommended these conversations continue. In October, there may be a list of questions and criteria available to help rank proposals. Seth agreed that it is informative to look back at the actual triennial workplan and the description of the experimental management fund. It says that budget items reserve funds for conducting experiments or management actions within the GC amp with priority given to the LTMP-related experiments and management actions. This could help with identifying where funds could go.*
- *Jim Strogen indicated support for looking at native species protection and looking for information and strategies for preventing spread of invasive species. Vineetha agreed that these projects, perhaps with help from Reclamation and TWG, could be prioritized based on language in the experimental management fund. Kirk's DNA proposal is perhaps heading in that direction, but funding for newer proposals may not fall into that category, so the group can prioritize. She also added that Ryan's pit tag array may not be considered new or experimental work. The group could absolutely prioritize proposals for the experimental management fund based on the criteria that is set forth in the triennial workplan.*
- *When Bill Persons asked if MSCP had been looked at for funding under EDNA, Someone said that they had looked there for cost sharing. The MSCP fund is desirable because it is flexible and can thus*

be used for management actions and recovery actions more constrained for research. Someone said it seems like a logical project for the MSCP.

- *Seth Shanahan asked if there were any other proposals or any changes proposed to modify the proposed GCMRC and Reclamation spreadsheets. Given no response, he moved on to committing to retain the experimental management fund discussion a recurring line item on future TWG agendas. Additional discussions may occur between Reclamation and GCMRC.*
- *Bill Persons recommended a request for proposals that includes criteria and sideboards for evaluation. This would provide a level playing field for those competing for funding. Lee indicated this was a fair request and she would work on providing more direction in October on what Reclamation would like to see if the group will be evaluating proposals for FY20 funding.*
- *Seth added that the description of the experimental management fund prioritizes activities that are related specifically to experiments and management actions, adding that GCMRC apparently has a few proposals that are specific to experiments and management actions, presumably the trout management flow was one of them. Seth indicated that means about $200,000 of activities are at the top of the list because that's the intent of that fund. That may not leave any money left over, but it is still a good idea to make a request for proposals. Jim Strogen asked if there would be a bag meeting to help develop criteria. Seth encouraged the group to review the direction in the triennial workplan, but he also indicated there could be benefit to carrying the conversation forward.*
- *Jan Balsom agreed that there is good direction in the LTMP and procedures as well. The group is considering urgent and important top-right proposals – the types of projects the experimental fund was designed for, such as ESA and Section 106 compliance. These are the top categories for almost everything and the group can rely on guidelines that have already been established and see if proposals pass the test. For example, the DNA proposal resonates because it is a small investment that answers a nagging questions that's affecting our native species integrity.*
- *Kelly Burke asked about coming up with a strategy ensuring that appropriations are predictable as is long term funding through power revenues. She asked if there was any sort of contingency planning. Seth responded that this is less a topic for the TWG, unless directed by AMWG to consider it. It is an emerging issue. Seth indicated he would consider bringing it up at the AMWG meeting. Kelly asked if there was anything members could do. Seth encouraged members to call their congressional representatives. Vineetha indicated that Leslie James of CREDA, she already kind of alluded to this issue and already mentioned there needs to be some high-level conversations, but it isn't something that can be addressed at the TWG level.*

Motion:

The TWG recommends that the AMWG recommend for approval to the Secretary of Interior the fiscal year 2020 budget as described in the attached Bureau of Reclamation and GCMRC budget worksheets presented at the June 11, 2019 TWG meeting.

Motion: Cliff
Second: Craig (WAPA) seconded.
Passed by consensus

Management of Downstream River Temperatures – A Review of Methods, Study to Date, and Discussion Factors to Consider

Presenters: Reclamation and USFWS

Presentation Summary: When Glen Canyon Dam is full, Reclamation typically releases from the penstocks, of which there are eight at a height of 3,470 feet. Reclamation generates power when the

penstocks feed the power plant, and Reclamation tries to release from there. When the reservoir is full, the penstock pulls in cold water from the high metalimnion layer, which cools temperatures in the river. The impacts are, however, conditional. Prior to building the dam, temperatures had a wide range, but with releases from the cooler metalimnion after installation of the dam, temperatures have been steadier. This changed in the 2003 to 2004 period when the reservoir elevation dipped, causing penstocks to pull from warmer water to release downstream. Although temperatures are higher in the summer, water temperatures have not varied as much as they did prior to building the dam. Starting in 2003, Reclamation started to see late summer and fall temperatures go up above 12 degrees, with a peak of 16 degrees, because the lower reservoir elevations are pulling in more water. This impacts temperatures downstream, which is a concern because warmer temperatures are advantageous to non-native fish that compete with native fish, and it could encourage disease and parasite growth.

Reclamation needs to consider whether there is a need to change the problem statement when moving forward with feasibility studies. Reclamation has conducted temperature control studies since 1978 when the BO triggered a need to look at temperature impacts in the mid to late 1990s. In 1999, Reclamation drafted a science plan with GCMRC and developed an EA, which led to the scientific review panel having strong concerns with potentially negative effects, particularly related to non-native fish. The feasibility studies were all conducted with the focus of looking at warm water releases to counteract cold water conditions. Reclamation was starting to see the impacts of drought between 2004 and 2006, which drove a second round of feasibility studies because the fixed inlet solution was no longer an option with lower reservoir levels. Reclamation and NPS considered potentially entraining non-native species in the dam, but opted not to move forward with the initial design of that study. Reclamation and NPS are still interested in pursuing and addressing this issue and are looking for more current workplan drivers. The 2016 LTEMP ESA has a conservative measure related to addressing temperature concerns in the dam, and there are plans to address that, including an evaluation of current and evolving technological advances that could provide for warming and cooling the river in high and low flow discharge scenarios and in high and low reservoir levels.

Connie Svoboda has been working with Reclamation on a summary report of what current and evolving technologies might be. Reclamation's research and development office is considering running a price competition on temperature control of reservoir release flows, which would not be specific to Glen Canyon, but would be a general competition to find new ways to provide temperature control using citizen solvers and crowd sourcing to provide solutions. Reclamation is considering a potential prize competition for FY2020, which could last about two years. Reclamation realized it did not have much information about applications of technologies, other than selective withdrawal and temperature curtains. Connie has been looking at alternatives that have been used in practice and in theory and expects to complete the report by the end of FY2019.

Reclamation has considered the idea of potentially installing power generation capabilities on bypass tubes. In the 1980s, Reclamation studied this as part of a feasibility study to increase peaking power. Reclamation proposed two hydropower units for a total capacity of 250 megawatts. At the time, the price was $155 million, and the initial study concluded without moving on to feasibility due to opposition to any additional development that might impact the Grand Canyon, the decreased need for peaking power, and budget cuts. Reclamation reconsidered that study in 2018, and TSC recommended that Reclamation consider conducting a new feasibility level study to better define the actual project assumptions and current needs. Reclamation is currently reviewing TSC's project management plan for a price tag and as a potential option for moving forward. The potential economic benefit of having generation on the bypass tubes might outweigh the cost of the project. Reclamation expects to review

TSC's report to determine whether there are any feasible technologies that would work for cold and warm water solutions. Additional details are in Attachment 7.

Discussion:

- *Kirk Young commented that an increase in warm-water non-native fish and fauna has created challenges to recovery for three species of native fish and asked whether Reclamation should spend time thinking about how to manage times when specific objectives call for warm water and when Reclamation is concerned with invasive species. Kirk's biggest concern was water that is too warm, especially in the Upper Basin and in the Grand Canyon where warm water fauna would present challenges. He was also interested in what others thought.*
- *Bill Person said he did not think the statement about disadvantages of adult, non-native fish was accurate. Adult non-native fish can handle cold water, but they cannot reproduce in cold water, which is a disadvantage to non-native fish. Craig McGinnis added that when temperatures increase, fish metabolism increases. When fish metabolism increases without an increase in the available food source the result is undernourished fish. Reclamation has been working to improve the food base because this concern could have a negative impact on native fish. Another concern happens when fish pass critical density and the food base becomes a problem.Bill Persons stated that under the bug flow issue, when insects lay their eggs in cold water they may not hatch for a year or longer. Jim Strogen thought that the likelihood of lower lake levels would provide warmer water. Jim expressed concern for losing a management tool that can cool water when necessary.*
- *Jan asked how Reclamation felt about low summer flows. Kirk thought the biggest challenge was that there was no cover for the warm water fauna that could invade the area. Kirk was not too concerned about the lack of a low summer flow but was concerned with the prospects of warm water fauna living at the mouth of the LCR and in prime native fish habitat.*
- *Lee asked if Connie has had a chance to review some of the technologies in more depth and if Connie saw any one technology as a potential game changer for cold water temperature releases. Connie responded that selective withdrawal systems have been shown to be effective, but those are costly. Some of the surface pumps and destratification devices might also be an option, but Connie was not sure those would be effective enough.*
- *Someone asked how Connie was incorporating water quality into her study. Connie responded that she was considering other types of water quality except temperature; however, Reclamation would need to focus in on temperature almost exclusively with the potential for some other water quality components. Someone asked if Connie's work was being funded through Reclamation or some other process. Connie responded that Reclamation's Research and Development was funding her research. Lee added that Reclamation did not use program funding for Connie's efforts. Someone asked how studying the release of cold water interfaced with project E of the GCMRC budget. GCMRC is looking at temperature, but not in a sense of whether colder temperatures can be released from the dam. It is more focused on monitoring temperatures and not affecting them in any way.*
- *Craig Ellsworth stated that WAPA was interested in seeing the increased power generation on bypass tubes study move forward. WAPA wants to ensure analyses for falling below powerplant as well as options for passing water, and what those mean for generation at Glen Canyon, are included in the study.*
- *Someone asked if the study would preclude whatever else Connie is doing. Lee stated Reclamation wanted all options on the table. The generation on the bypass tubes is expensive, and there is a limited pool for conditions under which to release from the bypass and a limited cooling capacity available. Additionally, there is not a lot of flexibility with this solution. Reclamation needs a solution that would be relevant at high reservoir levels, at low reservoir levels, for warm water deliveries, and for cool water deliveries.*

- *Someone asked if Reclamation was looking strictly at hydrogeneration versus the cost of constructing and commented that there are other values to consider that are not associated with a monetary value. Lee responded that Reclamation wants to capture those additional values but that a large price tag means Reclamation needs to have a solid justification for moving forward.*
- *Craig mentioned that there has been discussion about how large the non-reimbursable side of the account could get over the next 10 to 20 years if the appropriations bill passed and Reclamation had access to power revenues again. A large capital expenditure might qualify for an extension of non-reimbursables, which was how Reclamation had been funding programs like these. Lee responded that was something to consider.*
- *Peggy Roefer commented that there is a big difference between warming and cooling and asked if, after receiving all information, Reclamation would focus on cooling or would Reclamation focus on both cooling and warming. Kirk responded that Reclamation was interested in a tool that does everything. Kirk added that although it might seem like that tool probably does not exists, Reclamation should use the process to look for ideas and answers.*
- *Jan Balsom commented that the problem statement was really about what could be done to advantage the native populations and disadvantage non-native populations in the river below the Glen Canyon Dam. Jan mentioned not wanting to see whatever mechanical fix Reclamation develops exacerbate another problem. Jan added that she was glad to hear of the prize competition because there are a lot of smart people that could propose different solutions.*
- *Peggy suggested doing a mass balance with salt because water at the bottom of Lake Powell is saltier. Peggy was concerned about increasing the salt concentration leaving the dam.*
- *Kirk commented on a couple of things to keep in mind, including having something ready in case the project qualifies for an infrastructure proposal that could pass through Congress. Kirk also stated that Reclamation might consider how to manage water temperature on the cusp, so when elevation drops down to minimum flow in overnight periods, Reclamation could cool things down enough to hit the appropriate temperature mark.*

Public Comment

Comment/Discussion:

- *There were no public comments.*

Meeting Adjourned at 5:00 pm

Glen Canyon Dam Technical Work Group Meeting
June 11-12, 2019

Date: June 12, 2019 **Start Time**: 8:30 am
Conducting: Seth Shanahan, TWG Chair
Meeting Recorder: Rosana Nesheim, Galileo Project
Attendees:

Committee Members/Alternates Present

Jan Balsom, NPS, GCNP
Clifford Barrett, UAMPS
Peter Bungart, Hualapai Tribe*
Shane Capron, WAPA
Bill Davis, CREDA
Craig Ellsworth, WAPA (Alternate)
Charlie Ferrantelli, Wyoming State Engineer's Office
Derek Fryer, WAPA
Paul Harms, New Mexico Interstate Stream Commission
Brian Healy, NPS, GCNP
Ken Hyde, NPS, GCNRA
Leslie James, CREDA*
Vineetha Kartha, ADWR
Stewart Koyiyumptewa, Hopi Tribe
Ryan Mann, AZGFD
Craig McGinnis, ADWR
Jessica Neuwerth, CRBC
Emily Omana-Smith, Reclamation*
Bill Persons, Trout Unlimited
Ben Reeder, GCRG*
Peggy Roefer, State of Nevada
Seth Shanahan, Southern Nevada Water Authority
Jim Strogen, Trout Unlimited, IFF
Kirk Young, FWS

USGS/GCMRC

Tara Ashby
Helen Fairley
Ted Kennedy
Michael Moran

Reclamation

Heather Patno
Lee Traynham

Interested Person

Rob Billerbeck, NPS
John Jordan, Trout Unlimited & IFF
Amy Ostdiek, State of Colorado
Sarah Rinkevich, DOI

Denotes attendees participating solely via Webinar

Presentations and Discussion

Welcome and Administrative
Presenter: Seth Shanahan, TWG Chair & others, as assigned
Presentation & Discussion Summary:

- Quorum Established with 16 members or alternates present.
- Unresolved issues from yesterday's meeting: There were no unresolved issues from the previous day.

Trout Management Flows – A Review of Information Needs, Research to Date, and Next Steps
Presenters: Josh Korman, Ecometric Research
Presentation Summary: TMFs are typically conducted during the summer to reduce the probability of larger recruitment events of young rainbow trout in Glen Canyon. TMF studies have shown the majority of rainbow trout tend to hold around the daily minimum flow elevation even when flows are at their daily maximum, so the idea would be to bring out flows to a TMF high flow level. This would cause young trout that depend on shallow water to eventually move upslope and seek more refuge in lower angle, slow velocity, shallow habitats. When the flow drops suddenly, some of those fish would be stranded and killed, potentially reducing the recruitment of trout. USGS has some idea for timing the TMFs because trout spawn from the fall through the end of spring, with the majority spawning in March and April and emerging about two months later. May through July would be a window of potential times for TMFs.

High levels of trout abundance at the LCR have the potential for negative effects on the humpback chub. There are, however, some concerns about TMFs that stakeholders have voiced, including tribal concerns with the taking of life. The angler community and members of the general public have also voiced concerns on the number of trout that would be killed. Since there is no way to mitigate those concerns, it is up to the stakeholders to determine whether or not to implement TMFs. Additional concerns include cost to hydropower, increased beach erosion, and the potential stranding of native fish further downstream, all of which could be mitigated under certain circumstances. TMFs could be timed with equalization flows and beach erosion that is already occurring. Farther downstream, where there are larger populations of humpback chub, would not experience TMFs as low or as quickly due to the dynamics of the wave propagation.

Data has shown that when growth rates decline rapidly, such as during a drought, fish have low growth and poor condition and are more likely to die off, leading to an immediate reduction in subsequent production. Data has also shown that high winter and spring runoffs result in more loading of phosphorus, which is a plant nutrient. This leads to more availability of food for the trout. High turbidity also limits how much trout consume because trout are visual predators. Research on the extent to which HFEs clear the water during the winter and promote trout is ongoing. The number of fish in acceptable condition is usually highest in the summer and drops in the fall and winter when there are low growth rates. Long-term decline in trout conditions occurred between 2012 and 2014 when the fish did not fully recover each summer, which led to a large die off. Data suggests this die off was largely the result of a reduction in phosphorus caused by a persistent drought. Limited recruitment continued through 2015 because of poor condition of the fish. Then recruitment increased in 2016 and more significantly in 2017. The current population is in good shape. One reason for the increase in growth rate is the increase in food availability. GCMRC has been working on the phosphorus data from Glen Canyon Dam. Steady flows that were imposed in 1991 are believed to have contributed to an increase in trout population. Data has also shown that the greater the recruitment in Lees Ferry, the more that young

trout are found in the Upper Marble Canyon. This supports the EIS assumption that limiting recruitment at Lees Ferry could limit downstream dispersal, but with severe tradeoffs to the fishery.

Conducting TMFs in May and June would likely be most effective, but it would be difficult to know how big the cohort of trout will be that early in the year. Another option would be to wait to see recruitment strength for TMFs in July or August, but that could also be too late to conduct the TMF. USGS will need to look at different ways to predict recruitment in an upcoming year, including monitoring contributing factors to higher trout recruitment. Additionally, USGS will need to reduce uncertainties for how high to conduct the flows and how long the flows should be held. Additional details are in Attachment 8.

Discussion:

- *Jim Strogen asked if the TMF applies to both rainbow and brown trout and if an earlier TMPF would impact brown trout negatively and also provide nutrients to the river to better impact the food base. Josh responded that the TMF applies to rainbow trout, and it would be earlier because their spawn is in the fall and early winter. It would be hard to detect the effect on brown trout because their abundance is still relatively low. Josh did not know whether there would be any nutrient factor benefit but added that more aquatic vegetation is more conducive to the brown trout. Josh added that even if the TMFs work on the rainbow trout, it would be difficult to measure the effects on brown trout.*
- *Bill Persons commented that Josh had mentioned there was about a 30% reproduction by the existing trout population in earlier years and asked how Josh derived those numbers. Josh responded that he used the Mattax, et al. study, in which the authors were doing some tetracycline marking or CWT tagging. The number of trout that were caught without the mark or tag was about 30%.*
- *Someone asked what was wrong with 30% recruitment by the population under those conditions. Josh responded that reduced recruitment leads to less trout and lower catch rates. Some evidence suggests there would also be bigger and healthier fish. Someone stated the fishery could not be sustained with natural reproduction at that rate, and it collapsed when stocking was discontinued in 1980 and 1981. The stocking was also discontinued in the late 1990s. The area was already under stable flows at that time, which helped the rainbow trout reproduction. Josh stated that would be the case if one were to try to reduce recruitment by a chronic effect of greater fluctuations, without thinking about impacts from operations and other resources. Josh was interested in what the data shows about the effectiveness of the bug flows.*
- *Someone asked if there was any hope for simultaneous bug flows and TMFs. Josh responded that Scott VanderKooi would rather not mix the two because it might be difficult to sort out the results when too many things are happening at the same time. It might be logical to finish the bug flow and determine whether that is an effective tool before moving on to another experiment. Someone added that there had been limited discussions on pairing or developing an experiment with Project N, but it might be a good idea to look at a couple of different resources with that type of experiment. TMFs were previously done in the winter, so it might be a good idea to do them in January or February because of the potential benefits to power during winter months.*
- *Josh did not think winter TMFs would affect rainbow trout, but they might affect brown trout. Flies are not laying eggs at that time, so it might be feasible; however, USGS would need to sort out the effects on brown trout. Brown trout were not considered when it was done in 2004 and 2005. Those TMFs focused on rainbow trout, and there was not much of a response at the time. However, based on the drought that occurred at the time, the system was impaired with low food availability. Now that there is a different water outlook, conducting TMFs in the winter would not have the same effect as in 2004 and 2005. Josh agreed but stated that it would not affect rainbow trout.*

- *Bill Persons asked if the group could see a chart showing the intensity of spawning each month of the year. Although the ideal time for TMFs would be during peak spawning, there could still be an impact in a winter TMF because rainbow trout also spawn in November. Bill asked what the impact on rainbow trout population would be with TMFs in winter versus peak spawning time. Josh responded that young trout are difficult to find prior to May, so any data from that time of year would have to be historical data and unobservable. Although there is spawning at that time, it is to early to tell the difference between rainbow and brown or red trout.*
- *Jan Balsom stated that the analysis in the LTEMP EIS looked at increasing fluctuations, which could help with one resource but be a detriment to other resources. Discontinuing stocking could lead to an immediate crash, but one of the graphs shows that was not the case, which makes it difficult to tell what actions should be taken in the system. Someone responded that the fishery is now in recovery and that leadership would have likely recommended stocking two or three years ago.*
- *Someone asked whether powerplant load could be used to bring the sediment up prior to an equalization flow. Josh responded that a powerplant capacity flow involves bringing water up and studying colonization rates of the habitat.*
- *Jan asked whether, given what is now known, Josh would predict a good recruitment if there was an equalization year again. Josh responded that it would be a value decision and that the science is strong but not definitive. One would need to trade the risk of not producing a lot of trout habitat or having a wave of trout go downstream, as it happened in 2011. Jan commented that the humpback chub population is doing well, but it's important to recognize factors like the recreational fishery at the upper end and a natural aquatic system that needs to be protected at the lower end. Jan suggested thinking about what the opportunities are to address some of the data gaps going forward because there might be an opportunity to conduct some of the experiments outlined in the EIS. Josh stated that the balance of things for the TMFs has shifted with information that changed after the EIS went public.*
- *Ryan Mann commented that he saw two uses for TMFs: limiting the numbers of fish overall that are moving into downstream systems and the potential as a management tool for just controlling the trout populations. A lot of that depends on phosphorus levels coming through the dam and methods for reducing the probability of a crash. Ryan added that bug flows are encouraging, but still preliminary. Ryan asked whether Josh foresaw a scenario where phosphorus levels and the health of the trout could be accurately predicted to determine whether a TMF would work out. Josh responded that he is hopeful that harvest or bug flows would be significant enough to make a difference. 2011 had good conditions that could have worked for a TMF. Josh added that it is hard to predict how many of the trout would live past four years when deciding whether to improve recruitment.*
- *Someone asked whether there was anything that could be done about carrying capacity as a management tool for the trout populations. Josh responded that lowering recruitment in 2011 and conducting the TMFs might have mitigated the collapse in the trout population. Fishing would likely still have been above targets, making the TMF successful. Someone stated that catch rates are only half the story when discussing the fishery. Trophy or size of fish is also a concern. The anglers might want to get back into scenarios where fish were larger. Josh responded that the fish in the last couple of years have been some of the largest fish. Fishery managers would need to decide whether to cut back recruitment. Josh does not think conditions will remain favorable to sustain the 2011 cohort because eventually the food base will likely drop, which is something that happens in cycles. Trimming the cohort back would likely help to avoid a possible collapse. Josh suggested researching mitigation alternatives like producing more food.*
- *Craig Ellsworth commented that the LTEMP mentions a mechanism of stranding young fish. Craig asked whether that mechanism was pre-ROD stranding or if it was just an idea to move those young*

fish into an environment that was not conducive. Josh responded that the Korman and Kapana study found that, for the most part, young fish stayed at the high-water level of the daily maximum. Josh added that the more habitats the fish can't use at all, the more those fish are at a disadvantage. This leaves less habitat and reduces capacity and recruitment. The mechanism in the LTEMP was not so much stranding as it was reducing the survival and growth through a chronic effect.

- *Craig asked Lee that is there were different mechanisms worthy of study for TMFs, what sort of sideboards are within the LTEMP to study different mechanisms. Lee responded that if it was outside the sideboards envisioned in the LTEMP, it would be a heavier lift. Reclamation could probably get to some justification to better understand the dynamics of the trout population, but testing an experiment is a different mechanism than was envisioned in the LTEMP. Lee added that it would merit more conversation. Jan Balsom commented that NPS has an opportunity to use the same resources and mechanisms used in designing the LTEMP and refine those based on new information.*
- *Seth stated that for any number of uncertainties that Josh pointed out, the TWG could help facilitate by looking into one or more of those experiments, as long as the LTEMP states TMFs could be conducted in any number of ways. Rob Billerbeck stated there is flexibility written into the EIS and the ROD for applying it to the rainbow or brown trout and adjusting the timing. Rob added that changing the TMF to a different daily fluctuation routing would likely not be supported by the LTEMP. Rob questioned what the defense would be for changing to something else if what is in the LTEMP has not been tested. The EIS extensively evaluated effects of a lot of different high fluctuating regimes and found a lot of negative impacts to other resources. Rod cautioned against focusing on one resource. Rob asked Josh what his thoughts were on inflow and phosphorus based on what happened in 2011 and what Josh thought would happen with a large recruitment event likely caused by equalization. Rob also asked what the possible dangers where to the rainbow trout fishery, based on the big data point of 2011. Josh responded that the impact on the humpback chub seemed to be just one factor, and there is currently little recruitment of the humpback chub coming out of the LCR, which would not make a difference. The limiting factor is the expanding population in the western Grand Canyon. The risk is low, but it is a value-based risk. The bigger risk is probably that the brown trout would expand. Josh added that fisheries survive during fish collapses and looking back and understanding what happened in the past would lead to less panic if a collapse occurs.*
- *Someone asked if an equalization year could lead to a collapse and impact to the humpback chub again, and what would happen if TMFs were not used. Someone suggested trying this to see if the rainbow trout fishery collapses, if the brown trout increases, or if there is an impact to the humpback chub. Josh responded that one could also learn more from TMFs on the rainbow trout and apply that to the brown trout, but that might be a bigger risk; however, one could also learn if the TMF was effective for rainbow trout and if it were more likely to be effective for brown trout. This could increase confidence in a potential tool.*
- *John said the comprehensive fishery management plan and the NPS comprehensive fishery management plan included a provision for stocking in the event of certain conditions, and that the declines are in the realm of those concerns. John added that in discussions about whether this meets compliance, NPA and FWS would provide nebulous, circular answers like "kind of, maybe, sort of," which led to a situation where when one of those events occurred there were written assurances that were provisions but not practical assurances. John did not think there was a long-term plan for the department to stock beyond a couple of years, and part of that would be to measure its effectiveness on improving the fishing and its impact on humpback chub downstream. John added that there was a lot more to this than just adding fish in now that the fishery is recovering.*
- *Kirk Young commented on the issue of mortality in the canyon, which is a big issue, and the scenario of having a fish boom and then collapse without management. Kirk asked whether Josh had a feeling for the relative magnitude of the either allowing collapses every seven or eight years or intervening*

periodically with the TMFs. It might be worth noting that large mortality events would occur either way. Kirk also commented that temperature appears to be a big covariant for phosphorus in the system. Humpback chub might be responding to the lack of phosphorus or the temperature might be causing an impact. Josh said he thought the conditions of humpback chub correlated with some of the reservoir cycles, suggesting that the phosphorus signal could be traveling downstream. Josh added that when the phosphorus is high, the lake tends to be high, so the temperatures tend to be cooler coming out of the dam. Kirk asked whether this negated the effect, adding that he agreed there was some compelling factor, but that is was hard to ignore major population expansions that seem to have taken place at some of those same timeframes. Josh said the population expansion in the western Grand Canyon could be different because the biomass there has been increasing since 2014. There are more fish biomass than there should be, and water clarity might be a factor.

- *Seth said that though it was important to remember it was not just a tradeoff between killing or not killing a large number of trout, but it was also about having intermediary steps that perhaps kill fewer fish over a period of time. Seth also said Josh had mentioned doing some additional work that the experimental management fund might not fund. Seth asked Josh to bring up that slide, so the group knows whether this is something that gets triggered. Josh stated his understanding was that there was a contingency coming from the experimental fund that would cover the field costs for a TMF or for learning about TMFs, like a powerplant flow to be better informed about causation prior to studying those things. Josh added that there is some contingency to measure recruitment before and after conducting a TMF, and this might be due to the potential spring HFE.*

A Review of the 2017 Knowledge Assessment (KA) and its Utility for Organizing Information about Potential Future Experimental and Management Actions

Presenters: Seth Shanahan, TWG Chair

Presentation Summary: The KA organizes information about potential future experimental and management actions. The next KA is expected to come out in about six months, and it will be important for understanding how experiments are affecting resources across the board. The TWG needs to review KA methods to be able to use the KA to organize information in a way that makes sense and for the TWG to start seeing tradeoffs in a more obvious way. This should help direct some of the research effort and to resolve some uncertainty. The TWG does have resource goals, which the LTEMP identified, but does not have quantitative measures that help evaluate performance toward meeting those goals. TWG is waiting for Reclamation and the DOI agencies to develop a path forward on those monitoring metrics. TWG recognizes that with some goals, the maximum extent can't be reached without the detriment of affecting another goal, and that balance might shift over time.

2017 KA objectives were to summarize what was known, to assess needs for monitoring, and to identify knowledge gaps. The TWG now wants to focus on the experimental and management actions part of the KA to try to determine what certain actions might look like and how those affect any number of resources. The new KA includes color-coded symbols to make it easier to see how strong the average expected effect of a resource would be and how it could change over time. TWG would need to define the timeframe on some of the effects because timeframes could vary depending on the experiment. One consideration would be to find metrics that could be applied for various factors. Additional details are in Attachment 9.

Discussion:

- *Rob Billenkemp said this is a great potential tool similar to what NPS has used as part of the scorecard report on resources in the Park. Rob noted, though, that combining numerous subparameters such as high quality, quantitative data with lower quality qualitative data may erode confidence in the analysis and even provide misleading results. He continued that one way to deal*

with this is to not combine the qualitative (like visitor experience logs) with the quantitative data (like the Lucas study). He noted that in the past, it is the use of high-quality science that has helped guide the AMP.

- *Seth acknowledged the difficulties of trying to roll these kinds of metrics into one value to make it simple. He noted the tradeoff of trying to distill out a lot of different information, so it needs to be representative. He pointed out the power of the spreadsheet tables, which identify those disparities between high confidence quantitative measures with lower confidence qualitative measures. He noted that the approach in the EIS does a great job with this and pointed out the value in providing a broad understanding, even if it doesn't show everything. It serves as best available data.*
- *Bill Persons asked about averaging across the resources, noting it is difficult to come up with a single number to reflect varying results. Seth said that there were two different measurements for the aquatic food base in the 2017 knowledge assessment. So, there were two measurements for each experiment (the food based diversity and a secondary production measurement). These were averaged arithmetically (one plus the other divided by two). But the report acknowledges the potential issues with averaging, indicating that there may possibly be more benefit in weighting values or showing values another way. Seth did not advocate a method, other than capturing information, and deferred to Ted and Jeff's powerplant capacity flows conversation, indicating he would like to hear their best professional judgement on how to determine powerplant capacity flow affect, what is the strength of that effect, what is the direction of the effect, and what is their confidence in the findings. That would help populate the spreadsheet.*
- *Seth continued, saying there will be another knowledge assessment in line with the annual reporting meeting in January of next year. He has asked Scott to talk with his staff about using the same tools to get this information, focusing on improvements. Vineetha asked whether the fall HFE's would be powerplant capacity and whether the resources presented are the entire suite of resources. Seth responded these are not all of the resources, since they were not able to address tribal resource values. He suggested keeping the resources as they are because that is what was done, but spend some time examining how to address this. The other component is that this list represents more than the LTEMP, including water quality and aquatic food base, so there's a little discrepancy.*
- *Seth indicated the objective of the presentations was to get a chance to talk to subject matter experts and ask the pointed questions about the presentations and the assumptions that went into them. Then the group can ask them about their level of certainty in their assessment of the information provide so the group can determine whether new or different information is needed. Jan added that the group should consider this an opportunity to question what the experiment is trying to achieve, what can be learned from the experiment, and what is still not known. That will help in determining if an experiment is a good tool to evaluate what the effects are going to be on resources of concern. Seth recommended reserving judgement on whether a concept is feasible until the process of understanding the information, assumptions, potential outcomes, and level of confidence are discussed.*
- *Peggy Roefer referenced the topic of a potential spring HFE as a good example of the need to determine what the impact would be to all the resources. This mechanism is a good way of tracking that process. Mike noted that since an experiment starts with a hypothesis, this is a good way to form a hypothesis. An example is the relationship of powerplant capacity flow to the food base. The experiment tests the hypothesis. Seth added that in an adaptive management process, it is useful to set the hypothesis (with the information as the hypothetical), implement the experiment, and then come back to see if the information changes based on actual data collection. Ben Reeder recommended coming up with modeling certain powerplant capacity scenarios.*

- *Helen Fairley said the first objective should be to determine the research question and learn from the result. There needs to be consideration of what resources would be impacted, what those impacts would be, and whether the learning potential is worth the potential to impact resources. This needs to be the approach for the spring HFE. Seth acknowledged this, adding it is difficult to define what can be learned, but that this framework allows for learning in the evaluation process.*
- *Kelly Burke noted Larry has called this a solid framework for designing these experiments. What the group is trying to learn isn't a mystery; it is centered around the goals and objectives of the LTEMP.*

Powerplant Capacity Flows – A Discussion about the Concept and its Expected Effect to Resources and their Characteristics

Presenters: TWG Members

Presentation Summary: This was an opportunity for TEG members to discuss the concept of powerplant capacity flows and the potential effects to resources and their characteristics.

Discussion:

- *Seth initiated the discussion of what powerplant capacity flow might look like. The concept is that it would fit within the base operations of the LTEMP ROD, as indicated in Table 1 of the ROD. If that is the case, then the maximum flow out of the dam is 25,000. There is also a maximum daily range of 8,000, meaning a range could only go from lower than 25 up to 8,000, so then it needs to be at about 17,000. There are also ramp rate restrictions; the rate can only get there as fast as going from 17 to 21, which is a step to 4,000 followed by another step of 4,000 to 25. For maximum flows, each of the generators can produce 3,500 at full pool.*
- *Jan Balsom noted that the maximum for non-experimental flows was about 32-33, but it seems that the capacity could be higher if everything is functioning. But the operational criteria within LTEMP includes a caveat that provides for going up to maximum flows or normal operations may be exceeded if it is necessary. It is important to have a clear understanding of the parameters in case there are different parameters. Seth agreed, noting that Table superscript B says 25,000 can be exceeded, but only for HFE's and for emergencies, but those are not normal conditions. He reiterated the importance of defining maximum flows.*
- *Jan Balsom noted that proactive flows and other flexibilities were built into the experimental framework. Seth noted the distinction, saying the focus is powerplant capacity flows as a type of proactive spring HFE or a type of HFE versus base operations. Rob Billenkemp said this identifies a grey area. Reclamation would need to confirm if there is any flexibility in going to 25 and not calling it an HFE. Going to that area between 25 and 31, as it says in B, would then be an HFE which means it would either have to be sediment-triggered or a proactive. The proactive would have a lot of flexibility. It is triggered by the water level, so if in the coming year it reaches over 10 million acre feet, that could be a possibility to try a proactive spring flow that goes up to 31 or 32 (whatever the full powerplant capacity would be). If it isn't called an HFE, it seems it could only go to 25.*
- *Seth questioned why it would be called a proactive spring HFE and not go above the powerplant anyway. Rob noted the hypothetical sediment benefit of going a little bit higher, adding that it is important test to see if it really does work the way it is advertised.*
- *Clifford Barrett recommended looking at footnote A as a possible loophole; it shows examples of experiments and actions to include (ex. HFE's, LSF, DFM), but it doesn't exclude other actions. If this committee makes a recommendation to the Secretary, it could include text that it fits into the criteria. Emily Omana Smith noted that a big point to make is that this may not necessarily be considered an experiment. Seth said the thinking has been that it is not an experiment, but the ROD provides some flexibility as well as sideboards for addressing resource improvement with the operations framework. Someone* said to do the experiment, then if it works, do it as a base

operation. Craig Ellsworth*/McGinnis?* *countered that actions still need to stay within this framework and that not everything can be called an experiment.*

- *Peggy asked if the experts could say if there is a difference between 25,000 and 33,000 cfs and whether there be a big difference to the resources at 25,000. Seth said that if the cap is below 25 under base operations, and the only way to get above 25 is either a sediment triggered HFE, or a proactive spring HFE as triggered by equalization year, then there wouldn't be a benefit to keeping it below 33. One might as well just run the model, see how high it can get, and do the best good for beach building possible for that resource goal. Rob Billenkemp said Paul Graham suggested that he might be able to speak to about having a variety of magnitudes over time. The group doesn't want to only have low magnitude HFE's, but there might be situations in which having low magnitudes occasionally could have some benefits.*
- *Shane Capron said a lot of these types of experiments are spelled out in the ROD. Some, like proactive spring HFE's in the equalization years, don't seem to have a lot of flexibility. But there are no down ramp ramping rate restrictions in the ROD for trout management flows. There is only a ramping rate restriction for 1,000cfs per hour on the up ramp, and it provides for up to three days at the powerplant and then back down, but there is flexibility within that too. If there was an experiment under the trout management flow umbrella that had multiple resource objectives, it seems that Reclamation could make an argument for that. It would be a learning opportunity if there was some type of trout management flow, perhaps one that had a slow down ramp, that wasn't intended to result in mortality of trout. He agreed with Seth that it is hard to get to 25,000cfs without some other discussions. The ramp rate of 4,000cfs is retained as normal operations but there is no down ramp limitation, so the objective is to go all the way from whatever is sent out, and it can be all the way up to powerplant, all the way to the minimum flow within one hour. WAPA has looked at this and thinks it can be implemented if Reclamation wants to do that. The only restrictions are between minimum flows and powerplant and the up ramp rate of 4,000.*
- *Seth said this discussion is starting to show how these experiments could potentially be rationalized. The base operations version fits within Table 1 in the ROD. For the trout management flow-justified type of experiment, there would need to be a justification related to learning about trout management, but there should be a co-benefit of learning about other things.*
- *Melinda Arviso-Ciocco asked for an action item to touch base with Bill Chada, and possibly David Braun, on the slides and the information on the cultural resource assessment. Lee agreed.*
- *Someone asked if a low, steady flow in 2025 is an option for consideration. Seth said yes. Vineetha asked if the capacity of the turbines dictates the 25,000, above which bypass tubes would need to be used. Rob said the turbine capacity is more like 31,500. Vineetha said she agreed with Craig that the limit needs to be followed exactly. Seth noted two scenarios, including the trout management flow type (powerplant capacity flow), in which there can be an exceedance of the 8,000cfs daily change, presumably up to 25. The other scenario is under base operations starting at 17,000cfs, since there is an 8,000 daily change limit. Craig Ellsworth/McGinnis? added that the TMF language in the LTEMP includes an example max flow of 20,000. It isn't clear whether there is a maximum specification for a TMF, but Craig assumed it is 32 for a TMF.*
- *Seth directed the group to consider the base operations option, noting the down ramp rate would have to follow a maximum of 2,500 cfs per hour. The last couple of HFE's were at 1,500cfs per hour. Assuming the group agrees on the 25 maximum, and if all the other assumption still apply, there is probably some gray area in the 8,000 max daily change and how it relates to monthly factors. Seth indicated he could incorporate feedback into a hydrograph for discussion. In response to Craig's question about whether Reclamation would move monthly volumes around, Seth said that would result in affects to another month.*

- *Rob noted the HFE section says HFE's would be between 31,500 and 45,000cfs, so that probably would restrict calling something an HFE that's between 25,000 and 31,500. Seth added that if it went up to 31,500, it would not be called an HFE; a justification would still be needed. Seth wasn't clear if there has been discussion on the hydrograph and flexibility. He presented a potential hydrograph based on the base operation restrictions (to be used as a discussion point) for a 24-hour period that starts at 17,000cfs, but it allows the 8,000cfs of daily change up to 25,000. It then goes for some period of time, before dropping down by 1,500cfs each hour until it reaches that next 17,000cfs level. This is what was done for the last couple of HFE's. This is just an example of potentially what that powerplant capacity flow might look like. Seth opened the conversation up to allow for questions to the scientists about affects from this sample hydrograph.*
- *Shane Capron asked why the down ramp wouldn't occur at 2,500. Seth said he inserted an assumption that follows the HFE down ramp rate of 1,500 used, according to the Reclamation website, in the last couple of HFEs. Shane suggested going a bit later at 25,000 and using a down ramp at 2,500, as used in prior efforts. Seth agreed, saying the example reflects base operations and the flexibility the group has been discussing.*
- *Peggy asked what happens to beaches and other sand dependent resources if these flows, or powerplant capacity, are conducted in the spring and there is no sand, since there hasn't been much sand coming in. This assumes there is no trigger based on HFW protocol. Paul said there is a basic principle that any high flow is going to transport sand and by doing a powerplant capacity flow or higher, there is a ramp up of about 20,000cfs. At the higher release ranges, when there are no inputs, sand starts to export. That sand will come from the bars, as well as the channel and eddies. Anything is going to cause net export of sand and some of that will come at the expense of sandbar erosion. At a 24- hour duration, there will be a notable difference. If there are inputs in the fall HFE, there is a good chance for recovery. There is no reason to do a powerplant capacity flow in the spring if there are no sediment inputs. Peggy asked what the impact would be if there was some sand left over from the fall. Paul indicated that the more sand in the system, the better. There will be some bar building and some erosion with the powerplant capacity flow. At 25,000, there will be sand in suspension, but at the same time, there will be net erosion from the system. If there is an HFE in the previous fall, some of the higher elevation HFE deposits might erode and replace with deposits at a lower elevation. The deposition is in a smaller area. In a powerplant HFE, a larger area is being inundated. While there are very few repeat measurement during flows, and the one time that there were sandbar surveys directly after a powerplant capacity (that was in 2000), that wasn't a particularly enriched environment, so there was a net increase but it was very small compared to a higher magnitude HFE. Peggy asked if there was a threshold for not doing a capacity flow. Paul recommended following the protocol on expanded accounting periods.*
- *Paul said the net positive or negative effects in this case would depend on subsequent summer operations. Shane asked if there would be net additional sediment transport to Marble Canyon. Paul said yes, but there will be erosion along with the bar building. He added this isn't the tool he would choose to rebuild sandbars, given all available options. Paul said that depends on what kind of event is needed to see a signal.*
- *Bill Persons asked for clarification on the objective of the experiment. Ryan Mann responded that powerplant capacity flows may never hit the accounting window for a spring HFE. If that is the case, it is beneficial to look at the benefits of the current situation relative to resources. Alternately, it might be beneficial to discuss changing the accounting window to address foreseeable issues. Ben Reeder suggested another scenario in which there could be a proactive spring HFE if there was an expectation of having an equalization in which there was also an expectation of having a mass import of sand. Seth asked why a powerplant capacity flow would even be considered if there was a proactive HFE. Rob Billenkemp said if there was a sediment trigger, a spring HFE would be the most*

sensible action. If there was an expectation of going into equalization without sediment triggers, and equalization is over 10 million acre-feet, that is the potential trigger for the proactive spring flow. He noted the trout management flows have some flexibility, calling this a "risk averse" option. The less risk averse option is to wait and see what happens. He asked if there is something in-between that would provide information about TMF's for the future. If none of those apply, then there might be some benefit to the fish to do a peak in the spring. NPS usually argues for a spring peak at the historic time because usually there are biological benefits to that. This would not apply if any of those other options are on the table.

- *Craig Ellsworth/McGinnis said that since the objective is related to biological goals, it makes sense to talk about whether the scenario on the screen will make an impact or whether there needs to be an adjustment to the variables (ex. days) before talking about impacts to other resources.*
- *Seth asked if it is better to have a hydrograph that peaks at 25 or if it should be lower to accommodate the 8,000cfs change. Someone noted the HFEs benefit to the biological resources, as well as to the beaches and other resources, but there may never be a spring HFE trigger, even if there have been slow inputs and enough overall sediment for the entire year.*
- *Peggy asked if there would be a benefit to bugs and if so, how long would it take under this scenario. Ted said that at 25,000 for 24 hours, there are learning opportunities, particularly related to invasive mudsnails and how they would be affected by a spring disturbance. Presumably there would be a benefit to other desirable insects from disturbing this competitive species and from the upstream scouring for the growing season. Currently fall HFE's are scouring substraights at the time of year when there's not much time for the system to recover rapidly due to low sunlight. He added that, while there are things to learn from a 24-hour flow, a longer flow would be better. Mudsnail concentrations are high during, and for a few hours after, the rising event, but then they hide, and concentrations drop. There concentrations follow a similar pattern as the sand concentrations, so there could be a bigger effect to mudsnails at 25 to 35.*
- *Peggy asked about the optimal time for such a flow. Josh Korman indicated that May is too early to measure any colonization of trout habitat. He added that 24 hours seems like a short time to test the concept of TMF's, given that fish have to move up to this high habitat, so it wouldn't be particularly informative. It is possible to learn whether the flow produces more food later in the year and subsequently leads to better trout recruitment. He added that there would be some cleaning of the gravels in a 24-hour period, but that would only be in June and July when the juveniles are measured. In the best-case scenario, this would look like an unexpectedly high food base and recruitment. There wouldn't be any study specifically around the flow because the duration is short. Peggy asked what the best month would be to do this. He said the best time to affect mudsnails would be April or May, based on the 2008 BHPF, where there was mudsnail export followed by a recovery of the more desirable aquatic insects and an unusually high trout recruitment. This flow would be a test of whether the 2008 event could be replicated with a mini event. Ted said the 2008 study was actually in March and the 1996 HFE was in early April, adding those times would be starting places for him.*
- *Kelly Burke suggested looking back at what has been done in the last 20 years relative to all three flows. Ted said that was done as part of the 2011 HFE synthesis and that effort helped to define the current protocol. Back in 2011, the understanding was that the current accounting periods and protocol would include experimenting with fall and spring HFE's; it now seems there is less likelihood of being able to experiment with spring HFE's. He added that is why the powerplant flows are under discussion. The objective is to understand how a spring disturbance could be a useful tool for managing the ecosystem; this is the only way it can be done within the existing LTEMP. Kelly suggested looking at flow types and durations even before the executive decision.*

- *Someone said this scenario would have a negative impact on hydropower. There would be a release of water that would have been released on peak. That would move on peak water to off peak, which would impact the ability to market that power at a higher level. On peak is typically during the day and off peak is typically during the night. It changes from month to month and from year to year and it also changes with economics. Right now, on peak prices are very similar to off peak prices in shoulder months like April and November and so in those months there is not much of a price difference between on peak and off peak, thus not much of an impact. Unless power prices go negative, there will always be a negative impact. Currently, there is no needed capacity so that is why bug flows are costly. Shane added that earlier (March or early April) would have reduced costs compared to May. The other consideration is it might be difficult to get up there based on some constraints. The general interpretations so far about the maximum daily change has been treated over a monthly timescale. If, for example, the month of August will have 8,000cfs change from the base to the peak, for the month that would be 10,000 to 18,000 and that is the maximum change. That would not be stair stepped. He didn't believe the EIS analyzed a scenario where it goes from 10 to 18 and it stays there, then goes from 18 to 25 and it stays there for a day, then it comes down to 18, stays a day, and then it comes down to 10. It isn't clear whether a different interpretation that maximum daily change could be applied each day versus across the month could be made. It hasn't been done that way, so to get to 25 under the assumption of status quo, 17,000 would be the baseline. That would be a huge monthly volume; it would be equalization times volumes for a month. If the interpretation remains that the maximum daily change is across the month, there are a lot of unknowns. Seth remarked these may be questions that require legal counsel. Lee indicated that it is important to provide enough specifics so the scenario can be compared to the record of decision.*
- *Rob Billenkemp asked Paul if there would ever be a sediment benefit in a year that did not hit a sediment trigger and did not qualify as an equalization year where a proactive HFE was considered. Paul said he didn't think so, since the tradeoff of doing something that is probably going to have a small, potentially negative or positive affect muddies the long-term goal of looking at the cumulative effect of doing a sediment enriched HFE. There isn't a good reason to justify it based on the sediment response, but there could be some other reason to do it.*
- *Seth indicated that, due to time, some of the other experimental flow discussions are tabled.*
- *Lee said the July 25-August 2 integrated stakeholder river trip still has two spots available.*
- *Seth asked Emily Palmquist and Joel their thoughts on how the potential base operations powerplant capacity flow hydrograph might affect vegetation, cultural, and other resources. Emily said that assuming a one-day flow going up to 25,000cfs in the spring, she didn't see much change to riparian vegetation. Other than some young seedlings, not much vegetation would be removed. A daily flow for a month, also going up to 25,000, would be eroding the sand and likely removing some of the plants that have grown on the sandbars. April or May would offer the best likelihood of having a positive effect. March is a little early; spring annuals would see benefit, but not perennial species. Riparian plants are adapted to extended larger spring floods. A slow reduction helps germinated seeds to grow their roots. A fast drop after a flood will strand anything that germinated. A flood that isn't big enough to remove plants won't create that arid surface, so anything that did germinate would be germinating on areas that are already bare. She continued, noting that effects from a one-day flow would be limited to annuals and plants with shallow roots. Those effects would be dependent on whether plants were above or below the 25,000cfs line and how long the water would be available.*
- *When asked what Joel would say, Paul said he would likely agree that impacts would be minimal. The potential benefit of doing a spring event is having a bit more sand area exposed during the dry season for wind transport, but it is more difficult to predict effects for a fall event. Helen agreed,*

adding that a spring HFE could potentially have measurable effects on sand transport and availability, but noted the conversation is about a powerplant capacity flow, which likely wouldn't do much in terms of sandbar building. It would be within the zone that still gets wetted by capillary action to some degree, so that would reduce sand transports. Overall, the effect of increasing sand transport upwind into where the archaeological sites are is minimal to probably not measurable.

- *Seth recommended setting up an ad-hoc group to explore these topics in more detail. The ad-hoc group would be tasked with generating the most ideal hydrograph for a powerplant capacity flow that is allowed by baseflow operating criteria and to complete the knowledge assessment spreadsheets for the effects to resources from that potential hydrograph. That would be specific to this powerplant capacity flow item, so it would require consideration of what was heard today, as well as additional exploration with the scientists and others to try to get to an ideal scenario. That could require looking at different variables to try to get at the goal of improving as many resources as possible, but not at the expense of other resources. Vineetha recommended defining powerplant capacity flow as well as the goal, which should include not having negative impacts on other resources. Seth agreed, adding that the group could discuss concerns about spring HFE triggers. He noted that trout management flows can inform trout management and also improve other resources as a co-benefit. The group learned about the decision-making process for a bug flow this year and that Reclamation, Fish and Wildlife Service, and GCMRC are leading an internal process to address information needs and planning considerations specific to trout management flows. He recommended allowing the federal agencies to start that conversation and to think about the other resource benefits. As part of their thinking about the hydrographs and information needs, they can then infuse these other concepts and discussions into their process. Kelly indicated Larry Stevens would likely want to participate in the group. Peggy agreed to lead the group.*
- *In response to the question about how the federal group talking about the trout management flows would interact with the ad-hoc group, Emily Omana-Smith provided an update on some work she has been doing related to whether or not to implement bug flows and TMF's. She and Jess came up with an approach for doing background work that can support the continued discussion that this group will need. They decided to first convene a small group of federal family technical representatives tasked with reviewing the LTEMP, reviewing what's currently in the triennial workplan related to trout management flows, and reviewing Korman paper that was distributed to TWG last summer as well as the Korman presentation from today. Then a second group of technical stakeholders would convene to get started with the work discussed earlier. Seth recommended providing regular updates at TWG meetings. Jan recommended adding Brian to the DOI version of the group.*
- *Seth asked if there were any objections to the proposal. Hearing none, he indicated he would work on a specific charge for the ad-hoc group and add updates to future TWG meetings.*

Updated Website for the Grand Canyon Monitoring and Research Center

Presenters: Tom Gushue, GCMRC

Presentation Summary: USGS received a directive to migrate all USGS websites to a site with a more corporate look that was similar to websites other DOI bureaus already use by April 29, 2019. The old USGS website is no longer accessible, but all the information from the old site, plus additional information, is now on the new USGS website.

GCMRC tested the new website extensively over the last month, and everything seems to be working. Tom walked through the new website to demonstrate where to find information like the wiki page and the GCD AMP page. There are also links to experiments like the HFEs, as well as publications related to those. GCMRC split out its publications from its library services, but was unable to migrate the old GCMRC publications page to the new website. That information is not available for now, but GCMRC

does have a library services page that includes information on how to access content that is not available through USGS. A staff directory includes information about each staff member and their work. The data and tools quick link replaced the old map and data portal and is split between online maps, data applications, and data releases. The site also includes a link to GCMRC's projects. Additional details are at https://www.usgs.gov/centers/sbsc/gcmrc.

Discussion:

- *Seth Shanahan commented that it was a lot of new information and a lot of great resources, and that Tom did a great job on the new website.*
- *Tom requested that TWG members use this resource to access things like archived projects, discontinued projects, and items GCMRC no longer studies. Tom asked that any questions be directed to Tom via email.*
- *Lee Traynham asked if Tom was able to track visitor hits to the website to get an idea of how much traffic the website gets. Lee asked the same question of Craig Ellsworth for the wiki page. Tom responded that there is a way to track visitors, but USGS has not fully explored that tool. Craig responded that he has not been able to track visitors to the wiki page.*

Discussion of Emerging Issues and Request for Agenda Items for Next Meeting

Presenters: Seth Shanahan, TWG Chair

Presentation Summary:

Topics the TWG captured from days one and two of this meeting:

- Formation of the new ad hoc group with Peggy Roefer as its chair
- Trout Management Flows
- Reporting to the AMWG the need to think about contingency planning for any given year that TWG does not have funding
- Offline conversations about topics related to financing and project implementation and to have Bill Persons report back to the TWG on a regular basis.

Discussion:

- *Vineetha Kartha suggested a follow up on the DCP presentation and to have a page dedicated to DCP on the wiki.*
- *Jan Balsom suggested a presentation on the first pilot vegetation project conducted in March/April 2019. NPS combined this project with work that GCMRC was doing and had two ancestral labs for crews that participated. Jan asked that Mike Kerisly conduct the presentation.*
- *Kelly Burke suggested a follow-up conversation with Larry on continued work on the organic study.*
- *Jan suggested a follow up on the TCPs for some of the fish passage research.*
- *Emily Omana-Smith suggested an update on the prize competition Connie Svoboda mentioned.*

Public Comment

Comment/Discussion:

- *There were no public comments.*

Meeting Adjourned at 2:55 pm

Key to Glen Canyon Dam Adaptive Management Program Acronyms

ADWR – Arizona Dept. of Water Resources
AF – Acre Feet
AZGFD – Arizona Game and Fish Department
AIF – Agenda Information Form
AMP – Adaptive Management Program
AMWG – Adaptive Management Work Group
AOP – Annual Operating Plan
ARM – Annual Reporting Meeting
ASMR – Age-Structure Mark Recapture
BA – Biological Assessment
BAHG – Budget Ad Hoc Group
BCOM – Biological Conservation Measure
BE – Biological Evaluation
BHBF – Beach/Habitat-Building Flow
BHMF – Beach/Habitat Maintenance Flow
BIA – Bureau of Indian Affairs
BO – Biological Opinion
BOR – Bureau of Reclamation
BWP – Budget and Work Plan
BT – Brown Trout
CAHG – Charter Ad Hoc Group
CAP – Central Arizona Project
CESU – Cooperative Ecosystems Studies Unit
cfs – cubic feet per second
CFMP – Comprehensive Fisheries Management Plan CMINS – Core Monitoring Information Needs
CMP – Core Monitoring Plan
CPI – Consumer Price Index
CRBC – Colorado River Board of California
CRAHG – Cultural Resources Ad Hoc Group
CRCN – Colorado River Commission of Nevada
CRE – Colorado River Ecosystem
CREDA – Colorado River Energy Distributors Assn.
CRSP – Colorado River Storage Project
CWCB – Colorado Water Conservation Board
DAHG – Desired Future Conditions Ad Hoc Group
DASA – Data Acquisition, Storage, and Analysis
DBMS – Data Base Management System
DCR – Department of Cultural Resources
DMSA – Demand Management Storage Agreement
DO – Dissolved Oxygen
DOE – Department of Energy
DOI – Department of the Interior
DOIFF – Department of the Interior Federal Family
DROA – Drought Response Operations Agreement
EA – Environmental Assessment
eDNA – Environmental DNA
EIS – Environmental Impact Statement
ESA – Endangered Species Act
FACA – Federal Advisory Committee Act
FEIS – Final Environmental Impact Statement
FLAHG – Flow Ad Hoc Group
FRN – Federal Register Notice
FWS – United States Fish & Wildlife Service
FY – Fiscal Year (October 1 – September 30)
GCC – Glen Canyon Conservancy
GCD – Glen Canyon Dam
GCES – Glen Canyon Environmental Studies
GCT – Grand Canyon Trust
GCMRC – Grand Canyon Monitoring & Research Center
GCNP – Grand Canyon National Park
GCNRA – Glen Canyon Nat'l Recreation Area
GCPA – Grand Canyon Protection Act
GLCA – Glen Canyon Nat'l Recreation Area
GRCA – Grand Canyon National Park
GCRG – Grand Canyon River Guides
GCWC – Grand Canyon Wildlands Council
GSA – General Services Administration
GSF – Green Sunfish
HBC – Humpback Chub (endangered native fish)
HFE – High Flow Experiment
HMF – Habitat Maintenance Flow
HPP – Historic Preservation Plan
IFF - International Federation of Fly Fishers
IG – Interim Guidelines
INs – Information Needs
KA – Knowledge Assessment (workshop)
LCR – Little Colorado River
LCRMCP – Lower Colorado River Multi-Species Conservation Program
LTEMP – Long-Term Experimental and Management Plan

LTEP – Long Term Experimental Plan
maf – Million Acre Feet
MA – Management Action
MATA – Multi-Attribute Trade-Off Analysis
MLFF – Modified Low Fluctuating Flow
MO – Management Objective
MRP – Monitoring and Research Plan
NAU – Northern Arizona University (Flagstaff, AZ)
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NNFC – Non-native Fish Control
NOI – Notice of Intent
NPCA – National Parks Conservation Association
NPS – National Park Service
NRC – National Research Council
O&M – Operations & Maintenance (Reclamation Funding)
PA – Programmatic Agreement
PBR – Paria to Badger Creek Reach
PEP – Protocol Evaluation Panel
POAHG – Public Outreach Ad Hoc Group
Powerplant Capacity = 31,000 cfs
R&D – Research and Development
RBT – Rainbow Trout
RFP – Request for Proposal
RINs – Research Information Needs
RIP – Recovery Implementation Plan
ROD Flows – Record of Decision Flows
RPA – Reasonable and Prudent Alternative
SA – Science Advisors
SAEC – Science Advisors – Executive Coordinator Secretary – Secretary of the Interior
SCORE – State of the Colorado River Ecosystem
SHPO – State Historic Preservation Office
SOW – Statement of Work
SPG – Science Planning Group
SSA - Species Status Assessment
SSQs – Strategic Science Questions
SWCA – Steven W. Carothers Associates
SWE – Snow Water Equivalent
TCD – Temperature Control Device
TCP – Traditional Cultural Property
TEK – Traditional Ecological Knowledge
TES – Threatened and Endangered Species
TMC – Taxa of Management Concern
TMF – Trout Management Flows
TWG – Technical Work Group
TWP - Triennial Work Plan
UCRC – Upper Colorado River Commission
UDWR – Utah Division of Water Resources
USBR – United States Bureau of Reclamation
USFWS – United States Fish & Wildlife Service
USGS – United States Geological Survey
WAPA – Western Area Power Administration
WY – Water Year