Potential LTEMP Experiments
Spring/Summer 2022

Technical Work Group Meeting
April 13, 2022

Traynham, Bureau of Reclamation
Kennedy, USGS, Southwest Biological Science Center,
Grand Canyon Monitoring and Research Center
LTEMP Process for Experiments

- Annual Reporting and TWG meetings
- Notification and Consultation to Tribes & PA Parties
- Implementation / Planning Team Recommendation
- DOI decision

1.4 COMMUNICATION AND CONSULTATION PROCESS FOR ALTERNATIVE D

To determine whether conditions are suitable for implementing or discontinuing experimental treatments or management actions, the DOI will schedule implementation/planning meetings or calls with the DOI bureaus (USGS, NPS, FWS, BIA, and Reclamation), WAPA, AZGFD, and one liaison from each Basin State and from the UCRC, as needed or requested by the participants. The implementation/planning group will strive to develop a consensus recommendation to bring forth to the DOI regarding resource issues as detailed at the beginning of this section, as well as including WAPA’s assessment of the status of the Basin Fund. The Secretary of the Interior will consider the consensus recommendations of the implementation/planning group, but retains sole discretion to decide how best to accomplish operations and experiments in any given year pursuant to the ROD and other binding obligations.
# Potential LTEMP Flow Experiments

## Water Year 2022

<table>
<thead>
<tr>
<th>GCD Experimental Flow</th>
<th>Duration</th>
<th>Implementation Window</th>
</tr>
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<tbody>
<tr>
<td>Fall HFE</td>
<td>up to 96 hours</td>
<td>October - November</td>
</tr>
<tr>
<td>Extended Duration Fall HFE</td>
<td>97-192* or 97-250 hours***</td>
<td>October - November</td>
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<tr>
<td>Spring HFE^Δ</td>
<td>up to 96 hours</td>
<td>March – April</td>
</tr>
<tr>
<td>Proactive Spring HFE^Δ◊</td>
<td>24 hours**</td>
<td>April – June</td>
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<tr>
<td>Trout Management Flows</td>
<td>up to 3 cycles/month for 4 months</td>
<td>May – August</td>
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<tr>
<td>Macroinvertebrate Flows</td>
<td>target 2-3 replicates</td>
<td>May – August</td>
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</tbody>
</table>

* First test not to exceed 192 hours

** First test 24 hours

*** After first test, up to 250 hours

Δ no Spring HFE in same WY as extended duration Fall HFE

◊ no proactive Spring HFE in same WY as sediment-driven Spring HFE

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**WY 2022 Related Activities:**

- [Drought Response Ops at GCD](#) – Lower winter releases, reallocation
- Consultation w/ Tribes re: Trout Management Flows – Jan kickoff
- Planning/Implementation Process Review
Review – 2021 Bug Flows

• Recommendation #2:

To inform discussion of potential future implementation of the Bug Flows experiment, the PI Team recommends, by consensus, the following next steps for DOI to consider:

- The PI Team commits to document its considerations in a memo to DOI and the LTEMP Leadership Team.

- ✓ Request that GCMRC state resource implications for non-implementation of Bug Flows in WY 2021.

- ✓ Request that GCMRC complete a report by January 2022 summarizing experimental findings and discuss how the observations of non-implementation compared to the predictions.

- ✓ Request that WAPA provide additional information regarding purchase power cost estimates, including assumptions and uncertainty, such that effects to hydropower are minimized if Bug Flows are implemented in the future.

- ✓ Request that the Science Advisors Program establish and convene an independent review panel to evaluate the Bug Flows experiment in achieving its objective and to develop opportunities for further experimentation.
Goal 2. Natural Processes

- Restore, to the extent practicable, ecological patterns and processes within their range of natural variability, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems.
30 years of Adaptive Management Experimentation: 1990-2020

High Flow Experiments (HFEs)

- 1996 HFE (March/April)
- 2004 HFE (November)
- 2008 HFE (March)
- 2011 Equalization Operations
- HFE Protocol Established (Nov '12, Nov '13, Nov '14, Nov '16, Nov '18)

Steady Flow Experiments

- Dam operations constrained
- 2000 Low Summer Steady Flow Experiment. Low steady releases from June August.
- 2008 2012 Fall Steady Flow Experiment. Low steady releases in September October
- 2018 2020 Bug Flow experiment. Low steady releases on weekends, May August (THIS REPORT)

Start of Key Monitoring Datasets Evaluated in Report

- 2008 Invertebrate drift
- 2012 GPP, Community science insect monitoring
- 2009 Juvenile native fish monitoring
Low Summer Steady Flow Experiment-2000

- ~120 days of steady flow
- Target: juvenile native fish
- Food web monitoring relied on static metrics
  - algae biomass
  - benthic invertebrates (larvae)

Large impact to hydropower
- High demand summer months
  - Exacerbated by energy market manipulation (ENRON)

Figure 6-9. Mean densities of Chironomidae in the Lees Ferry reach of the Colorado River in April, June, July, August, and September 1993–97 and 2000. Error bars represent 95-percent confidence intervals. Data from Arizona Game and Fish Department (Rogers and others, unpub. report, 2003).
Fall Steady Flow Experiment-2008 to 2012

- 60d/yr steady flow for 5 years
- Target: juvenile native fish
- New tools for food web monitoring developed
  - 2008-Invertebrate drift
  - 2009-Juv. native fish growth/surv
  - 2012-GPP, comm. light trapping

Lower impact to hydropower than 2000 experiment
- Low demand months
- Fewer days/yr

From Hall and others 2015, Limn. & Ocean.
Bug Flow Experiment-2018-2020

- ~36d/yr steady flow for 3 years
- Targeted egg laying process
- Lower cost than 2008-2012 experiment
  - Fewer days/yr
  - Low demand weekends
Bug Flows Synthesis

Key Findings

- Enhanced natural processes and improved food base
  - More egg laying substrates
  - More insect emergence
  - More caddisflies
    - But not more midges
  - More algae (GPP)

- Enhanced rainbow trout fishery
  - Higher catch rates

“Objective: Improve food base productivity and abundance or diversity of mayflies, stoneflies, and caddisflies” LTEMP Table 4.

Unpublished data, subject to change, do not cite.
UPDATED RESULTS

- Cessation of Bug Flows associated with:
  - ~50% decline in midges

  Consistent with hypothesis that Bug Flows was improving conditions for midges

  ~25% decline in caddisflies

  Tough to untangle what this means
  - no direct benefits to larvae or emergence in '21
  - But preceded by 3 years of good egg laying

Unpublished data, subject to change, do not cite.
GCMRC Recommendation

1) Repeat weekend experiment—May to August
   - Solid design, easy comparison, reduce uncertainties

2) Expand, add months—March to October
   - More of a good thing

3) Start earlier—March to June
   - Focus on GPP and larval benefit, lower cost

3) Start earlier, add fall mo.—March to June, Sept to Oct
   - Longer experiment yet reduces impact to hydropower

4) Shorten experiment (e.g., May-June only)
   - Lower cost
Conclusion

- The best available science continues to indicate Bug Flows were successful at Enhancing Natural Process that sustain the Colorado River ecosystem.
Planned monitoring—2022

- Community Science light traps
  - ~ 750 samples per year, throughout Canyon
  - Robust dataset for tracking insect response

- Fish diet and food web studies
  - Q: Are changes in food base benefitting native fish?
  - Non-lethal methods to honor tribal values
    - Stable isotopes
    - Fecal e-dna
    - Lavage (stomach pumping) where possible

Kennedy et al. 2016
BioScience

Unpublished data, subject to change, do not cite.
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<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<td></td>
<td>AMWG/TWG Webinar</td>
<td>Draft Report distributed for PI Team review</td>
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<td>4</td>
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<td>6</td>
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<td>Leadership Team mtg; DOI decision</td>
<td>Leadership Team</td>
<td>TWG Meeting</td>
<td>Notify GCDAMP stakeholders, public</td>
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Potential Hydrograph Alternatives

• Hydrograph characteristics:
  o Implementation window May 1 – August 31
  o Steady weekend lows, fluctuating weekday releases
  o Weekend lows “H” cfs higher than weekday lows
  o Weekly, Monthly, and Annual release volumes would not change.

• FY22 Hydrograph Alternatives*
  o Alt 1: H level → Base Hydrograph, H750**
  o Alt 2: H level → H1 (zero offset)
  o Alt 3: H level → H -250 (negative offset)

* All alternatives feature 36 days of steady flows
** H750 - Weekend releases are 750 cfs higher than weekday lows
Glen Canyon Dam Hourly Proposed Macroinvertebrate Release Patterns during May 2022

May Volume = 599 kaf

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<tr>
<td>May</td>
<td>6,910</td>
<td>12,301</td>
<td>9,350</td>
<td>13,427</td>
<td>9,350</td>
<td>12,196</td>
<td>8,600</td>
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<td>June</td>
<td>7,621</td>
<td>14,401</td>
<td>9,350</td>
<td>16,130</td>
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<td>16,380</td>
<td>8,600</td>
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<td>July</td>
<td>9,037</td>
<td>17,037</td>
<td>9,851</td>
<td>17,851</td>
<td>9,710</td>
<td>17,960</td>
<td>9,585</td>
<td>17,585</td>
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<td>August</td>
<td>9,453</td>
<td>17,453</td>
<td>10,119</td>
<td>18,119</td>
<td>9,904</td>
<td>18,540</td>
<td>10,119</td>
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Resource Considerations

1. Water quality and water delivery
2. Humpback Chub
3. Sediment
4. Riparian Ecosystems
5. Historic properties and traditional cultural properties
6. Tribal Concerns
7. Hydropower production and WAPA’s assessment of the status of the Basin Fund
8. Rainbow Trout Fishery
9. Recreation
10. Other Resources

Reference: 2016 LTEMP ROD, p. B-8,
Section 1.3 Implementation Process for Experiments Under Alternative D
Basin Fund Status & Impacts

• Projected Basin Fund Decline
  o $83M by end of FY22

• Projected costs of FY22 Bug Flows: about $1.4M

• Prior year costs
  o FY18 – **actual $165K** (estimated $335K) (H1000)
  o FY19 – **actual $327K** (estimated $332K) (H750)
  o FY20 – actual TBD ($750K-$1M) (estimated $407K) (H750)
Stakeholder Feedback

• AMWG/TWG Informational webinar (3/30)
  o Request for comments by Friday, April 8

• Support
  o Fly Fishers International/Trout Unlimited Recreational Anglers

• Opposed
  o Colorado River Energy Distributors Association
Technical Recommendation

• Summary
  o Implement Bug Flows May 1 – Aug 31, 2022
  o Adverse effects to hydropower; defer on “unacceptable”
  o Uncertainty in hydrology, operations, resources
    ▪ Bi-weekly PI Team coordination May – August
    ▪ New conditions, unanticipated effects, potential off-ramps
  o Further consideration of design improvements

• Team Perspectives (of 15)
  o Support (10)
  o Opposed (1)
  o Abstained (2)
  o Absent (2)
THANK YOU !!!