Integrating LTEMP into GCDAMP Processes[1]

October 18, 2016

[1] This draft presentation was prepared to facilitate the agenda item of the same name. The purpose of the agenda item is for the TWG to engage in a preliminary conversation about its potential role in the future, when the LTEMP is decided. The presentation focuses on the LTEMP FEIS Preferred Alternative, but because the Secretary of the Interior has not issued a ROD, the presentation is based on a hypothetical outcome and therefore is for discussion purposes only. The presentation is not a product of the Department of the Interior.

Components of the Process[1]

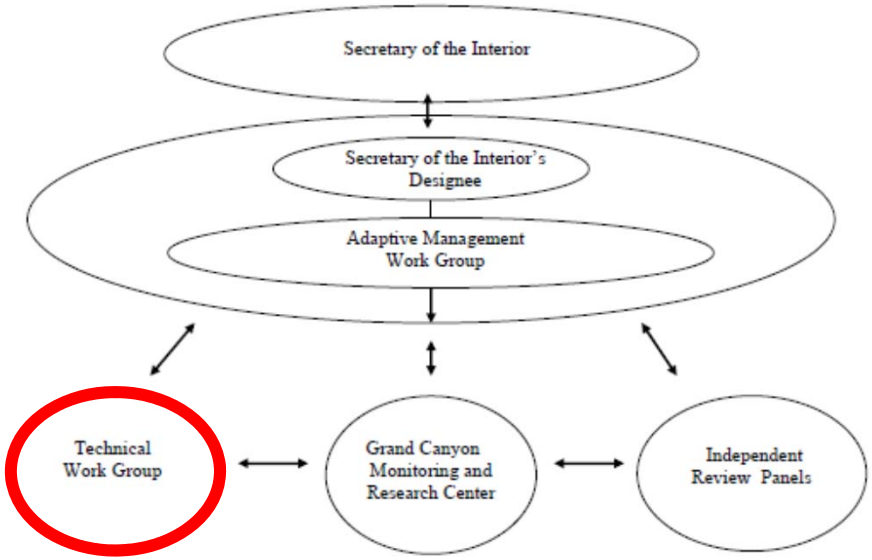
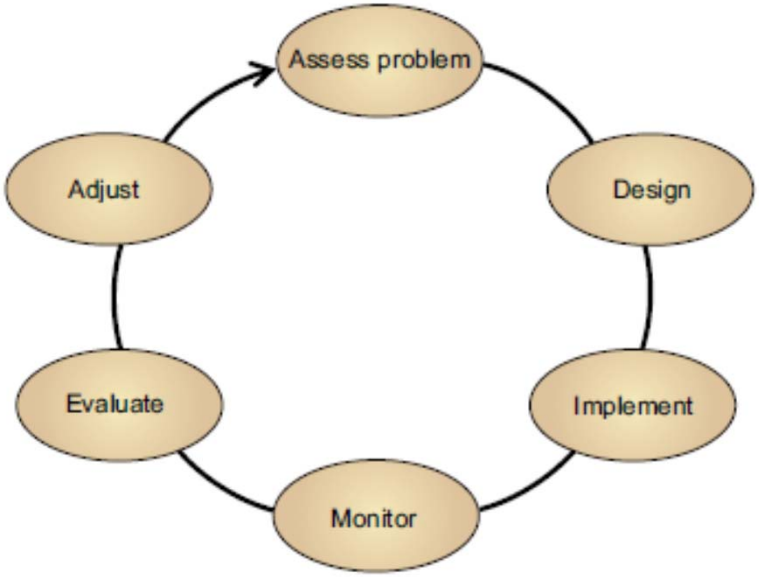
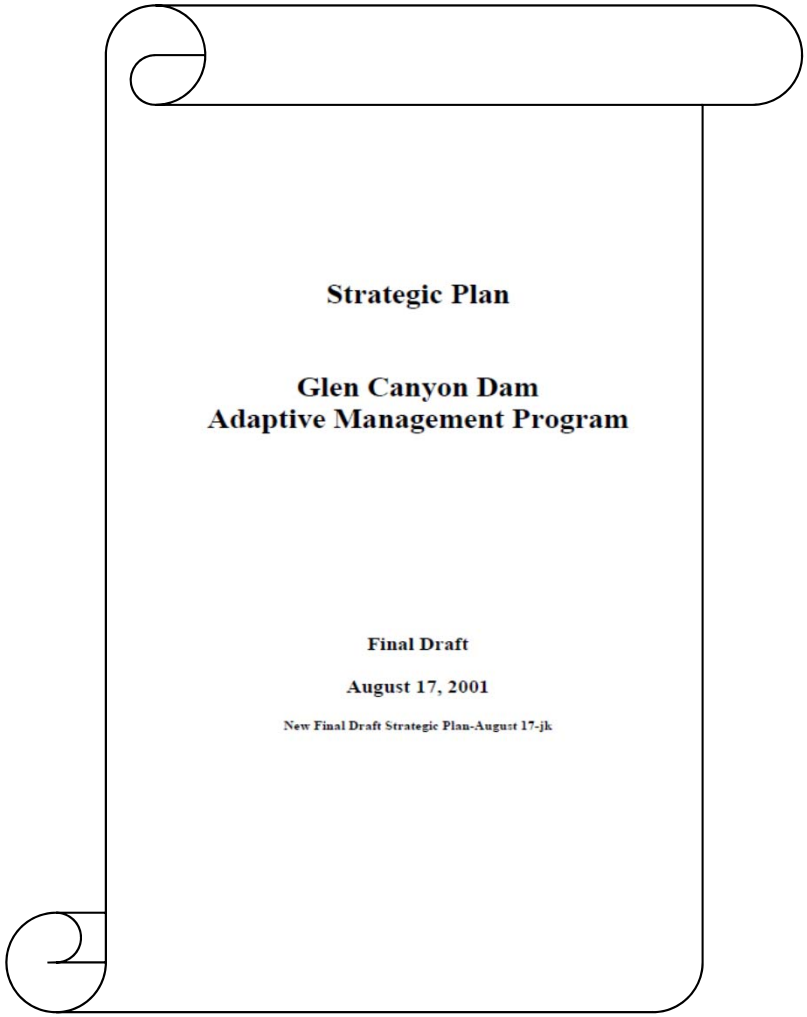


Figure 1. Organizational components of the Glen Canyon Dam Adaptive Management Program.

[1]Strategic Plan Glen Canyon Dam Adaptive Management Program approved by AMWG on January 17, 2002

Overall Process[1,2]




Strategic Plan

Glen Canyon Dam
Adaptive Management Program

Final Draft

August 17, 2001

New Final Draft Strategic Plan-August 17-jk

[1]Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2009. Adaptive Management: The U.S. Department of the Interior Technical Guide
[2]Strategic Plan Glen Canyon Dam Adaptive Management Program approved by AMWG on January 17, 2002

Planning and Implementation Process[1,2]

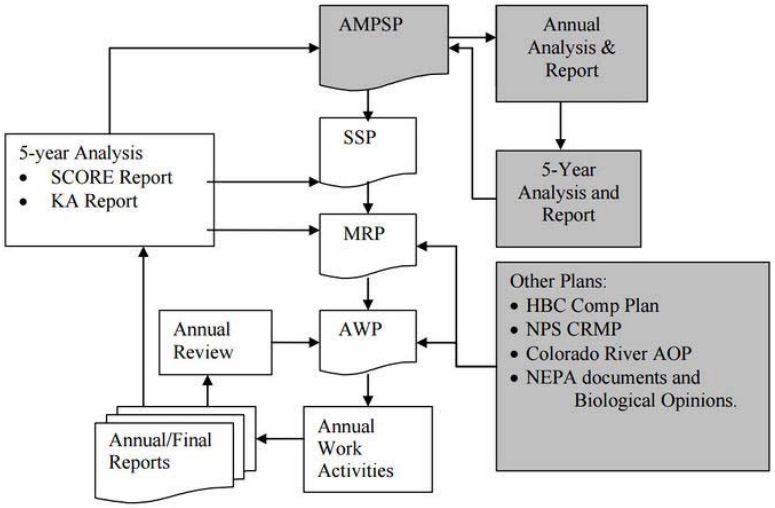


Figure 2. Collaborative science planning and implementation process. The Glen Canyon Dam Adaptive Management Program and the U.S. Department of the Interior have lead responsibility for the shaded boxes. The Grand Canyon Monitoring and Research Center has lead responsibility for the boxes that are not shaded.

Glossary

AMPSP	Strategic Plan
SSP	Strategic Science Plan
MRP	Monitoring and Research Plan
AWP	Annual Work Plan
KA	Knowledge Assessment
SCORE	State of the Colorado River Ecosystem

[1]Strategic Science Plan to Support the Glen Canyon Dam Adaptive Management Program, Fiscal Years 2007-2011 approved by AMWG on April 29, 2009
[2]Monitoring and Research Plan to Support the Glen Canyon Dam Adaptive Management Program, Fiscal Years 2007-2011 approved by AMWG on April 29, 2009

TWG Roles and Responsibilities

- Technical assistance to the AMWG[1] enabling the AMWG to[2]:
  - Advise the Secretary in meeting environmental and cultural commitments
  - Recommend resource management objectives for development and implementation of a long-term monitoring plan
  - Review and provide input on the annual report to Congress
  - Annually review long-term monitoring data to provide advice on the status of resources and whether the DFC's and AMP Strategic Plan goals and objectives are being met.
  - Monitor and report on all program activities undertaken

[1]Glen Canyon Dam Technical Work Group Operating Procedures, June 27, 2013
[2]Glen Canyon Dam Adaptive Management Work Group Charter, August 24, 2015

TWG Roles and Responsibilities

- Consult with GCMRC in developing criteria and standards for monitoring and research programs[1]
- Develop research management questions for the design of monitoring and research administered by GCMRC[1]
- Provide information, as necessary, for preparing annual resource reports and other reports, for the AMWG[1]
- Prepare a triennial budget development timeline and process that can be used in the future[2]
- Review FY17 budget after issuance of the LTEMP ROD[3]

[1] Glen Canyon Dam Technical Work Group Operating Procedures, June 27, 2013
[2]Memorandum from Anne J. Castle dated May 7, 2014
[3]Approved by AMWG on August 24, 2016

TWG Roles and Responsibilities from LTEMP Preferred Alternative (§ 2.2.4)

Explicit

- DOI to seek TWG consensus on annual hydrograph (§ 2.2.4.1)
- DOI to host annual reporting meeting for stakeholders (§ 2.2.4.4)
- DOI to meet with TWG to discuss contemplated annual experimental actions (§ 2.2.4.4)

Potential ???

- Advice on implementing the condition-dependent adaptive design
- Advice on annual implementation considerations
- Advice on long term off-ramp conditions
- Advice on work planning and budgeting

Annual Hydrograph

"Reclamation will seek consensus on the annual hydrograph through…regular meetings of the…TWG…" (p. 2-46)

TABLE D-6 Monthly Release Volumes (in ac-ft) by Water Year Release for Alternative D

	Water Year Release (maf)									
Month	7	7.48	8.23	9	9.5	10.5	11	12	13	14
October	480,000	480,000	642,583	642,583	642,583	642,583	642,583	642,583	642,583	642,583
November	500,000	500,000	641,532	641,532	641,532	641,532	641,532	641,532	641,532	641,532
December	600,000	600,000	715,885	715,885	715,885	715,885	715,885	715,885	715,885	715,885
January	664,609	723,467	763,000	858,351	919,662	1,042,283	1,103,594	1,226,216	1,348,837	1,471,459
February	587,262	639,271	675,000	758,457	812,632	920,983	975,159	1,083,510	1,191,860	1,300,211
March	620,206	675,132	713,000	801,004	858,219	972,648	1,029,863	1,144,292	1,258,721	1,373,150
April	552,170	601,070	635,000	713,134	764,072	865,949	916,887	1,018,763	1,120,640	1,222,516
May	571,506	622,119	657,000	738,108	790,830	896,274	948,996	1,054,440	1,159,884	1,265,328
June	598,005	650,965	688,000	772,331	827,497	937,830	992,997	1,103,330	1,213,663	1,323,996
July	651,718	709,434	749,000	841,702	901,823	1,022,067	1,082,188	1,202,431	1,322,674	1,442,918
August	652,434	710,214	750,000	842,627	902,814	1,023,190	1,083,377	1,203,753	1,324,128	1,444,503
September	522,090	568,328	600,000	674,286	722,451	818,776	866,939	963,265	1,059,593	1,155,919

Annual Hydrograph

TABLE D-7 Monthly Release Volumes (in ac-ft) by Water Year Release for Alternative D with Low Summer Flows

	Water Year Release (maf)									
Month	7	7.48	8.23	9	9.5	10.5	11	12	13	14
October	480,000	480,000	642,583	642,583	642,583	642,583	642,583	642,583	642,583	642,583
November	500,000	500,000	641,532	641,532	641,532	641,532	641,532	641,532	641,532	641,532
December	600,000	600,000	715,885	715,885	715,885	715,885	715,885	715,885	715,885	715,885
January	664,609	723,467	763,000	858,351	919,662	1,042,283	1,103,594	1,226,216	1,348,837	1,471,459
February	587,262	639,271	675,000	758,457	812,632	920,983	975,159	1,083,510	1,191,860	1,300,211
March	620,206	675,132	713,000	801,004	858,219	972,648	1,029,863	1,144,292	1,258,721	1,373,150
April	730,640	795,346	840,007	943,631	1,011,033	1,145,837	1,213,239	1,348,044	1,482,848	1,487,603
May	756,226	823,198	869,423	976,676	1,046,439	1,185,964	1,255,726	1,395,252	1,534,777	1,537,189
June	791,289	861,367	909,735	1,021,961	1,094,958	1,240,952	1,313,949	1,459,944	1,487,603	1,487,603
July	427,856	465,748	491,901	552,582	592,052	670,992	710,463	789,403	908,217	1,126,373
August	427,856	465,748	491,901	552,582	592,052	670,992	710,463	789,403	908,217	1,126,373
September	414,056	450,723	476,033	534,756	572,953	649,349	687,544	763,936	878,920	1,090,039

Annual Reporting Meeting

"these meetings will present the best available scientific information and learning from previously implemented experiments and ongoing monitoring of resources" (p. 2-57)

- What is the scope of the meeting?
- Should the meeting be organized by:
  - Resource?
  - Work plan project?
  - Strategic Plan goal?
  - DFC?
  - LTEMP Resource Goal?
  - Experimental outcome?
- Can the meeting serve other purposes?
  - Knowledge assessment
  - Cooperative agreement reporting
  - AMWG program reporting
  - Content development for report to Congress

Discussion of Annual Experiments

"DOI will meet with the TWG to discuss the experimental actions being contemplated for the year" (p. 2-57)

- Should this occur in January?
- Should there be additional *check-ins* with the TWG later in the year?
- Will more than a *listing* of potential experiments be discussed?
- Should potential outcomes be discussed?
  - If so, which outcomes should be simulated?
  - If so, which tools would be useful to simulate outcomes?
  - If so, should simulated outcomes be compared to monitoring results in subsequent Annual Reporting Meetings[1]?

[1]i.e., should we engage in adaptive management!

Experimental Scenarios in Year 1-2[1]

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2											HFE	
3											Ext. Dur. HFE	
4					Bug Flows							
5					Bug Flows						HFE	
6					Bug Flows						Ext. Dur. HFE	
7					TMF							
8					TMF						HFE	
9					TMF						Ext. Dur. HFE	
10		Mechanical Removal										
11		Mechanical Removal									HFE	
12		Mechanical Removal									Ext. Dur. HFE	

[1]Year 3-10 include Spring HFE's and Proactive Spring HFE's and Year 11-20 include LSF's

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
13					Bug Flows							
					TMF							
14					Bug Flows						HFE	
					TMF							
15					Bug Flows						Ext. Dur.	
					TMF						HFE	
16					Bug Flows							
		Mechanical Removal										
17					Bug Flows						HFE	
		Mechanical Removal										
18					Bug Flows						Ext. Dur.	
		Mechanical Removal									HFE	
19					TMF							
		Mechanical Removal										
20					TMF						HFE	
		Mechanical Removal										
21					TMF						Ext. Dur.	
		Mechanical Removal									HFE	
22					Bug Flows							
					TMF							
		Mechanical Removal										
23					Bug Flows						HFE	
					TMF							
		Mechanical Removal										
24					Bug Flows						Ext. Dur.	
					TMF						HFE	
		Mechanical Removal										

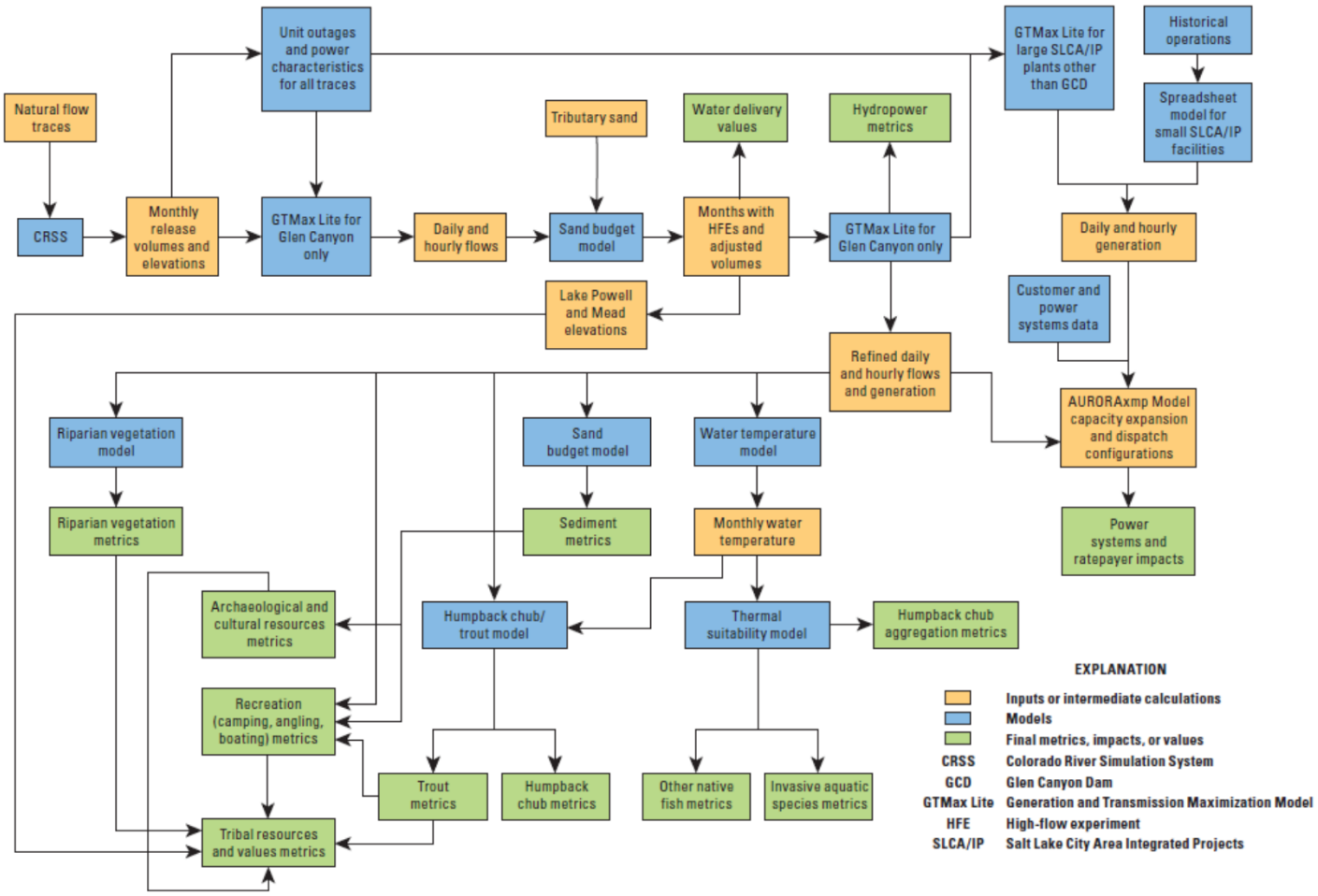


Figure 2. Model flow for the analysis of the Long-Term Experimental and Management Plan long-term strategies against the performance metrics.

[1]Appendix C, Page C-37 from LTEMP FEIS

An Example of a Scenario Outcome

July: $T_{LCR} = T_o + 3.791 / (0.000461 \times Apr\ Projected\ Release_{JUL})^{0.63} \times (36.31 - T_o)$,
where: $T_o = 249.4 - (0.0668 \times Apr\ Projected\ EOM\ Elev_{JUL}) + (3.766E\text{-}7 \times Apr\ Projected\ CY\ Inflow)$

where:

T_{LCR} = temperature at the Little Colorado River Confluence, °C

T_o = Lake Powell release temperature, °C

EOM Elev = Lake Powell projected end-of-month elevation, ft

CY Inflow = Lake Powell projected calendar year inflow, ac-ft

Release = Lake Powell projected monthly release volume, ac-ft

Calculation described in Appendix D, Page D-22 to D-23 from LTEMP FEIS

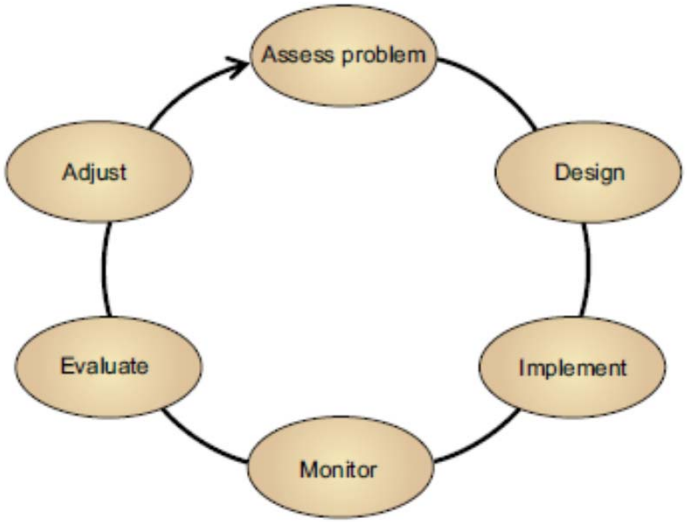
	Outcome		
Scenario	July 2017 Colorado River Temperature at LCR Confluence (°C)	Etc.	Etc.
1	15		
2	15		
3	15		
4	15		
5	15		
6	15		
7	15		
8	15		
9	15		
10	15		
11	15		
12	15		
13	15		
14	15		
15	15		
16	15		
17	15		
18	15		
19	15		
20	15		
21	15		
22	15		
23	15		
24	15		

Potential Roles and Responsibilities ???

Condition-dependent adaptive design

- Input on deciphering what it is[1]
- Advice on Science Plan
- Advice on experimental plans
- Advice on how to balance learning with achieving desirable outcomes

Adaptive Management



[1]Searching the term “condition-dependent adaptive design” in Google yields two results, the Executive Summary for the LTEMP DEIS and FEIS. We are truly charting a new course!

Potential Roles and Responsibilities ???

Annual implementation considerations

- Input on monitoring sufficiency
- Input on resource conditions
- Input on identifying unacceptable impacts
- Is the Annual Reporting Meeting the forum for providing input?

Long term off-ramp conditions

- Input on if objectives are being met (are treatments producing the desired effect?)
- Input on if there are unacceptable adverse impacts

TABLE 2-9 Implementation Criteria for Experimental Treatments of Alternative D

Experimental Treatment	Trigger and Primary Objective	Replicates	Duration	Annual Implementation Considerations[a]	Long Term Off-Ramp Conditions[b]	Action if Successful
Sediment Treatments						
Spring HFE up to 45,000 cfs in Mar. or Apr.	Trigger: Sufficient Paria River sediment input in spring accounting period (Dec.–Mar.) to achieve a positive sand mass balance in Marble Canyon with implementation of an HFE Objective: Rebuild sandbars	Not conducted during first 2 years of LTEMP, otherwise implement in each year triggered, dependent on resource condition and response	≤96 hr	Potential unacceptable impacts on water delivery or key resources such as humpback chub, sediment, riparian ecosystems, historic properties and traditional cultural properties, Tribal concerns, hydropower production and the Basin Fund, the rainbow trout fishery, recreation, and other resources; unacceptable cumulative effects of sequential HFEs; spring HFEs will not occur in the same water year as an extended-duration HFE (>96 hr)	HFEs were not effective in building sandbars; or unacceptable adverse impacts on the trout fishery, humpback chub population, or other resources	Implement as adaptive treatment when triggered and existing resource conditions allow
Proactive spring HFE up to 45,000 cfs (Apr., May, or Jun.)	Trigger: High-volume year with planned equalization releases (≥10 maf) Objective: Protect sand supply from equalization releases	Not conducted during first 2 years of LTEMP, otherwise implement in each year triggered, dependent on resource condition and response	First test 24 hr; subsequent tests could be shorter, but not longer, depending on results of first tests	Same as spring HFEs	Same as spring HFEs	Implement as adaptive treatment when triggered and existing resource conditions allow

Potential Roles and Responsibilities ???

- The Work Plan and Budget is an important policy tool for integrating LTEMP into GCDAMP processes. It should include:
  - "long-term monitoring programs and activities that will ensure that Glen Canyon Dam is operated in a manner consistent with section 1802" of the Grand Canyon Protection Act.
  - "any necessary research and studies to determine the effect of the Secretary's actions under section 1804(c) on the natural, recreational, and cultural resources of" GCNP and GCNRA.
- TWG input on content and organization
- TWG input on priorities

Other Thoughts[1]

- Does the TWG need specific direction from the AMWG?
- Are the LTEMP Resource Goals integrated into GCDAMP processes?
- How can experimental monitoring be implemented without disrupting long-term monitoring? How is it budgeted?

[1]This is here just to see if you're reading these footnotes. Your reward for doing so is to learn that pteronophobia is the fear of being tickled by feathers.