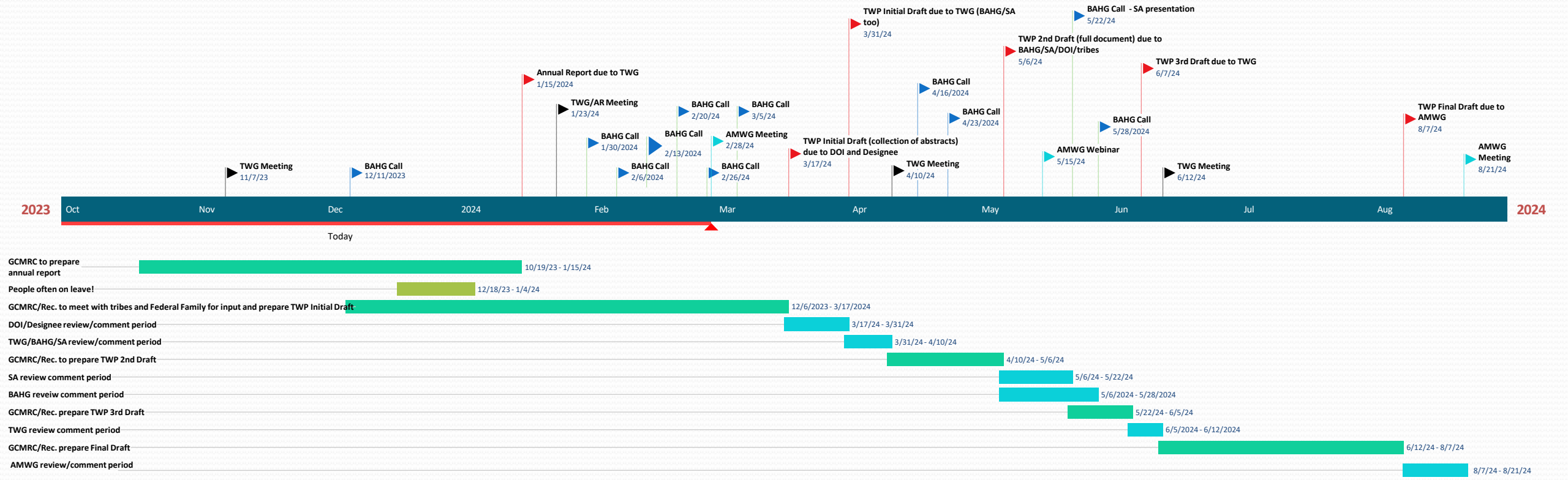
BAHG Update

February 2024 AMWG Meeting

Erik Skeie, BAHG Chair

What am I rambling on about today?

1. TWP Timeline
2. GCMRC FY2025-2027 Proposed Projects and BAHG Feedback
3. AMWG Discussion


TWG Meeting
11/7/23
BAHG Call
12/11/2023
Annual Report due to TWG
1/15/2024
TWG/AR Meeting
1/23/24
BAHG Call
1/30/2024
BAHG Call
2/6/2024
BAHG Call
2/13/2024
BAHG Call
2/20/24
AMWG Meeting
2/28/24
BAHG Call
2/26/24
BAHG Call
3/5/24
TWP Initial Draft (collection of abstracts) due to DOI and Designee
3/17/24
TWP Initial Draft due to TWG (BAHG/SA too)
3/31/24
TWG Meeting
4/10/24
BAHG Call
4/16/2024
BAHG Call
4/23/2024
TWP 2nd Draft (full document) due to BAHG/SA/DOI/tribes
5/6/24
AMWG Webinar
5/15/24
BAHG Call - SA presentation
5/22/24
BAHG Call
5/28/2024
TWP 3rd Draft due to TWG
6/7/24
TWG Meeting
6/12/24
TWP Final Draft due to AMWG
8/7/24
AMWG Meeting
8/21/24
2023
Oct
Nov
Dec
2024
Feb
Mar
Apr
May
Jun
Jul
Aug
2024
Today

GCMRC to prepare annual report
10/19/23 - 1/15/24
People often on leave!
12/18/23 - 1/4/24
GCMRC/Rec. to meet with tribes and Federal Family for input and prepare TWP Initial Draft
12/6/2023 - 3/17/2024
DOI/Designee review/comment period
3/17/24 - 3/31/24
TWG/BAHG/SA review/comment period
3/31/24 - 4/10/24
GCMRC/Rec. to prepare TWP 2nd Draft
4/10/24 - 5/6/24
SA review comment period
5/6/24 - 5/22/24
BAHG reveiw comment period
5/6/2024 - 5/28/2024
GCMRC/Rec. prepare TWP 3rd Draft
5/22/24 - 6/5/24
TWG review comment period
6/5/2024 - 6/12/2024
GCMRC/Rec. prepare Final Draft
6/12/24 - 8/7/24
AMWG review/comment period
8/7/24 - 8/21/24

GCMRC TWP FY 2025-2027

- Projected FY25 Budget: $12.5M
  - 80% GCMRC = $10M
  - 20% BOR = $2.5M

- **General BAHG Feedback:**
  - GCMRC to think of how these Projects relate into the larger picture of LTEMP and the ecosystem as a whole.
  - GCMRC should clearly define how their Projects relate to LTEMP and management decisions.
  - The BAHG requests that Reclamation conduct a priority exercise with the Projects in the Initial Draft of the TWP similar to previous work.
  - The BAHG will also undergo its own prioritization exercise after the Initial Draft of the TWP is developed.

Project A

- A.1 – Stream Gaging
  - Stage
  - Discharge
- A.2 – Water Quality
  - Water Temperature
  - Salinity (specific conductance)
  - Turbidity
  - Dissolved Oxygen
- A.3 – Sediment transport and budgeting
  - Suspended- and bed-sediment data
  - Sediment loads (silt and clay loads and sand loads)
  - User-interactive sand budgets in 6 reaches from Lees Ferry to Lake Mead
- A.4 – Database and Website support (has lacked funding in prior years)

Project A continued

- **BAHG Feedback:**
  - Move the Database and Website management into Project K in order to streamline the TWP.
  - Analyze duration and extent of clear water flow, and what consequences that may have on the ecosystem.

Project B

- B.1 – Sandbar Monitoring
  - Continue with traditional sandbar modeling from previous TWP
  - Maintain Remote cameras – Update with new system (NEW)
  - Investigate of impact of HFE hydrograph shape on sandbar morphology (NEW)
  - Continue to investigate the interactions between sandbars and vegetation (NEW)
- B.2 Bathymetric and topographic mapping for monitoring long-term trends in sediment storage
  - Upper Marble Canyon will be remapped May 2024
  - Provide updated assessments for sandbar and sand storage response in Lower Marble Canyon and Eastern Grand Canyon
  - Develop method for "synoptic" assessment of sand storage for all of Grand Canyon
  - Riverbed dynamics in Western Grand Canyon – Continue evaluation of riverbed respons
- B.3 Control Network and Survey Support
- B.4 Sediment and Sandbar Modeling
  - Predictions of turbidity and fine sediment storage for fish habitat and nutrient dynamics
  - Improve sandbar modeling to better predict sandbar erosion
  - Predictions of flow depth and velocity for fish habitat in Marble Canyon

BAHG Feedback: There was no additional feedback from the BAHG.

Project C

- C.1 – Ground-based riparian vegetation monitoring
  - Annual data collection
  - Analysis of vegetation as wildlife habitat (NEW)
- C.2 – Determine hydrological tolerances and management tools for plant species of interest
  - Greenhouse experiments on daily fluctuating flows
- C.3 – Predictive models and synthesis
  - Flows that would push plant communities toward metric goals
  - Use existing data to explore changes in dominant species impacts on the rest of the community
  - Flow/vegetation/sediment modeling
- C.4 – Vegetation management decision support
  - Consult on vegetation removals/plantings
  - Phragmites (NEW)

Project C continued…

- **BAHG Feedback:**
  - Supportive of moving towards a habitat based approach.
  - Suggestion to develop a wildlife habitat metric, and to look at wildlife habitat based on ecological functional groups.

Project D

- D.1 Dam operations, vegetation management, archaeological sites
  - Continue long-term monitoring of archaeological sites using lidar and site classification
  - Evaluate mechanisms responsible for observed changes in site classification (NEW)
  - Continue experimental vegetation management study with NPS (Move to Reclamation?)
  - Experiment with different vegetation removal strategies, plantings, and sediment capture (Move to Reclamation?)
  - Collaborate with Hopi Tribe, NPS, and others, to explore applicablitiy of traditional dryland farming knowledge and soil management practices (NEW to Reclamation?)
- D.2 Monitoring landscape-scale ecosystem change with repeat photography
  - Continue compiling record of ecological changes affecting cultural landscape and archaeological site preservation using repeat photography
- Evaluate rock art site condition using lidar and photogrammetry (NEW)
- Pilot study to evaluate potential to extract cultural and ecological information from Colorado River deposits using eDNA (NEW)
- Collaboration with NPS on formal analysis of archaeological site monitoring data (NEW)

Project D continued…

- **BAHG Feedback:**
  - Consider whether some of these items have gone from experimental to management actions, and who should ultimately take ownership of any management actions.
  - Concern expressed about Zuni being unable to connect with their ancestors if their sites are buried.

Project E

- E.1 – Phosphorus (P) Budgeting in the Colorado River (CR)
  - Further Develop Relationships between silt and clay concentrations and P
  - Determine sediment P concentrations throughout CR and LCR
  - Quantify sediment P uptake/release capacity & how changing chemical/physical conditions may affect sediment P reservoir
  - Construct a P budget for CR (NEW)
  - Use the P budget to estimate nutrient transport across other years and extend to GPP modeling (NEW)
- E.2 – Rates and composition of primary producers in the CR
  - Develop a mechanistic GPP model
  - Quantify the relative contribution of diatoms vs macrophytes to Glen Canyon GPP
  - Continue to document shifts in the vegetation community in Glen Canyon (NEW)
  - Canyon wide survey of diatoms and voucher taxa for the ecosystem (NEW)
- E.3 – Fish Metabolism & Ecosystem Models
  - Measure standard and active metabolic rates of native fish (Bioenergetics Modeling)
  - Integrate data in ecosystem models for Glen Canyon (ongoing) and Grand Canyon (NEW)

Project E continued…

- **BAHG Feedback:**
  - Look into developing a controlled experimental area downstream of the dam.
  - Use bioenergetics in E.3 to determine how piscivorous warm water invasive fish species are, and better determine how much of a threat they pose to native fish species.

Project F

- F.1 – Aquatic invertebrate monitoring in Grand Canyon
  - Community Science
  - eDNA
- F.2 – Aquatic invertebrate monitoring in Glen Canyon
  - Monthly sampling of drift, sticky traps, light traps
- F.3 – Invertebrate monitoring in tributaries (NEW)
  - eDNA work only funded in FY21
- F.4 – Fish Diet Studies
  - Fecal DNA sampling
- **BAHG Feedback:**
  - Use the eDNA collected in this project to detect/determine cause of human pathogens.
  - The BAHG also asked if GCMRC foresaw any Bug Flow replicates occurring in the upcoming TWP, GCMRC stated the link between bug flows and humpback chub growth/survival has not been established, and further replicates may help determine if such a link exists.

Project G

- G.1 – Humpback Chub (HBC) population modeling
  - Close-kin mark-recapture of HBC (NEW)
- G.2 – Annual spring/fall HBC abundance estimates in lower 13.6 km of the Little Colorado River (LCR)
  - Model vulnerability to climate change and drought (NEW)
- G.3 – Juvenile HBC monitoring near the LCR confluence
- G.4 – Remote Passive Integrated Transponders (PIT) tag array monitoring in the LCR
  - Expand PIT antenna detections throughout Grand Canyon (NEW)
- G.5 – Monitoring HBC aggregation relative abundance and distribution
  - Estimate HBC abundance in Western Grand Canyon
- G.6 – Juvenile HBC Monitoring – West
- G.7 – Chute Falls HBC translocations
  - HBC exploration above Blue Springs (NEW)

Project G continued…

- **BAHG Feedback:**
  - Include a means to monitor HBC response to actions in the LTEMP SEIS.
  - Examine whether or not bioenergetics from Project E could be used to look at carrying capacity of HBC in lower Western Grand Canyon.
  - Consider investigating whether or not the Paria is suitable for HBC, and what would happen to the HBC populations in WGC should Lake Meade ever refill.

(NEW) Project X: Other Native Fish

- Analyze existing data – Bluehead Sucker, Flannelmouth Sucker, Razorback Sucker, and Speckled Dace
  - Data: size, distribution, capture, and PIT-tag antennas
  - Estimate native fish demographics
  - Improve predictive modeling
- New Technology-pilot study: Acoustic tags with "predation sensors"

- **BAHG Feedback:** There was no additional feedback from the BAHG.

Project H

- H.1 – Rainbow Trout monitoring in Glen Canyon
  - Electrofishing and Creel Survey/Citizen science
- H.2 – Experimental Flow Assessment of trout Recruitment
  - Mark-recapture and reproductive status
- ~~Brown trout early life stage studies~~
- H.4 Salmonid Modeling
  - Causal hypothesis
  - Incorporate incentive harvest into Brown Trout modeling
  - Trout population dynamics
  - Predictive capabilities for decision-making

- **BAHG Feedback:** There was no additional feedback from the BAHG.

Project I

- I.1 – System-wide ~~native fish and~~ invasive species monitoring
  - Long-term monitoring
  - Parasite monitoring
- I.2 – Invasion and colonization dynamics of warm-water fish
  - Nonnative fish surveillance
  - Evaluate risk of upstream pools in the Little Colorado River to Humpback Chub
  - Use eDNA as early detection tool for nonnative fish

Project I continued: Smallmouth Bass (New)

- Modelling population dynamics
  - Improving forecasting tools
  - Analyze data from multiple agencies for nonnative fish to determine efficacy of removal actions and/or flow management actions
- Reproduction
  - Use kinship genetic analysis to estimate number of nests and the role of local reproduction vs. entrainment
  - Test efficacy of side scan sonar to locate nests
  - Determine hatch dates of larval fish
- Lab Studies
  - Determine larval survival and growth under high turbidity conditions and varying temps.
  - Diet studies and food preference

Project I continued: Warmwater Fish Projects (New)

- Other Nonnative Fish
  - Mark-recapture of Green Sunfish to determine efficacy of removals and vital rates
  - PIT tag experiment in lab – shed/mortality rate of small fish
  - Literature review to inform development of walleye models
  - Metrics-develop pipeline to analyze fish data in an occupancy framework.
  - Mini antenna citizen science pilot to detect fish
- Lake Powell – Entrainment
  - Determine the efficacy of nets using paired eDNA samples
  - Lake Powell eDNA study at depth to determine species that could be entrained
- Emerging Threats
  - Monitor fish disease and parasites associated with warm water
  - Utilize tools like metabarcoding to monitor for new introductions of aquatic invasive species

Project I continued

- **BAHG Feedback:**
  - Include entrainment in the population dynamics model moving forward.
  - Add a Project Element to allow for GCMRC involvement in discussion and review of actions from the Strategic Plan developed by SBAHG
  - Ensure Project I is equipped to monitor/analyze data from any actions in the LTEMP SEIS.
  - Develop a reporting method that combines all findings from the various agencies on invasive species to keep the AMWG and TWG up to date on the statues of non-native fish detections in the system.

Project J

- J.1 – Recreation
  - Continue with monitoring and research related to Brown Trout Incentivized harvest program
  - Develop modeling capabilities for recreation metrics (NEW)
  - Regional economic impact of recreation spending under different future hydrology (NEW)
- J.2 – Integrated modeling project
  - Continue to develop predictive screening model capabilities to integrate socio-economic, biological, and physical resource outcomes downstream
  - Focus on value of information (i.e., linking research to management) methods
- J.3 – In collaboration with interested tribal partners design and implement a framework for monitoring integration of Tribal Knowledge of cultural benefits (NEW)

Project J continued

- **BAHG Feedback:**
  - Concern with inclusion of hydropower monitoring, analysis and metrics, particularly as the Socio-economic Ad Hoc Group recommended moving Project N to Reclamation.
  - There was BAHG supportive of the remaining proposed elements.

Project K

- K.1 – Geospatial Data & Analysis
  - Support to Science Projects
    Develop of maps, tools, GIS layers, Guidance on ArcGIS
  - Analysis and processing support (Use of Python, Training, Data Integration)
  - Access to Geospatial Content (Data services, Online Maps)
- K.2 – Data Management / Data Science (Geospatial and Non-spatial)
  - Centralize the enterprise environment (NEW)
  - Fish Monitoring, Lake Powell Water Quality, Sandbar Monitoring, Riparian Vegetation
  - Project A: Sediment monitoring database and website (NEW)
- K.3 – Data Telemetry / IoT / Field Engineering
  - Support, Maintenance, Improvements (Glen Canyon Dam IoT Site, LCR IoT site, Stream Gauging
  - Connect Sensors
  - Direct-to-Cell beta program (SpaceX; NEW)

- **BAHG Feedback:** The BAHG suggested potentially expanding geospatial data collection to support Tribal research efforts.

Project L

- L.1 – Overflight remote sensing
  - Map Colorado River ecosystem landcover changes
    - Use remote sensing imagery from previous workplan Project L
  - Measure system-wide changes in high-elevation sand deposits
    - Use previous Project L work and collaborate with projects A,B,C,D
  - Flow/vegetation/sediment modeling
    - Contribute landcover change observation for model calibration and validation
    - Collaborate with projects A,B,C,D
  - Overflight mission to acquire multispectral imagery (NEW)
    - Proposed only for 2026 and similar to 2021 efforts
  - Overflight mission to acquire airvorne lidar (NEW)
    - Proposed only for 2026 in conjunction with imagery overflight

Project L continued

- **BAHG Feedback:**
  - Concern about increased price if the flights include LiDAR and multispectral imagery
  - GCMRC was encouraged to look at ways to save money or cost share, specifically if there is opportunity to cost share with the USGS 3DEP Program.

Project M

- M.1 – Leadership, management, and support
- M.2 – Logistics staff
  - Anticipating increase in Logistics area
- M.3 – IT

- **BAHG Feedback:** There was no additional feedback from the BAHG.

Project N

- N.1 – Hydropower monitoring and research – (SEAHG Recommendation Move to Reclamation side of budget using the Scope in the 2021-2023 TWP)

- **BAHG Feedback:** The BAHG was supportive of the SEAHG recommendation, but will need additional information on what exactly this would mean in terms of budget and the project work.

AMWG Discussion

- Are there any other nonnative species (fish, crayfish, vegetation, etc.) we need to focus on?
- What research goals would you like to see more information gathered on?
- Are there ways we could involve more citizen/community science projects?
- Is there any additional feedback AMWG members would like to provide?

The BAHG 2025-2027 TWP Future

- Future BAHG Meetings:
  - 3/5/24: Post-AMWG
    - Other Dates may be added as needed
  - 4/16/24: Initial DRAFT Feedback #1

- KEY DATES:
  - 3/17/24: TWP Initial Draft due to DOI
  - 3/31/24: TWP Initial Draft due to TWG
  - 5/6/24: TWP 2nd Draft due to Science Advisors and TWG
  - 6/7/24: TWP 3rd Draft due to TWG
  - 6/12/24: BAHG Recommendation at TWG Meeting (might get pushed to July)
  - 8/7/24: TWP Final Draft Due to AMWG