

**Utah Lake Water Quality Study
Science Panel Meeting #7 (via web)
Summary
March 19-20, 2020**

This document includes a list of future meetings, action items, and a brief summary of the discussions. Please review the action item list for tasks assigned to you and/or the Science Panel in general (those are highlighted in yellow). A list of attendees can be found at the end of the document.

Upcoming Meeting/Call	When	Suggested Agenda Items
ULWQS Science Panel (Call #12)	TBD	○ Seek SP approval of SRP and RFPs
Independent SP call	TBD	○ Rank Responses to RFPs
SP Meeting #8	June/July	○ Touch base on ongoing research; other items TBD
SP Call #13	Aug/Sep	○ Check in on various items

I. Action Items

Meeting Summaries	Who	Due Date	Completed
1. Post background materials and presentations to Dropbox [link]	Facilitation Team	April 1	April 1
2. Share draft meeting summary	Facilitation Team	April 1	
3. Review and share comments on summary	Science Panel	April 8	
4. Finalize meeting summary/post to Dropbox	Facilitation Team	April 8	
Near-term Research Projects	Who	Due Date	Completed
5. Review and comment on sediment final report and bioassay interim report	Science Panel	April 6	
University of Utah Model Development	Who	Due Date	Completed
6. Share draft Model Report with the Science Panel once reviewed by DWQ	DWQ and Science Panel	April 24	

Science Panel Technical Support/Data Characterization	Who	Due Date	Completed
7. Share draft SRP for Science Panel review	Tetra Tech	April 24-May 8	
8. Review and share comments on SRP	Science Panel	May 1-May 15	
9. Draft RFPs and share for Science Panel review	Tetra Tech	April 24-May 8	
10. Review and comment on draft RFPs	Science Panel	May 1-May 15	
Atmospheric Deposition	Who	Due Date	Completed
11. Share updated WFWQC sampling and analysis plan with the Science Panel	Facilitation Team	March 20	March 20
12. Review and comment on the WFWQC sampling and analysis plan	Science Panel	April 6	
Miscellaneous	Who	Due Date	Completed
13. Save papers shared by members of the Science Panel to the Dropbox	Facilitation Team	April 3	

Day 1: Thursday, March 19, 2020 9:00 a.m. to 12:30 p.m.

II. Meeting Recording – March 19

Recordings of the meeting (also available on the DWQ website in the near future) can be found at the following links:

March 19: <https://utdeg.adobeconnect.com/pnrk8yu8x84e/>

March 20: <https://utdeg.adobeconnect.com/p20kpgaar7sj/>

Please use the video scroll bar along the bottom of the recording window to find the appropriate time in the webinar recording for the session you would like to watch. There are bookmarks in the 'Events Index' on the left side of the screen identifying each session.

III. Key Points of Discussion – March 19

Welcome and Agenda Review

Dave Epstein, SWCA, welcomed everyone to the web meeting and listed the Science Panel members, project team members, and other participants listening in to the meeting. Mr. Epstein also provided an overview of the meeting agenda.

Mr. Epstein recognized the challenging situation presented by the spreading COVID-19 outbreak and the need to move the meeting to a web meeting. He thanked everyone for their flexibility and willingness to

adapt. Additionally, Mr. Epstein went over the ground rules and the functionality of the Adobe Connect room. He presented some of the Adobe Connect tools that would be utilized for the meeting and thanked everyone for their patience as the Facilitation Team worked out the kinks of the meeting tools.

Strategic Research Plan: Identify RFP Topics

Dr. Michael Paul, Tetra Tech, stated that the goal for the meeting was to identify a set of research projects, based on the 19 previously agreed upon research priorities, and begin to develop Request For Proposals (RFPs) so the projects can be implemented in time for the 2020 field season. Dr. Paul gave a brief review on the status of the Strategic Research Plan (SRP) and the process used to develop the prioritized list of research ideas to address the Steering Committee Charge questions. He provided an overview of the working document “Strategic Research Planning and Priorities” that contained the ranked list of 19 research priorities and proposed research ideas based on research priorities 1 through 4.

Dr. Erica Gaddis, Steering Committee co-chair, reported that the Steering Committee was supportive of the ranked list of research priorities and requested that the Science Panel consider how atmospheric depositional data will be integrated into the external loading estimate as part of Research Priority #1: Internal versus External Loading.

The Science Panel discussed whether existing data and information on sediment fluxes and loading should be utilized before pursuing additional information. They stated that loading could be addressed using existing standing stock and flux data through modeling. The Science Panel decided that existing data and information should be included as part of the RFPs.

Dr. Hans Pearl mentioned that the mismatch of P availability and chlorophyll *a* could be a result of co-limitation or N limitation. He stated that the bioassay research indicates there is a strong indication of co-limitation. He reiterated the importance of understanding N cycling and interactions with P.

Dr. Mike Brett added that a mass balance can be calculated from the long term monitoring data. He said that, based on the data, there is a strong seasonality of high P concentrations in late summer that do not correspond with P loading indicating a P release from sediments. He highlighted the need for more N data (and a compilation of nitrogen data for Utah Lake) and shared a [paper \(public link\)](#) with the panel on mineralization in terminal lakes.

Dr. James Martin suggested a review of available data for sediment fluxes to determine the contribution of sediment N and P to the mass balance. He recommended the use of models (EFDC and SEDFLUX) to identify data gaps; in particular, factors affecting sediment concentrations.

For the P bioavailability measurement discussion, Dr. Ryan King mentioned that there could be fractions of dissolved P that may or may not be bioavailable that get measured as SRP because of the acidic fraction. In bioassay treatments where N is added in combination with low levels of P and an algal growth response occurs, the decrease of P shows it is bioavailable regardless of the form of P.

Dr. Mitch Hogsett added that 50% of TP was soluble and the long term monitoring data may actually be total dissolved phosphorous instead of SRP due to methods used. The orthophosphate is filtered and put on ice and should never be acidified. He stressed the need to verify DWQ methods to make sure they are not acidified.

For the littoral idea Dr. James Martin suggested that the rate constants (e.g., denitrification rates) in the model be reviewed or verified.

Dr. Gaddis let the Science Panel know that the Timpanogos Special Service District (TSSD) Utah Lake mesocosm study received funding from the legislature. She explained that the funding will be dispensed and overseen by the Division of Forestry, Fire, and State Lands and because the funds are legislative and go through a state agency, the TSSD RFP will have to go through procurement.

Scott Daly, DWQ, commented that if the Science Panel is interested in the mesocosm approach, they should outline what they would want to see in a mesocosm experiment so the information can be provided to the TSSD study team. He explained that TSSD is using this summer to develop the mesocosm study concept and to work out how they will deal with the challenges related to wind and waves in the lake. Dr. Martin asked about what is known about the relationship between Secchi depth and light extinction (macrophytes) and whether it might make sense to pursue a compilation of light data.

Dr. Paul replied that Tetra Tech is developing light availability relationships based on DWQ data and expanding on Dr. Brett's analysis.

The Science Panel decided to discuss the following research ideas in which to develop RFPs:

- Study #1: to address Science Panel Research Priorities #1, 2, 5, and 7 carbon, nitrogen, and phosphorus cycling inventory and knowledge gap identification
- Study #2: to address Research Priority #9 - Littoral Sediment Study
- Study #3: to address Science Panel Research Priority #3 - Calcite Binding to Phosphorus

Mr. Epstein asked the Ex Officio members of the Science Panel if they plan to submit proposals to perform any of the research studies to be outlined in RFPs. Drs. Janice Brahney and Soren Brothers expressed interest in study #2 related to littoral sediments. Dr. Greg Carling expressed interest in both study #2 and study #3 related to calcite binding. Mr. Epstein explained that the breakout sessions to develop the RFPs would be organized to avoid participation of the Ex Officio panelists interested in competing for the work.

Strategic Research Plan: Draft RFP Outlines Breakout Session

The Adobe Connect web meeting room was divided into two breakout rooms for discussion of RFPs for studies #1, #2, and #3. Dr. Paul facilitated a group of Science Panelists as they worked through developing the components of the RFP for study #1 (P, N, and C cycling) and study #2 (littoral sediments). Mr. Epstein facilitated the other breakout room working on study #3 (calcite binding). Due to time constraints, the second breakout session was postponed for the following day.

Public Involvement

David Richards: There is little to no data on the role of benthic algae on ecology of Utah Lake including nutrient cycling. A pretty big data gap.

Responses: Dr. Brothers said that based on benthic algae experiments, there was only 10-15 centimeters of visibility so there wasn't much benthic algae, roughly less than 1% of productivity. Historically it could have been higher. Currently it is a minor role.

Dr. Martin added that benthic algae are simulated in the EFDC/WASP model.

Dr. Hogsett added that benthic algae probably cannot attach because it is nonconsolidated sediment and no benthic mats were seen during core sampling.

Dr. Brett also added that benthic algae would probably be buried and light limited.

David Richards: Traditionally mollusks governed Carbon cycle but to lesser extent today. We did a rough estimate of Carbon cycling in Jordan River downstream of UL and found invasive Asian clam and New Zealand mudsnail govern C-cycle.

LaVere Merrit: It is also very important to know what the Atmospheric Deposition (AD) contributions are if we are going to try to tie down water column - sediment cycling. I am strongly of the opinion that AD is much higher than previously thought. With significant N coming from the AD, that component is again very important.

David Richards: A secondary question/concept is that chemistry is chemistry but there are over 400 species of algae, 50 species of zooplankton, tons of biomass of benthic invertebrates and diversity and a dozen species of invasive fishes all interacting and influencing chemistry.

Day 2: Friday, March 20, 2020 9:00 a.m. to 12:30 p.m.

I. Key Points of Discussion

Welcome and Agenda Review

Mr. Epstein welcomed everyone back to day 2 of the web meeting and listed the Science Panel members, project team members, and other participants listening in on the call. Mr. Epstein also provided an overview of the meeting agenda.

Strategic Research Plan: Draft RFP Outlines Breakout Session

The Science Panel was divided into 3 different breakout rooms to discuss study #1 (P, N, and C cycling) and study #2 (wetting and drying of littoral sediments), study #3 (calcite binding), and the components of the other research ideas that could be addressed in mesocosm studies. Unlike on the first day, for this breakout session there were three groups working concurrently to allow all SP members to participate (since some members had indicated an interest in bidding on work).

Following the breakout session, Dr. Paul, Mr. Epstein, and Mr. Daly reported out on the breakout discussions and provided outlines for the three studies:

- **Study #1 to address Science Panel Research Priorities #1, 2, 5, and 7: Carbon, Nitrogen, and Phosphorus Cycling Inventory and Knowledge Gap Identification**
 - Expected outcomes:
 - A depiction and understanding of major standing stocks and fluxes of phosphorus, nitrogen, and carbon internal and external loading; putting numbers to the conceptual models
 - An understanding of major fluxes of nitrogen into and out of the lake ecosystem via gaseous exchange
 - Identification of data gaps in phosphorus, nitrogen, and carbon internal and external cycling elements and a study plan to fill the gaps
- **Study #2 to address Research Priority #9: Littoral Sediment Study**
 - Expected outcomes:
 - Estimate the fluxes of nutrients from newly inundated littoral (areas that had been exposed during low lake levels that became inundated)
 - Comparison of the relative magnitude of these nutrient fluxes to total lake fluxes
 - A literature review of general processes in similar lake ecosystems
- **Study #3 to address Science Panel Research Priority #3: Calcite Binding to Phosphorus**
 - A deep-level characterization of phosphorus in the lake; in the water column and sediments, both particulate and dissolved
 - Estimate of the magnitude of phosphorus binding to and release from sediment compounds
 - A detailed description of the mechanism of phosphorus binding to sediment compounds (including calcium compounds)
 - Description of the compounds that bind to phosphorus
 - Description of the conditions that result in phosphorus binding and release from sediment compounds.

A discussion ensued and Dr. Martin suggested that mesocosms could be used to look at changes in sediment and concentrations over time. However, he said that it could take years to see that change.

Dr. Brothers suggested that when using mesocosms consider carp exclusions.

Dr. Pearl added that ratios and forms of N are important in relation to toxin production.

Dr. Paul indicated the breakout session results will provide the outlines for the three studies. He added that the studies will be developed into RFPs and be distributed for review by the Science Panel.

Public Involvement

David Richards: Wasatch Front Water Quality Council have proposed a pilot mesocosm project for measuring effects of carp on ecology to measure carp effects on zooplankton.

Utah Lake Model Development

Nick von Stackelberg, DWQ, gave a progress update on the University of Utah (U of U) model development and an overview of model processes and limitations. He explained that DWQ had received the calibrated model from the U of U team this week and will start the initial scoping of potential tasks for a modeling contractor to work on addressing model gaps. Dr. Martin led a discussion on the existing

model structure and missing components. Mr. von Stackelberg and Dr. Martin received several questions from the Science Panel related to the ease of modifying model code in WASP, the groups of plankton included in the model, and the ability to model calcite binding of phosphorus.

Dr. Brett asked if the code could be modified to include calcite formation. Mr. von Stackelberg replied that it is not open source and that EPA maintains the code but could make modifications. Dr. Martin added that the code is not distributed, although, Dr. Martin or Tim Wool, USEPA, could theoretically modify the code; however, it would not be trivial or typical. He suggested a separate Science Panel meeting to discuss the changes. Juhn-Yuan Su, U of U, commented in the chat box that he has asked Mr. Wool to make such modifications.

Dr. Pearl and Dr. Brett suggested reconsidering the three cyanobacteria species in the model and to add more functional groups (e.g., diatoms, green, brown, and cyanobacteria). Juhn-Yuan Su noted that, as discussed during previous meetings, the only inputs to WASP for phytoplankton involves the fraction of grazability (by zooplankton) per phytoplankton group, while such fraction is CONSTANT throughout the entire model simulation period per node. He added that there do not appear to be other WASP portions that can be employed for simulating food web applications/processes. He indicated the "Aphanizomenon Gracile" corresponds to cyanobacteria for the Utah Lake WASP. These three phytoplankton groups are based on collaborations with Dr. Goel's group, where he suggested these groups be incorporated into WASP.

Dr. Hogsett asked why alkalinity or pH are not inputs and why there is no precipitation of calcium carbonate simulated in the model. He added that Ca-P precipitation for the P mass balance and balancing pH and ALK is required ($\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$).

Mr. von Stackelberg replied that they are modeled as effects of other processes. Dr. Martin added that this will need to be fixed with EPA and has been applied to other systems. He explained that the problem could be in the hydrodynamic linkage with EFDC or the wet/dry cells in this application. Juhn-Yuan Su added that for pH and alkalinity, the Utah Lake WASP will yield high values for pH (e.g., 14) and alkalinity (e.g., 10^{23} mg/L), followed by "NaN" values for all constituents throughout the entire simulation period. Dr. Martin said it's not an equilibrium speciation model. The documentation for the WASP pH Alkalinity model is at: <https://www.epa.gov/ceam/wasp-model-documentation>

Dr. Martin explained that there could be a possible simple model modification for wet and dry cells using the sediment diagenesis versus the descriptive models. Mr. von Stackelberg added that sediment diagenesis slows the model down so they need to reduce the number of cells. He said that it takes 7-8 hours for WASP and EFDC takes longer. Juhn-Yuan Su added that for the sediment diagenesis simulations (e.g., apply sediment diagenesis for particular nodes indicated as "wet" and apply prescribed values for others) and enabling sediment diagenesis throughout ALL nodes will instigate the model to run extremely slowly (e.g., 20+ hours for running past 1 day) and reduce the number of sediment diagenesis segments to resolve the sediment diagenesis issues.

Mr. von Stackelberg suggested that the next steps for the Utah Lake models are to review the models received by the U of U and summarize the needs and gaps in a memo. DWQ will review the model prior to distributing it to the Science Panel.

Public Involvement

LaVere Merritt: Sediment interaction is vital in dynamic processes - however, we know that some 70 to 90% of P is going to the sediments (w/o atmos. Dep.) it seems that this sediment - w. column interaction is what is determining the P concs in the w. col.

David Richards: EcoSim and EcoPath are decent models for manipulating carp levels

David Richards: other fish species will take up the slack from carp removal

LaVere Merritt: Are there other chemical reactions that are as important as Calcite?

LaVere Merritt: Where such are amounts of P are involved--might all of these others end up controlling?

LaVere Merritt: With such large amounts of P are being cycled might all of the others be dominant?

Brief Updates on Other Science Panel Business

Dr. Hogsett gave an update on the Wasatch Front Water Quality Council (WFWQC) atmospheric deposition sampling plan. He explained that he received the Sampling and Analysis Plan from the WFWQC on 03/13/2020. Dr. Theron Miller told the Science Panel that the NADP equipment was purchased and they are moving ahead with sampling. He believes that there will still be controversy over dry deposition monitoring because there is no protocol. Mr. Epstein reiterated the Steering Committee's interest in the Atmospheric Deposition studies and how they will be incorporated into the overall effort by the Science Panel. He reminded everyone that the SAP was supposed to be delivered by the WFWQC in February and the agreement between the WFWQC and the SP was the WFWQC would wait for comments to the SAP before sampling. Dr. Brett added that the key for the atmospheric deposition field data collection is transparency. He explained that if the Science Panel has access to the nitty-gritty details of the field data, then they will have much more confidence in them.

Mr. Epstein gave an update from the March 13, 2020 Steering Committee Meeting. He explained that the Steering Committee approved the Uncertainty Guidance with minor edits and that once the edits are made, the document will be shared with the Science Panel. He continued to explain that the Steering Committee needs more time to review and provide comments on the Framework Document. He stated that some members were concerned about the examples provided particularly, cyanobacteria cell counts. Mr. Epstein explained that Steering Committee comments are due April 3 and will be shared, along with a modified Framework Document, with the Science Panel. Finally he explained that the research prioritization list was approved by the Steering Committee with one edit that Research Priority #1 should include atmospheric deposition but that the Strategic Research Plan still needed to be finalized by the Science Panel so the Steering Committee could review it.

Dr. Gaddis gave an update on suggested changes to the Steering Committee and Science Panel Operating Principles that were approved by the Steering Committee during the March 13 meeting. She explained that the changes in the Steering Committee Operating Principles were suggested by local elected officials to improve the study process and include a process for Independent review that is based on existing Utah State Statute. Additionally, Dr. Gaddis described the change to the Science Panel Operating Principles, where the voting process would now formally include all Science Panel members and not only the independent members. She said that the next steps for the Steering Committee will be to discuss the management goals.

Public Involvement

David Richards: Utah Lake should be studied, modelled, and managed as a highly regulated reservoir not a lake ecosystem. Lakes and reservoirs function very differently. I have spent many hours, days, months, years, working and synthesizing ecological data of waters in the Utah Lake drainage including the Jordan River and also the geologic history, evolution and ecology of the Colorado River. For example, the Jordan River is a head-cut river similar to how the Colorado River formed the Grand Canyon. I speculate that it is entirely possible that during the very high-water above compromise in the early 1980s in Utah Lake, Jordan River head cutting could have drained Utah Lake or at least drastically permanently reduced its level given unconsolidated substrate at its outflow if it wasn't a reservoir. Including all the other anthropogenic activities negatively affecting Utah Lake, we are dealing with an analog system and we can make the lake anything we like.

LaVere Merritt: A good cost - benefit component would be a huge improvement in the decision – making.

Response: Dr. Gaddis replied that a cost benefit analysis will be part of the policy part of the process and included in the implementation. Also, the associated uncertainty will be included.

Day 1 Meeting Participants (Name, Organization)**Members of the Science Panel:**

- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Soren Brothers, Utah State University
- Greg Carling, Brigham Young University
- Mitch Hogsett, Forsgren Associates, Science Panel Chair
- Ryan King, Baylor University
- James Martin, Mississippi State University
- Theron Miller, Wasatch Front Water Quality Council
- Michael Mills, June Sucker Recovery Program
- Hans Paerl, University of North Carolina

Technical Consultant Staff:

- Michael Paul, Tetra Tech

Members of the Steering Committee:

- Eric Ellis, Co-Chair, Utah Lake Commission
- Erica Gaddis, Co-Chair, Utah Division of Water Quality
- Jay Olsen, Utah Department of Agriculture and Food

Members of the Public:

- Jeff DenBleyker, Jacobs
- Renn Lambert, LimnoTech
- LaVere Merritt, Brigham Young University
- David Richards, Wasatch Front Water Quality Council

Utah Division of Water Quality Staff:

- Scott Daly, Utah Lake Project Coordinator
- Jodi Gardberg, Watershed Protection Section Manager
- Jim Harris, Assistant Director
- Nick von Stackelberg, Modeling Lead

Facilitation Team:

- Paul De Morgan, RESOLVE
- Dave Epstein, SWCA

Day 2 Meeting Participants (Name, Organization)

Members of the Science Panel:

- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Soren Brothers, Utah State University
- Greg Carling, Brigham Young University
- Mitch Hogsett, Forsgren Associates, Science Panel Chair
- Ryan King, Baylor University
- James Martin, Mississippi State University
- Theron Miller, Wasatch Front Water Quality Council
- Hans Paerl, University of North Carolina

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