

**Utah Lake Water Quality Study
Science Panel Meeting #5
Summary
July 10-11, 2019**

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 Steering Committee in general. A list of attendees can be found at the end of the document.

Upcoming Meeting/Call	When	Suggested Agenda Items
ULWQS Science Panel (Call #9)	~August 2019	○ Progress – update on framework, development of full strategic plan ideas
ULWQS Science Panel (Meeting #6)	~October 2019	○ Progress – update on framework, development of full strategic plan ideas

I. Action Items

See ULWQS – SP July 10-11 Meeting – Action Items v4

Wednesday, July 10, 2019 9:00 a.m. to 5:00 p.m.

II. Meeting Recording – July 10

A recording of the meeting (also available on the DWQ website in the near future) can be found at the following link: <http://resolv.adobeconnect.com/plx3z5oupetm/>. 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 – July 10

Welcome and Agenda Review

Paul De Morgan, RESOLVE, welcomed everyone to the meeting and asked the group (members of the Science Panel and members of the public) to introduce themselves (see Section VIII. Participation – July 10 and 11 below). He went over the list of meeting materials, agenda items, and meeting ground rules.

Utah Lake Presentations

“omics” approach to cyanobacteria ecology in Utah Lake – Ramesh Goel, University of Utah
Dr. Goel, University of Utah, gave an overview of the research that his laboratory has been doing on the cyanobacteria community of Utah Lake. He described the composition of the algal community during both bloom and non-bloom periods.

Several members of the Science Panel asked questions or made comments related to the life history of cyanobacteria, the correlation or abundance with nitrogen, and the biomass of the algal community.

Utah Lake food web and ecosystem research – Jereme Gaeta, Utah State University

Dr. Gaeta, Utah State University, presented on his laboratory's research on the Utah Lake ecosystem and the interactions between introduced fish (common carp), lake levels, June sucker, aquatic macrophytes, macroinvertebrates, and northern pike. Dr. Gaeta summarized the results of the carp removal efforts to date.

Following the presentation there were several comments from members of the Science Panel related to potential efforts to control northern pike, the incorporation of extreme events in modeling efforts, and the potential effect of northern pike on carp populations.

Phosphorus and algae growth in Utah Lake – LaVere Merritt, Professor Emeritus, Brigham Young University

Dr. Merritt presented on eutrophication, nutrient removal (P), and nutrient limitation in Utah Lake. He indicated that water quality issues in Utah Lake are generally moderate and limited improvement in water quality could be achieved through investment in new wastewater treatment plant technologies.

Following the presentation there was some a discussion of nutrient limitation and the need to investigate whether nitrogen actually might be the limiting nutrient during specific time periods.

Utah Lake Loading Analysis Update

Mike Brett, University of Washington, presented the results of his review of a Utah Lake mass balance initially completed by Dr. LaVere Merritt. He explained a few discrepancies that were found between data provided by DWQ, the analysis presented in Merritt and Miller 2019, and the data provided by Dr. Merritt, but generally concluded that there is pretty good agreement between the two data sets. Dr. Brett suggested the mass balance is a great start and the Science Panel should undertake an effort to update the mass balance in the near future.

Dr. Brett argued that based on published relationships in the literature, a decrease in the nutrient concentrations of the inflows to Utah Lake should result in a decrease in in-lake nutrient concentrations. He mentioned that Utah Lake appears to be remarkably capable of sequestering phosphorus into the sediments, particularly given that the residence time is relatively short. Additionally, he argued that light availability generally does not appear to be an issue throughout the water column of the lake.

Atmospheric Deposition of Nutrients in Utah Lake

Janice Brahney, Utah State University, went over the methodology taken to develop the white paper on nutrient deposition in the Great Basin. Dr. Brahney explained that an attenuation rate for the influence of the urban area was used, and this rate was doubled and quadrupled to consider the maximum deposition from urban areas. Additionally, she explained that the estimates were scaled back to only represent the soluble portion of phosphorus. Dr. Brahney discussed her methodological recommendations for future measurements of atmospheric deposition of nutrients on Utah Lake.

Dr. Brahney fielded several questions from the rest of the Science Panel related to the transport of indirect deposition within the watershed, the relative contribution of atmospheric deposition compared

to other nutrient input estimates to the lake, and estimates of deposition from other regions around the world. Additional comments on the white paper were requested from the Science Panel within 2 weeks.

Theron Miller, Wasatch Front Water Quality Council, went over the WFWQC proposal to estimate atmospheric deposition of nutrients into Utah Lake. Dr. Miller indicated the purpose of the study is to find out why some past measurements are orders of magnitude beyond others – is it the methodology or the spatial variability in deposition? Dr. Miller initiated a discussion with the rest of the Science Panel with the aim to ensure that the proposal describes a defensible methodology. Several comments were made related to the uncertain objective of the proposal and the idea that the proposal might need to be modified into a few proposals each focusing on separate objectives. Additional comments were made related to the details of the methodology and sampler design. Dr. Miller committed to re-writing the proposals.

Progress Update and Discussion on Tetra Tech Work Elements

Mike Paul, Tetra Tech, provided a summary of the nutrient criteria framework developed by Tetra Tech. He described the various framework components and suggested that a working draft of the framework will be shared with the Science Panel in August for review and comment. Additionally, Dr. Paul went over the conceptual models narratives which have been developed to describe each model. One Science Panel member suggested that both the ecosystem and causal models may not be necessary. Dr. Paul responded that the intended audience is different for each of the two models and at this point it may make sense to keep both models. Another Science Panel member questioned whether the conceptual models include all of the components of the models that are under development by the University of Utah. An action item was developed to work with the University of Utah team to ensure the conceptual models capture all the components of the mathematical models.

Dr. Paul also went over the data characterization and analysis and the updates from Tetra Tech's work on the various data characterization tasks. Dr. Paul first presented an estimate of nutrient recycling in Utah Lake by common carp. He committed to developing similar estimates for both phytoplankton and zooplankton. Dr. Paul also went over the analysis Tetra Tech has done related to algal cell count and pigment relationships, sonde data analysis, plankton temporal and spatial analyses, and more. Based on a comment from a Science Panel member, Dr. Paul committed to performing some of the same analyses for Provo Bay as a separate water body.

IV. Public Comment – July 10

No formal public comments were made at the end of the day, however several Public comments were made by Juhn Yuan Su from the University of Utah in the Adobe Connect chat box:

- What time period do the urban dust deposition rates correspond to (e.g., Summer time frame, etc.)?
- Meanwhile, what constituent does the urban dust deposition rates correspond to (e.g., nitrogen, carbon dioxide, methane, etc.)? I am thinking that these values correspond to nitrogen, but please verify.
- The atmospheric deposition inputs are implemented as time-series data applied to the ENTIRE system (e.g., the entire Utah Lake), which WASP does not allow one to incorporate spatial variability for atmospheric deposition. Only one time-series data per constituent can be inputted into WASP for the entire system although WASP allows the user to specify atmospheric

deposition rates (temporally-variate) for several constituents (ammonia, nitrate, organic nitrogen, orthophosphate, organic phosphate, and BOD).

- I do have a question regarding Dr. Miller's proposal for atmospheric deposition. As shown in Figure 2 in Dr. Miller's proposal, are the sites displayed the ones that exhibit historical atmospheric deposition data OR are these sites the ones for which atmospheric deposition measurements are planned to be implemented upon? Meanwhile, why are these sites generally distant from Utah Lake?

Day 2: Thursday, July 11, 9:00 a.m. to 5:00 p.m.

V. Meeting Recording – July 11

- A recording of the audio portion of the meeting (also available on the DWQ website in the near future) can be found at the following links: Thursday morning: <http://resolv.adobeconnect.com/p06u0eemtvhs/>, Thursday afternoon: <http://resolv.adobeconnect.com/psym9spng2ts/>

VI. Key Points of Discussion – July 11

Welcome and Agenda Review

Dave Epstein, SWCA, welcomed the group to the second day of the meeting and reviewed the meeting agenda. Introductions were made for all individuals present, who were not present during Day 1 of the meeting.

Near-Term Research Work Plan Update

Utah Lake-sediment water nutrient interactions – Ramesh Goel and Greg Carling

Dr. Goel provided a quick summary of the sediment water nutrient interactions work plan. He and Dr. Carling, Brigham Young University, then requested input from the Science Panel on a series of questions related to the work plan. One specific area of discussion was the composition of the water that will be used in the sediment core experiments. The research team plans to maintain turbidity similar to normal Utah Lake conditions with the use of an aeration stone. Dr. Carling stated that the research team will update a list of specific questions for the Science Panel and circulate them after the meeting. Their hope is to receive input from the Science Panel in the coming weeks to help finalize the work plan so the study can commence as soon as possible.

Paleolimnology and paleoecology of Utah Lake – Janice Brahney and Soren Brothers

Janice Brahney went over the paleo study work plan and specifically pointed out the edits made in response to Science Panel comments. There were a couple of questions and comments from the Science Panel with limited discussion.

Bioassay to investigate nutrient limitation of Utah Lake – Zach Aanderud

Zach Aanderud, Brigham Young University, provided a brief overview of the study work plan then posed some specific questions to the Science Panel. Dr. Aanderud solicited input from the Science Panel on whether additional bioassay deployments should be done in the summer and fall. The Science Panel agreed that two bioassays should be done in the summer (early and late summer) and that two should be done in the spring of 2020. A discussion ensued related to the physical setup of the experiment and

the use of a shading cloth to avoid light inhibition. Dr. Aanderud planned to follow-up with the Science Panel on the physical setup of the bioassay as necessary.

Progress Update and Discussion on Tetra Tech Work Elements (cont.)

Dr. Paul provided updates on the other elements of the Tetra Tech work plan (Data Characterization Analysis Plan) including plankton temporal and spatial analysis, diatom and macrophyte autecology, wind and turbidity, turbidity and macrophytes, and light extinction. Dr. Paul explained that significant work still needs to be done on many of the work plan elements; however, an extensive discussion ensued with the Science Panel on all of the subjects including those that have yet to be completed by Tetra Tech. One of the topics of discussion was the modeling of wind and waves and how they affect shear stress. Additionally, there were questions about the sech in Utah Lake and whether it causes a signal in the monitoring data. Another topic of discussion was light extinction and how it is influenced by suspended sediments. Several action items were developed for Dr. Paul to follow-up on some of the questions that came out of the discussion.

Dr. Paul shifted gears to discuss the data gaps analysis and specific issues the Tetra Tech team has encountered as they have worked through the data characterization and analysis. As Dr. Paul went through the list of data gaps, questions and comments from members of the Science Panel provided important information and ideas for filling the data gaps. Some of the data gaps mentioned included environmental requirements for diatoms and extant macrophyte species, historical population dynamics of carp and the relationship between carp and lake trophic state/nutrient regime, effects of carp bioturbation, the effect of carp removal efforts on macrophytes, nutrients, turbidity, and primary productivity, the relative impact of carp and wind action on turbidity, the effect of lake elevation and drawdown on macrophyte recovery, the expected lag time for lake recovery after nutrient inputs have been reduced, whether lake stratification plays a role in anoxia and phosphorus relate in the water column, presence information and sensitivity to nutrient-related impacts for warm water aquatic life, shorebirds, and waterfowl, additional information needed to define the nutrient criteria, and high-level question #4 from the Charge. As mentioned in the discussion, some of these questions may be answered by the efforts of individual members of the Science Panel who are already engaged with their studies to attempt to answer certain questions.

Initial Charge High-Level Question #4

Steering Committee Co-Chair Erica Gaddis explained that it is important for the Science Panel to be thinking about the questions under high-level question #4 from the Charge document. Dr. Gaddis posed the question as to whether there are additional pieces that could be added to studies that are already underway to help answer these questions or whether there are significant data gaps that would preclude the Science Panel's ability to answer these questions. Several Science Panel member comments pointed to existing information, studies under development, and potential studies that have been discussed by the Science Panel in the past. One member suggested it may take multiple lines of evidence to answer these questions. The Science Panel seemed to agree that they should spend some time on the strategic research plan to develop additional studies that would help to answer these questions.

Strategic Research Plan Development

The Science Panel discussed ideas for additional research needed to answer the questions outlined in the Charge document (to the SP from the SC). Dr. Gaddis explained that the ULWQS Steering Committee wants to have a discussion about what they want for the future of Utah Lake, but they would like to have an understanding of what is possible from the Science Panel beforehand. One member of the Science Panel suggested the Steering Committee start by prioritizing a list of potential endpoints and then the Science Panel could help to evaluate what might be possible to achieve in the future. Several ideas for research studies and ecosystem restoration projects were discussed including wetland restoration. The group agree to schedule time for additional work on the strategic research plan during future Science Panel calls/meetings.

VII. Public Comment – July 11

No public comments were made.

VIII. Participation – July 10 and 11

Meeting Participants (Name, Organization) – July 10

Members of the Science Panel:

- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Greg Carling, Brigham Young University
- Jereme Gaeta, Utah State 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

Technical Consultant Staff:

- Michael Paul, Tetra Tech (Adobe Connect)

Members of the Public:

- Scott Bird, Utah County Stormwater – Steering Committee
- Sam Braegger, Co-Chair alternate, Utah Lake Water Quality Study
- Chris Cline, US Fish and Wildlife Service – Steering Committee
- Ramesh Goel, University of Utah
- Dalin Graham, Utah State University Extension 4H (Adobe Connect)
- Chris Keleher, Utah Department of Natural Resources – Steering Committee
- Renn Lambert, LimnoTech (Adobe Connect)
- Hanyan Li, University of Utah
- LaVere Merritt
- Jay Olson, Utah Department of Agriculture and Food – Steering Committee
- Mark Quilter, Utah Department of Agriculture and Food
- David Richards, Oreo Helix
- Brian Selck, Timpanogo SSP

Utah Division of Water Quality Staff Present:

- Scott Daly, Utah Lake Project Coordinator
- Erica Gaddis, Co-Chair, Utah Lake Water Quality Study
- Jodi Gardberg, Watershed Protection Section Manager
- James Harris, Assistant Director
- Nick Von Stakelberg, Modeler

Facilitation Team:

- Paul De Morgan, RESOLVE
- Dave Epstein, SWCA

Meeting Participants (Name, Organization) – July 11**Members of the Science Panel:**

- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Soren Brothers, Utah State University (Adobe Connect)
- Greg Carling, Brigham Young University
- Mitch Hogsett, Forsgren Associates, Science Panel Chair
- Hans Paerl, University of North Carolina
- Ryan King, Baylor University
- James Martin, Mississippi State University

Technical Consultant Staff:

- Michael Paul, Tetra Tech (Adobe Connect)

Members of the Public:

- Sam Braegger, Co-Chair alternate, Utah Lake Water Quality Study
- Jeff Davis, (Adobe Connect)
- Ramesh Goel, University of Utah
- Heidi Hoven, National Audobon Society, Steering Committee
- Chris Keleher, Utah Department of Natural Resources – Steering Committee
- Renn Lambert, LimnoTech (Adobe Connect)
- Hanyan Li, University of Utah (Adobe Connect)
- Juhn Yuan Su, University of Utah (Adobe Connect)
- Mike Rau, Central Utah Water Conservancy District, Steering Committee alternate
- David Richards, Oreo Helix
- Brian Selck, Timpanogo SSP

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