Utah Lake Water Quality Study
Science Panel Call #7
Summary
April 25, 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 #8)	*Thursday, June 13* *9:00 a.m. - 12:00 p.m. MST*	o Progress update on data gaps updates, uncertainty ideas discussion, development of full strategic plan ideas
ULWQS Science Panel (Meeting #5)	*Wednesday, July 10, 9:00 a.m. - 5:00 p.m. MST; Thursday, July 11, 9:00 a.m. -5:00 p.m. MST*	o Final framework discussion, ideas on final strategic plan and presentation for SC

I. Action Items

Meeting Summaries	Who	Due Date	Completed
1. Post background materials and presentations to Dropbox [*link*]	Facilitation Team	TBD	March 8
2. Share initial version of action items	Facilitation Team	April 26	April 26
3. Develop/share draft meeting summary	DWQ/Facilitation Team	May 1	May 7
4. Review and share comments on summary	Science Panel	May 14	
5. Finalize meeting summary/post to Dropbox	Facilitation Team	May 21	
Previous Meeting Action Item Follow-up			
6. Share Region 8/U of U/DWQ model project MOU	DWQ	April 26	April 26
WFWQC Research	**Who**	**Due Date**	**Completed**
7. Provide input/feedback on WFWQC *Proposal to Measure Atmospheric Deposition of Utah Lake*	Science Panel	May 17	

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8. Share WFWQC 2019 Utah Lake monitoring plan	Theron Miller	May 10	
9. Provide input/feedback on WFWQC Utah Lake Monitoring plan	Science Panel	May 24	
University of Utah Model Development	**Who**	**Due Date**	**Completed**
10. Communicate project milestones including model calibration and delivery dates to the Science Panel	U of U Model Team	May 17	
11. Evaluate how to incorporate modeling uncertainty into the Uncertainty Analysis	Science Panel/Tetra Tech	TBD	
12. Plan model workshop to discuss model calibration and handoff	DWQ/Facilitation Team/U of U	TBD	
Science Panel Technical Support	**Who**	**Due Date**	**Completed**
13. Provide input (additions, omissions, etc.) on the draft Tetra Tech Analysis Plan	Science Panel	May 14	
14. Update the Utah Lake Conceptual Models	Tetra Tech	May 8	
15. Review and comment on revised conceptual model	Science Panel	May 14	
16. Develop a literature review (white paper) of estimates of atmospheric deposition	Janice Brahney	June 30	
Research RFP Development	**Who**	**Due Date**	**Completed**
17. Provide any remaining comments on RFPs	Science Panel	April 30	May 2
18. Finalize RFPs and release for responses	DWQ	May 3	May 3
19. Initiate RFP response review process with Independent Science Panel members	DWQ	May 23	
DWQ Data Collection	**Who**	**Due Date**	**Completed**
20. Share comments on DWQ sampling plan	Science Panel	May 17	
Science Panel April Meeting	**Who**	**Due Date**	**Completed**
21. Share draft agenda for June 13 Science Panel Call	Facilitation Team, Tetra Tech, DWQ	June 6	

II. Meeting Recording

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/pqyz3vh9ige3/. 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

Welcome and Agenda Review

Dave Epstein, SWCA, welcomed everyone to the meeting and asked the group to introduce themselves (see participant list below). He went over the list of individuals participating via teleconference, and reviewed the agenda items, materials, and meeting ground rules.

Follow-up on Action Items from Meeting #4

Action Item 11. Confirm relationship between ULWQS and the U of U modeling effort – Co-chair Erica Gaddis described the MOU between the EPA, Division of Water Quality, and the University of Utah. The MOU was developed at the beginning of the ULWQS and before the Science Panel was engaged in the project. The MOU outlines the interactions between the U of U, EPA, and DWQ to develop a model for the purpose of TMDL and standards development. There were three parts of MOU: share draft model and info, solicit feedback from DEQ and EPA, and develop the model based on input from EPA and DEQ. DWQ will distribute the MOU to the Science Panel.

Action Item 6. WFWQC sampling plan – Theron Miller distributed the WFWQC plan for sampling atmospheric deposition. The Science Panel will review and submit feedback on the proposal.

Action Item 16. Tetra Tech items for review – Tetra Tech would like feedback on the analysis plan document, as the plan will be implemented soon.

University of Utah Model Development Project

- Review of potential model applications to ULWQS

  Mike Paul, Tetra Tech, gave an overview of how the Science Panel may use the various models under development for the ULWQS. The models may be used to understand the reference state of a waterbody or run in "stressor-response mode" to look at how the lake responds to a gradient of nutrient levels. He explained that models can be used for post-criteria applications to evaluate how to achieve a particular nutrient criterion by running a variety of implementation scenarios. Mr. Paul suggested that during the call, the Science Panel should consider what changes should be made now versus in the future to ensure model meets the Science Panel and State's needs. Which models does the science panel need? Does the Science Panel need both the in-lake and watershed models? Will the models have what the Science Panel needs when the model is handed off (e.g. to make changes to model, source code, etc.)?

- Review recent information exchange between U of U and the Science Panel

  Mitch Hogsett, Forsgren, reviewed the memo sent to the U of U in December asking for clarification on mode processes and inputs. The U of U's response addressed topics of calibration performance, how bioturbation and sediment diagenesis processes, and how watershed inputs to the lake are accounted for. The U of U's response also identified the topics that are out of scope of the University research grant.

- Identify specific U of U model deliverables

  James Martin, MSU, led a conversation to review the role of the Science Panel in the U of U model development project. Science Panel members discussed their role to review the project deliverables and to provide recommendations for meeting needs of the ULWQS.

  Dr. Martin asked the U of U team to discuss the project timeline including when the project will be completed, what models are being developed, and when the models will be provided to the State.

  Mike Barber and Juhn Yuan Su explained that the U of U will conduct a historical baseline scenario and develop three future scenarios based on climate change projections.

  The U of U will deliver the calibrated model, not the historical baseline model incorporating modeled climate data as an input. The calibration will be completed this year in June or July.

  A question was asked to clarify the approach for calibrating models to real-world conditions. Each model is calibrated separately, with unique calibration periods that are independent of one another and based on the observed data available for each. Calibration will be completed to get the best independent model performance, and then the models will be linked to WASP. There is currently no plan to re-calibrate after the models are coupled for the historical baseline simulation. In-lake models are being calibrated using observed inflows and water quality data.

  James Martin asked if there will be any training or support to use the models after they are handed off to the Science Panel? The training could include how to use the models and apply different scenarios. The U of U does not have a problem doing a training session, but it is unrealistic to go over it in a day and it would be difficult to train a large number of people. However, the U of U would be available to assist.

  Dr. Martin asked members of the Science Panel what model constants, parameters, and end points are needed for the ULWQS and if they are included in the models. He mentioned several examples including chlorophyll a, cyanobacteria, and nutrient ratios. Dr. Martin also asked the following questions of the U of U team: How sensitive are the models to the parameters that might be used as end points? What are the opportunities or constraints of the models to determine the in-lake response to variations in the load to the lake? Can you play with the loads annually, comprehensively, across all land use types across the watershed?

  U of U response: The extent of that use of the models would need to be determined by the Science Panel. The U of U could demonstrate how to perform sensitivity analysis, but cannot commit to completing 100 model runs for somebody beyond what they already have to do for

their project. The U of U could participate in a workshop to do this. The models take a long time to run so sensitivity analyses are time consuming. A workshop of this nature would help gain the confidence the Science Panel and stakeholders by demonstrating how the model works, which inputs and parameters can be changed, etc.

Development of the upland watershed model (DHSVM) is in process to include 9 major sub-watersheds. DHSVM will simulate runoff and flow from upland watersheds primarily in non-urban areas and will provide flows up to edge of urban areas. SWMM will simulate the urban areas. DHSVM, SWMM, and GoldSim will provide the boundary inputs to EFDC and WASP.

Michael Paul, Tetra Tech, reiterated the question of how the models will be applied for the ULWQS. Is the calibration period appropriate for the State's use of the model? Mike Barber replied that it depends upon the overall goal of the model from DWQ and the Science Panel. Is the Science Panel interested in looking at average conditions, extreme conditions, or something else? Will the State set guidelines for nutrient deliveries in the future based on the normal condition or some extreme condition? That will determine the appropriate use of the model.

DWQ will have a technical consultant to execute whatever additional work the Science Panel needs. Model calibration period is WY 2006-2015 to capture all variation. A model validation will also be completed to determine if further calibration is needed.

- Review and discuss the EFDC and WASP QAPP

Model data is data, and the model should have its own QAPP, which includes guidelines on the problem, who is tackling it, acceptance criteria, etc. The group discussed particular elements within the QAPP, including:

Atmospheric deposition – the current intent is to use data from Olsen, 2019 for atmospheric nitrogen and phosphorus inputs into Utah Lake. Olsen (2018) had sampling events across each site, and used spatial interpolation for calculating atmospheric deposition. The Science Panel discussed the strengths and weaknesses of the Olsen dataset, including the observation that the data may exclude windy events that lead to significant deposition not captured in the "calm" days. There was some discussion that the data set could underestimate deposition in the model using Olsen's data. Additionally, the Olsen study has contaminated and uncontaminated samples. The Panel noted that there are other sources available (across Great Basin, arid regions, across the world) to get a solid foundation for atmospheric deposition in the water. Janice Brahney of the Science Panel agreed to write a white paper on the subject, but the timeline might get moved back if the key findings of the white paper must be incorporated into the calibration model. The Science Panel discussed the wide variability in deposition loadings, from an original estimate of 1600 tons/year to 100 tons/year in Olsen's dataset, to a mere 20 tons/year reported in another study.

Nutrient budget for lake – dependent upon the purpose of the State's model.

Groundwater inflow – Based on groundwater data availability. There appear to be big differences in groundwater inputs between Psomas and the LaVere estimates. The Science Panel needs to decide which estimates use.

Calibration - What data will be used for calibration and validation? These details should be supplied in the QAPP. Calibration and performance evaluation and acceptance criteria. Graphical and statistical performance measures. QAPP is a quasi-living document that can be revised through time. The group then mentioned receiving water models and how they are calibrated and validated: Nick von Stackleberg referenced a paper about acceptance criteria for receiving waters.

Sensitivity and uncertainty analysis – EFDC component: hydrodynamic data are used, and the model doesn't have many parameters to adjust; thus, any sensitivity analyses on the EFDC model are quite rough and informal. In the WASP model, there are opportunities to explore sensitivity around N, P, DO. However, measuring model uncertainty is a time-intensive process, since the model runs using 10 years of data and requires many simulations over long periods of time (45 minutes per year for EFDC, WASP takes about a day per year, depends upon grid resolution). In this light, testing model uncertainty may not be feasible. Science Panel can provide insights and references on that. One member of the panel suggested using a Monte Carlo experiment with 100 model runs. The Science Panel also asked whether the estimate of uncertainty be a deliverable with model, before model hand off? Additionally, model structural uncertainty is a huge concern in the model—no iron modeling, assumes constant zooplankton grazing, no bioturbation, etc.

- Discuss outstanding questions and topics addressed in the memo exchange

Concern about sediment transport: Sediment transport is done in both EFDC and WASP models, which will provide nice validation between the two?

The Science Panel discussed the feasibility of adding an absorption coefficient for calcite. While it initially appeared a simple addition that would not require any code modifications, further discussion revealed that calcite is tied to the pH of Utah Lake, so constructing an absorption coefficient would not be a trivial endeavor. The Panel decided that the path forward is to obtain the completed model, obtain reviews from the Science Panel, and use a consultant to make modifications after the fact.

A question was posed about WASP's incorporation of phytoplankton response and its resolution at the taxon level: Are nuisance taxa unique or is it more of a general phytoplankton factor? U of U replied that WASP can simulate up to 10 groups and incorporate limitation specifications (N fixers, etc.), however, these need to be calibrated with data. Furthermore, WASP does not handle macrophytes. U of U will use 5 phytoplankton groups for which they have growth rates and stoichiometric ratios for each group.

- Identify approach, including milestones, for model calibration and delivery
- Address remaining questions from the Science Panel

The Science Panel returned to the workshop discussion: when it will happen, who will be involved, etc. The group outlined two possible workshop purposes: (1) train people how to use the tools or (2) conduct a sensitivity workshop where the Science Panel weighs in on the calibration model. Suggestion: get model, then have a workshop on the model, how to use it, and the suggested calibration/sensitivity/uncertainty changes post-hand off. The bottom line is that the model needs to be in working order before a workshop is held.

The State established that the purpose of this meeting was to solidify dates for model calibration completion, model sensitivity completion, model handoff, a model workshop, and DWQ's use of the model.

U of U stated that the LAKE MODEL will be ready for hand off in mid-June, but they are unsure of when the report will be ready to share. U of U will follow up with a reasonable date.

IDEAL TIMELINE:
July 10th and 11th is the next Science Panel meeting, and the State would like to have model and model report available for review/discussion (so handed off a couple of weeks before).

Progress Report on Tetra Tech Work Elements

- *RFP Development*:

  Progress is being made on developing 3 RFPs to release for bid. The paleo RFP is pretty much ready to go, but the bioassay and sediment RFPs still need work.

  Bioassay – main issues are (1) determining the number of sites and (2) number of deployments. The Science Panel was in agreement that limiting to three sites should be sufficient, but perhaps we should consider including a marina and mid-Bay site. Tetra Tech is planning on 3-4 deployments in spring (but later than intended given that it's late April already), plus a spring 2020 deployment. The Science Panel was ok with this approach.

  Sediment – The current version reduced the number of cores from original draft of 180 cores and the number of experiments from 3 experiments instead of the original proposal of 6. The dredging experiment was removed from the study. Tetra Tech asked whether DI water could be used to dilute UT Lake water samples, or if reconstituted hard water would be more appropriate? The Science Panel briefly discussed the feasibility of making a synthetic version of Utah Lake water. Tetra Tech also verified with the Science Panel that the # treatments for phosphorus equilibrium studies were sufficient: Low, Medium, and High (4x, 2x, 0.5x, 3 reps of each).

- *Criteria framework and literature review:*

  Edits from last meeting were incorporated into literature review document. The document was finalized in mid-April. Tetra Tech is now beginning to work on the framework approach and document.

- *Data characterization and analysis plan:*

  The analysis plan document is still in draft form and Science Panel members are encouraged to contribute comments. Tetra Tech will begin with the "low hanging fruit" analyses like relationships between turbidity and wind, quantifying carp excretion rates, and some others. DWQ is very close to delivering a final and complete dataset.

- *Conceptual models:*

  Mike Paul is almost finished with the revised conceptual models and will distribute to the Science Panel soon.

- *Uncertainty analysis:*

  The draft uncertainty guidance document will also be complete soon. The document was derived from the March discussions and feedback and discussion from today too.

Public Involvement

Dan Potts – Represent anglers on Utah Lake, the largest recreational use on the lake. He reported that lower lake levels from 6 years of drought have led to a significant decrease in number of sport fishes and their year classes. Catfishes numbers, on the other hand, are stable. The carp removal has led to a reduction of overall carp biomass in the lake, but the ones that are still there are large in size and will likely be very successful spawners. Potts expects an explosion of common carp to compensate for removal.

David Richards – He is in process of completing a multi-metric index of biological integrity of Utah Lake.

LaVere Merritt – He will give a more detailed presentation in the July meeting 45 min to 1 hour. Atmospheric deposition is still a big issue that needs more thought. It is really important to get right for a unique system. Atmospheric deposition dominates everything stakeholders are concerned about. Turbidity is also a big issue. Dr. Merritt also commented that modeling calcite is a complicated endeavor for Utah Lake.

Wrap Up

Dave Epstein reviewed the meeting action items and reminded members of the next call on May 14, 2019. [Note: this call was subsequently cancelled].

IV. Meeting Participants (Name, Organization)

Members of the Science Panel:
- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Soren Brothers, 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
- Jereme Gaeta, Utah State University

Technical Consultant Staff:
- Jon Butcher, Tetra Tech

- Michael Paul, Tetra Tech
- Andrea Plevan, Tetra Tech

Members of the Public:
- Michael Barber, University of Utah
- Eric Ellis, Co-Chair, Utah Lake Water Quality Study
- LaVere Merritt
- Dan Potts, Salt Lake Fish and Game Association
- David Richards, Oreo Helix
- Juhn Yuan Su, University of Utah

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
- Elise Hinman, Watershed Protection Section

Facilitation Team:
- Dave Epstein, SWCA