ULWQS Numeric Nutrient Criteria Implementation Framework

Date: January 19, 2022

Developed by: ULWQS Steering Committee with DWQ support

Revisions:

- Version 1 – December 1, 2021
- Version 1.1 – January 14, 2022
- Version 1.2 – January 19, 2022
- Version 1.3 – TBD

Steering Committee Approved:

- Version 1.2 – January 19, 2022. All content except the executive summary.
- Version 1.3 – TBD. All content including the executive summary.

Acronyms

AD – Atmospheric deposition

DWQ – Division of Water Quality

EFDC – Environmental Fluid Dynamics Code

HSPF – Hydrologic Simulation Program - FORTRAN

NNC – Numeric nutrient criteria

POTW – Publicly owned treatment works

SC – Steering Committee

SP – Science Panel

SWAN – Simulating WAves Nearshore

TIN – Total inorganic nitrogen

TP – Total phosphorus

TSD – Technical Support Document

ULWQS – Utah Lake Water Quality Study

UPDES – Utah Pollutant Discharge Elimination System

WASP – Water Quality Analysis Simulation Program

WBP – Watershed based permit

WFWQC – Wasatch Front Water Quality Council

WQT – Water quality trading

1 Executive Summary

Under development.

2 Introduction

The Utah Lake Water Quality Study (ULWQS) Numeric Nutrient Criteria (NNC) Implementation Framework described in this document presents a roadmap for negotiating, defining, and developing all elements of a stakeholder-supported process to implement Phase 3 of the ULWQS. The ultimate goal of the Implementation Framework is to develop a comprehensive Utah Lake Water Quality Implementation Program (WQIP) by achieving the following objectives:

- Develop a practical, feasible, and effective nutrient management program through the evaluation of a suite of implementation scenarios that address all significant sources;
- Incorporate all significant nutrient sources to Utah Lake including nonpoint, point, and atmospheric sources;
- Evaluate the most cost-effective in-lake and watershed strategies to improve water quality in Utah Lake with the goal to see measurable improvements as quickly as feasible;
- Develop an adaptive management-approach to address changing watershed conditions and respond to effectiveness of the implementation program;
- Utilize flexible regulatory tools for implementation of point source discharge permits e.g., water quality trading and/or watershed based permits;
- Engage all management partners; and
- Leverage federal, state and local funding

This Implementation Framework was informed by discussions with the Utah County Publicly Owned Treatment Works (POTW) community and the ULWQS Steering Committee (SC) that occurred on August 5, 2021 and August 25, 2021, respectively. The comprehensive summary (Appendix A) of those discussions was organized into a traditional watershed planning construct that has been successfully applied in many watersheds in Utah. Specifically, EPA's *A Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters* incorporates a process for addressing most of the considerations provided by the SC and POTW stakeholders (Figure 1).

The EPA watershed planning construct was modified to incorporate several SC and POTW considerations related to point source management strategies that were not explicitly defined including water quality trading and watershed based permitting approaches. Figure 2 and Table 1 adapt the EPA six-step process to create a Utah Lake specific NNC Implementation Planning Framework that incorporates the SC and POTW considerations.

The Science Panel's ongoing research program, lake and watershed model development, and empirical analyses are directly relevant to this Implementation Framework and serve as the foundation for addressing many of the SC and POTW considerations. For example, the Utah Lake watershed model will be the primary tool for identifying the location and magnitude of significant nutrient sources throughout the watershed and identification of effective management strategies for each. Additionally, the in-lake water quality models will help determine if watershed management strategies will result in meaningful water quality improvements in the lake as well as estimate the timeframe for such improvements.

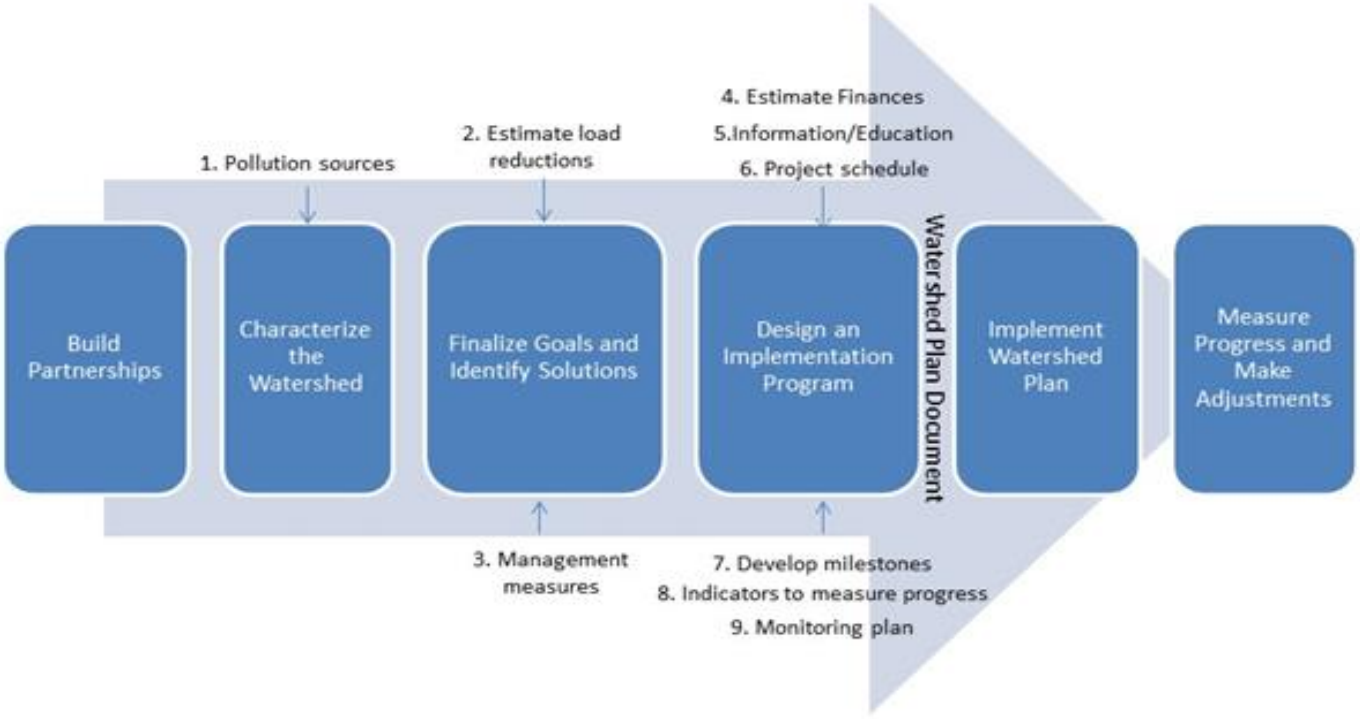

Figure 1. EPA Six-Step Watershed Planning Process.

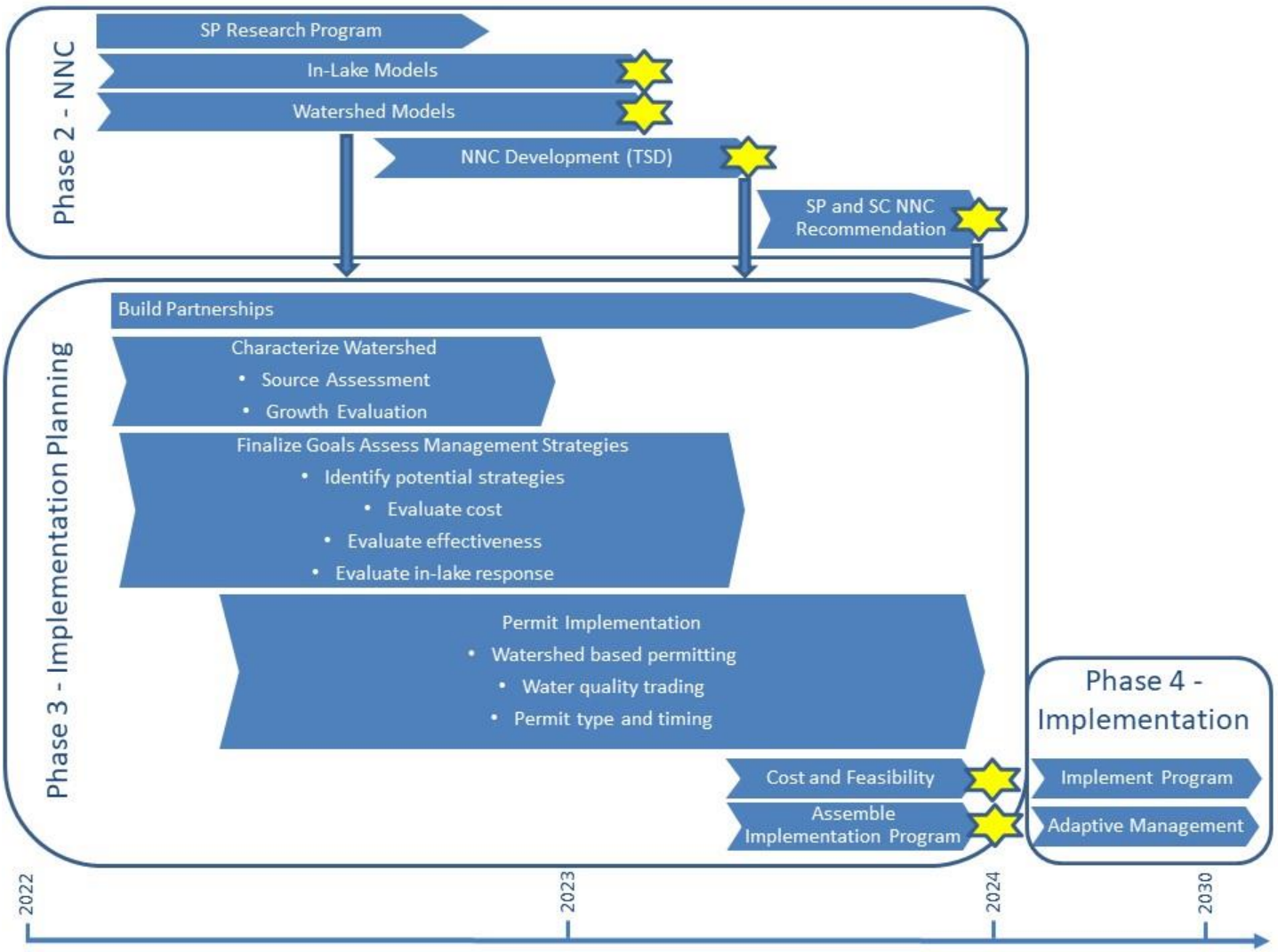

Figure 2. ULWQS NNC Implementation Framework.

3 ULWQS Implementation framework.

1. Phase 2 Work Elements

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
1.	Science Panel Research Program	SP research to inform SC Initial Charge and NNC development	• SP Bioassay Study to determine spatial and temporal extend of nutrient limitation (complete) • SP Sediment equilibrium study to quantify rate and magnitude of sediment nutrient recycling (complete) • SP paleolimnology and paleoecology study to determine historic lake condition and quantify changes over time • SP Littoral sediment study to quantify loading from drying/wetting associated with lake elevation fluctuation • SP phosphorus binding study to quantify the role of calcite binding, phosphorus mineralizing and redox on internal recycling • SP carbon, nitrogen, and phosphorus mass balance to quantify magnitude of internal and external nutrient loading (complete) • Wasatch Front Water Quality Council (WFWQC) atmospheric deposition (AD) research • WFWQC food web model and mechanistic modeling	None	SP, WFWQC, DWQ	Jun 2019	Sep 2022	Ongoing, fully funded
2.	In-lake model	Develop in-lake water quality and hydrodynamic model to inform the ULWQS	SP development of EFDC hydrodynamic model and WASP water quality model to characterize current conditions, development of NNC as described in the NNC Framework, and determining effectiveness of nutrient management strategies	SP Strategic Research Plan (SRP) results	SP, DWQ	Jun 2021	Dec 2023	Ongoing, fully funded
3.	Watershed model	Develop watershed model for NNC development and implementation	SP development of HSPF watershed model for development of NNC as described in the NNC framework, identification of potential nutrient management strategies, and evaluating effectiveness of implementation strategies	WFWQC AD research and SP SRP results	SP, DWQ	Jun 2021	Dec 2023	Ongoing, fully funded under current project scope. Additional scope may be needed pending final Implementation Framework elements
4.	Management Goals Evaluation and NNC Development	Identify range of protective N and P targets Evaluate achievement of Management Goals for a range of NNC targets	• SC development of the Management Goals document identifies preliminary water quality goals (“how clean is clean”) for Utah Lake and associated measures, targets, and assessment endpoints. The Management Goals provide a foundation for initiating implementation planning • SP Development NNC Technical Support Document (TSD) • SP and SC development of N and P recommendations to meet management goals	Utah Lake Management Goals, Assessment Endpoints, Measures, and Targets (2020), SP SRP results, in-lake model, and watershed model	SC	Complete Jan 2022 Jun 2023	Complete Jun 2023 Dec 2023	Ongoing, fully funded under current project scope.

2. Build Partnerships

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
5.	Identify key stakeholders	Identify parties responsible for implementing the Utah Lake /Water Quality Implementation Program (WQIP) Identify parties affected by the WQIP Identify parties with knowledge of existing programs and technical expertise (e.g., soil, water and land management entities)	SC discussion to identify relevant stakeholders external to the ULWQS	ULWQS Stakeholder Process (2017)	ULWQS SC	Jan 2022	Mar 2022	1 SC discussion. In-kind.
6.	Identify issues and concerns to be addressed in the watershed plan	Define stakeholder perspectives on lake and watershed condition	Completed for SC and POTWs 10/20/2021; identify additional issues based on other stakeholders' input	SC and POTW Considerations for Implementation Planning Update on Oct 20, 2021 (Appendix A)	ULWQS SC	Jan 2022	Mar 2022	1 SC discussion. In-kind.
7.	Develop preliminary goals and measures[+]	Identify preliminary long-term goals	Completed 12/3/2020	Utah Lake Management Goals, Assessment Endpoints, Measures, and Targets (2020)	N/A	N/A	N/A	N/A
8.	Conduct public outreach	Familiarize public and stakeholders with the watershed planning process, specific issues, and elicit input.	• Update and implement the ULWQS Public Engagement Communication plan • Conduct recreation user survey to inform goal setting	• Public Engagement White Paper for the ULWQS (2018) • Public Engagement Communication Plan (2018) • Utah Lake Recreation User Survey (scheduled for 2022)	DWQ and SC	Mar 2022	Dec 2024	• 6 SC discussions. In-kind. • Ongoing DWQ contract

[+] Notes one of the EPA 9 elements required for Clean Water Act Section 319 and NRCS National Water Quality Initiative funding

3. Watershed Characterization

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
9.	Gather existing data	Compile relevant data and geographic information including water quality, land use, population, water management, meteorological, etc.	Relevant and necessary information will be acquired during development of the Utah Lake watershed model. A specific list of data and information is available in the Watershed Model Quality Assurance Project Plan [INSERT TBD LINK]	None	SP, ULWQS technical support contractor, DWQ	Nov 2021	Mar 2022	Ongoing DWQ contract, 1-2 SC discussions
10.	Source identification and quantification[+]	Identify location of all nutrient sources in the watershed Quantify the magnitude of loading originating from each source Quantify influential hydrologic events (e.g., drought, flood, snowmelt)	• Watershed sources to be evaluated: stormwater, onsite septic systems, agricultural nonpoint sources, municipal treated wastewater, industrial discharge, atmospheric deposition, natural background sources • In-lake sources to be evaluated: internal recycling • Determine watershed characteristics relevant to determining nutrient sources and magnitude (e.g., land use, physical and natural features, water body conditions, climate related impacts including drought and wildfire, etc.) • After calibrating and validating the watershed model with measured in-stream water quality data, analyze model output to quantify nutrient loading for each source under current flow conditions. Quantify the influence of drought, flood, snowmelt, and other significant hydrologic events[+]	• C, N, P mass balance study (2021) • WFWQC AD studies (pending) • Calibrated/validated watershed model • Calibrated/validated in-lake model	ULWQS technical support contractor, SC confirmation	Jul 2022	Dec 2022	Ongoing DWQ contract, 1-2 SC discussions
11.	Critical Source Area prioritization	Determine temporal and spatial location of high priority sources to inform selection and prioritization of management practices and funding resources	• Develop a prioritization or ranking scheme considering source type and magnitude, land use, proximity to live water, and other relevant factors for all significant sources • Develop a prioritization or ranking scheme for in-lake critical source areas • Analyze in-lake and watershed model output utilizing the prioritization scheme to visually demonstrate source area prioritization results	• C, N, P mass balance study (2021) • Calibrated/validated watershed model • Calibrated/validate in-lake models	ULWQS technical support contractor, SC confirmation	Jul 2022	Dec 2022	Ongoing DWQ contract, in-kind, 1-2 SC discussions
12.	Evaluate future growth and land use scenarios	Quantify changes in nutrient loading in response to projected population growth, changes in land use, and climate-related disturbances.	• SC to determine appropriate planning horizon (e.g., 2040, 2060, etc.) for assessing growth and land use scenarios • Acquire population projections from Kem C. Gardner Policy Institute • Acquire and modify as needed the U of U land use projections for incorporation into the watershed model • Evaluate development of new communities and approaches for onsite/sewer • Develop preferred growth and land use scenario for evaluation in the watershed model (i.e., G1) • Analyze model output for the selected growth scenario to quantify loading for all sources • With calibrated and validated watershed model, quantify loading under reference conditions without anthropogenic influence • Analyze model output to determine future influence from climate-related impacts of drought and wildfire	Calibrated/validated watershed model	DWQ, ULWQS technical support team, SC	Jul 2022	Dec 2022	Ongoing DWQ contract, 1-2 SC discussions

[+] Notes one of the EPA 9 elements required for Clean Water Act Section 319 and NRCS National Water Quality Initiative funding

4. Assess Potential Nutrient Management Implementation Strategies

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
13.	Identify potential nutrient implementation management strategies for significant sources	Identify and select all potential **point source** implementation planning scenarios for evaluation of cost, feasibility, and effectiveness	Point source planning scenarios based on SC and POTW Considerations: • Scenario PS 1 – 1 mg L^{-1} TP and no limit for TIN; • Scenario PS 2 – 1 mg L^{-1} TP and 10 mg L^{-1} TIN • Scenario PS 3 – 0.3 mg L^{-1} TP and 6 mg L^{-1} TIN • Scenario PS 4 – TBD mg L^{-1} TP and TBD mg L^{-1} TIN. TP and TIN based on TBD thresholds in which reuse becomes practical. • Scenario PS 5 – TBD mg L^{-1} TP and TBD mg L^{-1} TIN representing the limit of technology	POTW community confirmation	SC	Dec 2021	Feb 2022	1 SC discussion, in-kind
14.			Individual POTWs, with at request support from DWQ, and consultation with the SC will assess point sources scenarios: • Develop methodology and guidelines for quantification of cost associated with NNC and growth to ensure comparability among facilities • Scope infrastructure and operational modifications to achieve each scenario (e.g., PS 1, PS 2, PS 3, and PS 4) for current conditions and the selected growth scenario (i.e., G1) • Quantify infrastructure, operational, maintenance, and other related incremental costs associated with NNC for each point source scenario • Quantify net environmental benefits including total discharge, greenhouse gasses, and increased chemical usage for each point source scenario with consideration to potential reuse strategies • Develop estimated implementation timeline for each scenario	SC confirmation of approach methodology	• SC, POTW stakeholders • Respective POTW manager • DWQ support at request of POTW managers	Mar 2022	Dec 2022	POTW in-kind, DWQ In-kind. 1-2 SC discussions
15.		Identify potential **stormwater** implementation planning scenarios for evaluation of cost, feasibility, and effectiveness	• Develop the optimal approach for addressing stormwater critical source areas previously identified. The output is 1 stormwater implementation scenario (i.e., SW) that identifies Best Management Practices to reduce stormwater loading. • Quantify infrastructure, operational, maintenance, and other related incremental costs for the stormwater scenario • Quantify net environmental benefits	Preliminary watershed characterization and source assessment	ULWQS technical support contractor, SC, UT Co. Stormwater Coalition	May 2022	Dec 2022	• Ongoing DWQ contract • Additional financial resources may be required to evaluate full suite of scenarios • TBD SC discussions
16.		Identify potential **nonpoint source** implementation planning scenarios for evaluation of cost, feasibility, and effectiveness	• Develop the optimal approach for addressing nonpoint source critical sources areas previously identified including agricultural runoff and tail water and irrigation efficiency improvements. Identify Best Management Practices (BMPs) to reduce nonpoint source loading. The output is 1 or 2 nonpoint source implementation scenarios that address all critical source areas (i.e., NPS 1 and NPS 2) • Quantify infrastructure, operational, maintenance, and other related incremental costs for each nonpoint source scenario • Determine effectiveness of BMPs (i.e., cost per pound) for nonpoint sources scenarios (i.e., NPS 1 and NPS 2) • Quantify net environmental benefits	Preliminary watershed characterization and source assessment	ULWQS technical support contractor, SC	May 2022	Dec 2022	• Ongoing DWQ contract • Additional financial resources may be required to evaluate full suite of scenarios • TBD SC discussions
17.		Identify potential **atmospheric deposition** implementation planning scenarios for evaluating cost, feasibility, and effectiveness	• Develop the optimal approach for addressing atmospheric deposition critical sources areas previously identified. Identify BMPs to reduce atmospheric loading. • Quantify infrastructure, operational, maintenance, and other related incremental costs for each atmospheric deposition scenario • Determine effectiveness of BMPS (i.e., cost per pound) for atmospheric deposition scenarios (i.e., AD 1 and AD 2) • Quantify net environmental benefits	WFWQC research	SC, WFWQC	May 2022	Dec 2022	• TBD, TBD SC discussions
18.		Identify and evaluate **In-Lake and ecological restoration** scenarios for evaluation of cost, feasibility, and effectiveness	• Develop a suite of ecological restoration alternatives with consideration of macrophyte reestablishment, carp and fisheries management, reestablishment of native aquatic organisms, reduction of sediment recycling, targeted dredging, chemical nutrient removal, chemical HAB treatment, creation of islands, and any other relevant TBD in-lake restoration alternative (i.e., EC 1, EC 2, etc.) • Quantify infrastructure, operational, maintenance, and other related incremental costs for each ecological restoration scenario • Quantify net environmental benefits	• In-lake hydrodynamic and wind/wave model • In-lake water quality model • SP water quality analyses	ULWQS technical support contractor, SC, SP	May 2022	Dec 2022	• Ongoing DWQ contract • Additional financial resources may be required to evaluate full suite of scenarios • TBD SC discussions
19.	Assess effectiveness of nutrient implementation management strategies	Quantify expected load reduction resulting from point source, nonpoint source, atmospheric deposition, stormwater, and ecological restoration implementation planning scenarios	Select the preferred combination or combinations of point source, nonpoint source, atmospheric deposition, stormwater, and ecological restoration implementation scenarios for evaluation in the watershed and in-lake water quality models:	• Calibrated/validated watershed model • SC discussion to define scenario combination	ULWQS technical support contractor, SP, SC	Aug 2022	Dec 2022	• Ongoing DWQ contract • Additional financial resources may be

4. Assess Potential Nutrient Management Implementation Strategies

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
			Potential Scenario Combinations (TBD) ● Example Scenario C 1 – PS 1 + SW 1 +NPS 1 +EC 1+ G1 ● Example Scenario C 2 – PS 2 + SW 1 +NPS 2 +EC 1+ G1 With the calibrated and validated watershed model: ● Quantify nutrient loading and flow to Utah Lake for each scenario combination (i.e., CS 1, C 2, etc.) developed above ● Quantify expected future loading under growth scenarios (i.e., Scenario G1 defined above)					● required to evaluate full suite of scenarios ● TBD SC discussions
20.		Quantify in-lake water quality and water quantity response for selected implementation planning scenarios	With the calibrated and validated in-lake water quality model: ● After calibrating and validating the in-lake models, quantify the load reductions needed to achieve in-lake NNC^{+} ● Quantify in-lake water quality and water quantity response for each combined scenario (i.e., CS 1, C 2, etc.) developed above ● Assess diminishing returns associated with increased load reduction scenarios for each combined scenario (i.e., CS 1, C 2, etc.) ● Quantify internal recycling and lake recovery time for each combined scenario (i.e., CS 1, C 2, etc.) ● Assess probability of achieving SC Management Goals and NNC Recommendation for each combined scenario (i.e., CS 1, C 2, etc.) ● Assess impacts of management scenarios on downstream designated uses, habitat, and water supply to the Great Salt Lake ● Assess potential for preservation of dedicated perennial instream flows to the Great Salt Lake ecosystem	● Completion of SP Strategic Research Program ● Draft Science Panel NNC Recommendation ● Calibrated/validated in-lake model	ULWQS technical support contractor, SP, SC	Mar 2023	Apr 2023	● Ongoing DWQ contract ● Additional financial resources may be required to evaluate full suite of scenarios ● TBD SC discussions

5. Permit Implementation

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
21.	Determine approach for incorporating NNC in UPDES permits	Develop Watershed Based Permitting (WBP) approach for UPDES permitted facilities	With support from DWQ permitting programs: ● Evaluate types of WBPs applicable to permitted facilities in the Utah Lake watershed (i.e., coordinated individual, integrated municipal, and multisource)	None	SC, DWQ, ULWQS technical support contractor	Mar 2022	Dec 2023	DWQ in-kind, TBD
22.		Evaluate and select considerations for permit development	With support from DWQ permitting programs and ULWQS Technical Consultant: ● Determine parameters and effluent quantity (e.g., load vs. concentration) to be included in UPDES permits ● Determine approach for permit limit averaging period (e.g., annual, seasonal, monthly, daily) ● Determine approach for sample collection and analysis	None	SC, DWQ, ULWQS technical support contractor	Mar 2022	Dec 2023	DWQ in-kind, TBD
23.		Evaluate potential for developing, and develop as needed, a Water Quality Trading (WQT) program	After selection of the preferred nutrient management implementation scenario and with support from DWQ permitting programs and ULWQS Technical Consultant: ● Evaluate the utility of a WQT program for feasible achievement of permit limits ● Determine if a WQT program is desired	None	SC, DWQ, ULWQS technical support contractor	Mar 2022	Dec 2023	DWQ in-kind, TBD
24.		Develop WQT program, as needed	● Develop, as needed, all components of the WQT program including: ○ Determine source types included in the trading program (e.g., point sources, stormwater, agricultural, AD, etc.) ○ Determine entities included in the trading program (POTWs, municipalities, UT County, Ag producers, etc.) ○ Determine geographic extent of the trading program ○ Determine commodity to be traded (e.g., nutrient loads) as quantified in the source identification and allocation section above ○ Determine the approach for tracking commodities, trades, and credits ○ Determine the approach for verifying compliance with trades	None	SC, DWQ, ULWQS technical support contractor	Mar 2022	Dec 2023	DWQ in-kind, TBD
25.		Determine compliance schedule for discharge permits	After selection of the preferred point source implementation alternative: ● Develop schedule for milestones for implementation ● Determine compliance date for selected alternative	None	SC, DWQ, ULWQS technical support contractor	Mar 2022	Dec 2023	DWQ in-kind, TBD

6. Cost and Feasibility

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
26.	Assess cost and feasibility	Quantify cost associated with preferred implementation scenarios and assess feasibility	● Develop methodology for determining feasibility of implementation alternatives including a priori determination of cost thresholds (e.g., medium adjusted gross income) ● Determine cost associated with each combined scenario (i.e., CS 1, C 2, etc.) with cost estimates developed above Assess feasibility for each combined scenario (i.e., CS 1, C 2, etc.)	Preliminary identification of preferred nutrient management scenarios	SC, ULWQS technical support contractor	Jun 2023	Dec 2023	TBD

7. Assemble the Implementation Program

Line #	Project/Component	Objective	Approach	Dependencies	Lead and Partners	Start Date	End Date	Estimated Cost or Level of Effort
27.	Preferred nutrient management implementation scenarios	Select the preferred nutrient management implementation scenario(s)	• Determine technical resources required to implement the watershed plan including administrative services, and personnel[+] • Determine financial resources needed for all components of the implementation program including personnel salaries and benefits, fees, material and supplies, services, installation, and operation and maintenance[+] • Develop final assessment of cost and feasibility • Develop final assessment of net environmental benefits for the preferred scenario(s)	Finalization of all preceding elements	SC, SP, DWQ, ULWQS technical support contractor	Jan 2023	Dec 2023	TBD
28.	Implementation schedule[+]	Develop a schedule for all implementation activities	• Evaluate geographic and generational equality • Develop approach for accommodating growth in nutrient load allocations (i.e., reserved allocation, incremental growth allocation) • Develop timeline for on-the-ground implementation of point source, nonpoint source, stormwater, atmospheric deposition, and ecological restoration with consideration of simulations implementation[+] • Evaluate effect of implementation pace on recovery	Finalization of all preceding elements	SC, SP, DWQ, ULWQS technical support contractor	Jan 2023	Dec 2023	TBD
29.	Milestones[+]	Develop interim milestones for tracking progress and measuring success	• Review and modify as necessary the SC Management Goals and associated measures based on the final NNC recommendation • Finalize Management Goals measures and targets • Develop implementation milestones	Finalization of all preceding elements	SC, SP, DWQ, ULWQS technical support contractor	Jan 2023	Dec 2023	TBD

30.	Monitoring[+]	Develop monitoring program to track progress, milestones, and success	• Develop the methodology for assessing measures and targets including data requirements, data quality objectives, and analytical methods
			• Develop monitoring strategies for collection of the data and information required for evaluating progress and measuring success
			  ○ Adapt and modify existing monitoring strategy to formalize Baseline Monitoring strategy
			  ○ Develop monitoring program to assess effectiveness of selected management practices
			  ○ Develop monitoring approach for evaluation of progress and success with respect to achieving Management Goal measures, assessment endpoints, and targets
			Develop monitoring strategy to inform the adaptive management program
				Finalization of all preceding elements	SC, SP, DWQ, ULWQS technical support contractor	Jan 2023	Dec 2023	TBD

31.	Information and education[+]	Finalize the education and outreach program	• Incorporate the final ULWQS Public Engagement Plan to develop final information and education program	Finalization of all preceding elements	SC, SP, DWQ, ULWQS technical support contractor	Jan 2023	Dec 2023	TBD
32.	Adaptive management	Develop adaptive management program to maximize financial and technical resources and effectiveness	Develop an adaptive management program using the following outline as a starting point: • Review and evaluate results of the implementation monitoring program • Report results, progress, and success to SC, elected officials, and the public • Adjust the implementation program based on results and progress • Adjust adaptive management monitoring strategy based on modifications to the implementation program • Evaluate newly identified stressors and/or implementation strategies • Update and maintain water quality models and analytical tools • Develop adaptive management timeline (e.g., 5-year review cycle)	None	DWQ, SC	Jan 2023	Dec 2023	TBD
33.	Final Utah Lake water quality implementation plan document	Develop comprehensive watershed plan document	• Compile all elements from this and previous sections and construct a comprehensive watershed plan	Finalization of all preceding elements	SC, SP, DWQ, ULWQS technical support contractor	Jan 2023	Dec 2023	TBD

[+] Notes one of the EPA 9 elements required for Clean Water Act Section 319 and NRCS National Water Quality Initiative funding

Appendix A

Utah Lake Water Quality Study (ULWQS)

Steering Committee and POTW Considerations for Implementation Planning

Updated on October 20, 2021

UTAH LAKE WATER QUALITY STUDY (ULWQS) – PHASE 3 CONSIDERATIONS

On August 5, publicly owned treatment works (POTWs) provided input on the considerations they would like to see included in the implementation planning phase (Phase III) of the ULWQS. On August 25, the ULWQS Steering Committee members also provided their input on the considerations to include in the implementation planning phase. The considerations from both meetings are summarized and categorized into themes below.

Theme – Modeling and Adaptive Management Considerations

- Clarify the inputs/outputs, assumptions, and methods of the model (e.g., watershed, in-lake circulation, food web?)
- Include in the model:
    - Changes in treatment plant chemistry/treatments and associated biota impacts
    - No human scenario
    - Impacts of air deposition on nutrients
    - Zero population growth scenario
- Use current flows for assessment of total loads and then model scenarios
- Potential scenarios for modeling and for evaluation of adaptive management phases:
    - Scenario 1: 10 mg/liter total inorganic nitrogen & 1 mg/liter total phosphorus
    - Scenario 2: 6 mg/liter total inorganic nitrogen & 0.3 mg/liter total phosphorus (i.e., limit of technology)
    - Scenario 3: Consider limits that would encourage alternate discharge methods like reuse and the feasibility of direct potable reuse under current and growth flows
    - Scenario 4: No limit for total inorganic nitrogen & 1 mg/liter total phosphorus
    - Consider using an adaptive management approach for phasing treatment plant improvements while other nutrient loads are evaluated and being reduced
- Consider 1) secondary nutrient removal, 2) tertiary nutrient removal, and 3) advanced methods (e.g., electrodialysis reversal, reverse osmosis)
- Consider geographical differences between entities[1]
- Model how nutrient loading by source is expected to change over time in a pie chart

Theme – Population Growth and Nutrient Loading

- Consider how to account for additional load from growth
    - Reserve “allocations” for future growth vs reduced loading as growth occurs
    - Geographic and generational equity implications (who pays/who benefits)
    - Impacts of a new city
    - Impacts of the “Island Project” being considered

[1] The term “entities” was discussed at the August 5, 2021 POTW meeting and refers to individual POTW facilities.

- Given population growth will change land use, consider how the transition from nonpoint sources to point sources will impact water quality

Theme – Evaluation of Environmental Tradeoffs

- Consider the type, timing, and impact of reuse on Utah Lake water quality and quantity, including the water balance of Utah Lake
    - Water quality and quantity tradeoffs associated with reduced in-flows to Utah Lake
    - Direct potable reuse
- Consider aquifer storage and recovery (ASR)
- Consider tradeoffs between increased chemicals and reuse with additional secondary benefits
- Consider the need for carbon addition to meet low limits vs. the benefit derived
- Evaluate other environmental tradeoffs for meeting limits (e.g., greenhouse gases) this includes reduction of algae or HABs vs the incremental greenhouse gas production
- Consider the impacts of potential projects conservation efforts and downstream habitat
- Consider the impacts of reuse on the Great Salt Lake

Theme – Permitting Considerations

- Evaluate annual or seasonal load limitations vs daily or monthly limits
- How do we calculate averages? Consider use of geometric means to minimize impacts from one high sample
- How are non-removable nutrients such as soluble organic nitrogen being considered in the permit load setting process?

Theme – Timing and Sequencing

- Itemize sources and contributing factors, such as sediment recycle, before developing interventions or setting load limits
- Sequencing of interventions/load reductions
- Timing/cost thresholds for facility upgrades
- Facility upgrades/timing of new compliance expectations
- Break out implementation into phases with assessment periods to quantify changes
- Parallel paths for reducing controllable loads (e.g., point source) and uncontrollable loads (e.g., non-point source, air deposition, sediment recycling)
- Consider recovery timelines

Theme – Costs and Attainability

- Clear definition of “clean” and assessment of what is attainable
    - How clean is clean enough for the cost/tradeoffs?
- Need to be able to prove the benefit to Utah Lake to elected officials to justify costs
- POTWs to assess the cost estimates of upgrading their facilities with support from the Utah Department of Environmental Quality if needed
- Consider technology-based limits
- Identify economically practical treatment limit
- Consider financing starting in 2025/2030/2035

Theme – Non-Point Sources

- Agricultural runoff and associated impacts of tail water

- Evaluate current irrigation methods and what nutrient reductions could be gained by implementing more efficient irrigation methods
- Non-point source/runoff from stormwater – mechanisms to reduce or control nutrient loads
- The sewage systems of new development using county and city plans (e.g., individual site systems or connected to POTWs)

Theme – Implementation Methods

- Assess the potential for water quality trading among POTWs and other non-point source nutrient sources
    - Easier to trade loads than concentration
    - Trade among POTWs
    - Stormwater and POTW effluent trades
    - Agricultural/POTW trades, requires quantification of load in agricultural runoff
    - Costs and logistics of a third-party verification system
    - Geographic extent of the trading system (i.e., the potential for trading outside the watershed)
    - Inclusion of agricultural programs that optimize water use
    - Bank of trade credits from early compliance
- Consider ecological/ecosystem restoration methods (e.g., carp reduction and vegetation stabilization) in addition to engineered solutions