Salton Sea Authority

July 8, 2026

Meng-Chen "Imogen" Lee
Michael K. Stenstrom
Department of Civil & Environmental Engineering
University of California, Los Angeles

Re: UCLA WaterSMART Applied Science Grant Proposal

Dear Ms. Lee and Professor Stenstrom:

The Salton Sea Authority appreciates UCLA's interest in developing a machine learning-driven water quality management tool to support Salton Sea restoration planning, monitoring, and decision-making.

Based on our discussions and our current understanding of the proposal, the Authority supports UCLA's submittal of the WaterSMART Applied Science Grant application and is willing to participate as a non-financial partner. The Authority's participation may include providing input, feedback, coordination with regional partners, review of management needs and scenarios, and other non-financial support as appropriate, subject to available capacity and any required approval by the Board of Directors of the Salton Sea Authority.

I also spoke with Vivien Maisonneuve of the California Department of Water Resources regarding this effort, and he confirmed that the proposed work could be value-added to Salton Sea restoration efforts. To achieve that potential, it will be important for the project to be framed in a manner that produces maximally beneficial results and to be properly resourced to ensure it can meet that objective.

The Authority is willing to work with UCLA in pursuit of that goal. This letter does not constitute a financial commitment, cost-share commitment, grant administration responsibility, or obligation to perform technical work by the Authority at this time. Any future commitment of Authority funds, staff resources, or formal project responsibilities would require separate review and approval by the Authority.

We appreciate UCLA's initiative and look forward to continued discussion regarding how this work can best support Salton Sea restoration partners.

Sincerely,

Sincerely,

G. Patrick O'Dowd
Executive Director / General Manager

UNIVERSITY OF CALIFORNIA, LOS ANGELES

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

Project Title:

From Inflows to Insights: A Machine Learning–Driven Water Quality Management Tool for SMART Salton Sea Restoration

Research Engineer: Meng-Chen Lee, Ph.D.

P.I.: Michael K. Stenstrom, Ph.D.

Executive Summary

The Salton Sea's restoration now turns on whether managers can anticipate and control water-quality and habitat conditions under declining inflows, rising salinity, and selenium pressure while protecting communities and wildlife. The State's Long-Range Plan sets the programmatic frame for habitat creation and air-quality protection, and the U.S. Army Corps of Engineers' (USACE) Imperial Streams & Salton Sea feasibility process is building the federal decision record to compare alternatives and refine operations. Within that joint context, the Species Conservation Habitat (SCH) ponds function as the near-term, adaptive "workbench" where operations, thresholds, and monitoring practices must be tested and improved in real time. Our proposal delivers a physics-guided machine-learning decision-support tool that ingests USACE hydrologic outputs (flows, stages, mixing) and SCH monitoring data to produce short-term forecasts, early-warning alerts, and scenario comparisons for dissolved oxygen, salinity, temperature, selenium, water-surface elevation, depth/inundation, and emergent-feature stability—directly supporting LRP objectives and feasibility-study evaluations.

This project combines machine learning with local constructed-wetland treatment insights, a comprehensive monitoring framework, and domain-expert knowledge to complement and extend existing hydrologic modeling and SCH habitat operations. Building on Imperial County constructed wetland pilots—which confirmed the ability of vegetated systems, sedimentation basins, and flow-through wetland hydraulics to attenuate nutrients, suspended solids, and transform selenium, while also revealing strong nonlinear sensitivity to retention time, loading rates, plant condition, microbial proxies, and seasonal variability—the tool is intentionally designed to address the predictive limits of traditional approaches. The framework integrates physics-guided ML/DL, ecological indicators, and inflow and mixing data from USACE hydrologic models to improve restoration scenario screening, anticipate water-quality drift, and provide explainable cause-effect relationships that reinforce scientific defensibility during feasibility comparisons and long-range planning.

The tool strengthens both operational reliability and planning confidence by converting multivariate, spatiotemporally dynamic monitoring datasets into quantitative and actionable decision insights. Managers can detect early dissolved oxygen decline, salinity drift, thermal stress, or selenium escalation with sufficient lead time to pre-screen and model operational levers before implementation, select responses that maintain water-quality stability under drought or climate extremes, and forecast recovery windows following intervention. By explicitly testing resilience trajectories and restoration scenarios, the tool helps answer a central feasibility question: which restoration alternatives are most likely to succeed under real inflow and climate stress, and what operational controls offer the most reliable path to maintaining long-term water-quality balance and habitat function? The system's ability to explain threshold approach timing, rank feasible hydraulic or chemical levers, and estimate recovery stability ensures decisions shift from reactive interpretation to anticipatory, evidence-based adaptive management, strengthening

both SCH operations and the defensibility of FS/LRP restoration alternative scoring under future hydrologic and climate uncertainty.

By Year 2, we aim to deliver a validated forecasting stack, an operational dashboard with alerting and driver-diagnostics, and a scenario engine that quantifies trade-offs among pollutant reduction, habitat reliability, and water use under drought and storm regimes. In practical terms, this makes SCH a continuously learning platform that de-risks day-to-day operation, strengthens the LRP/USACE comparison of restoration alternatives, and creates a transferable template for treatment wetlands and managed habitats elsewhere in the basin's tributaries.

The model architecture also enables modular expansion. Habitat suitability features such as foraging access, inundation duration, and island stability can be layered in to simulate biological endpoints, advancing FS scoring and SCH sustainability. Critically, the tool allows transparent communication of ecological thresholds and performance diagnostics, supporting inclusive governance and more equitable government–community dialogue. As lithium extraction and geothermal energy development accelerate in the region, this tool offers a structured method for evaluating water–habitat trade-offs and safeguarding restoration integrity under shifting basin demands. It transforms fragmented data into actionable insights, improves communication across agencies and communities, and provides a replicable, science-informed framework for nature-based solution governance.

The severity of the Salton Sea crisis, coupled with its critical role in sustaining the Pacific Flyway and global bird biodiversity, demands a sophisticated, innovative, and robust ecosystem service forecasting platform—such as the one proposed in this project—to maximize the long-term success of this grant and the decades-long restoration effort. As machine learning (ML) rapidly emerges as a prominent tool in international natural resource management, this project offers a lasting capability for multi-objective restoration planning. It bridges predictive modeling with public accountability and equips USACE, SSMP, and regional stakeholders with the transparency, precision, and foresight needed to achieve a resilient, just, and ecologically credible restoration of the Salton Sea.