



# California Water Boards 6<sup>th</sup> Annual Water Data Science Symposium



Mono Lake, Photo Credit: Mick Haupt



Owens River, Photo Credit: Dane Deaner

***Beyond Open Data:  
Radical Inclusivity for  
Water Data Equity***



**California Water Boards**  
**6<sup>th</sup> Annual California Water Data Science Symposium**  
**Beyond Open Data: Radical Inclusivity for Water Data Equity**  
**June 28 – 30, 2021**

**Symposium Program**

Event Partners..... 1

Presenter Acknowledgements ..... 2

Agenda ..... 4

Welcome and Keynote Speakers ..... 12

Monday, June 28..... 13

    Paya: The Water Story of the Paiute..... 13

Tuesday, June 29..... 16

    Session 1: From Data to Insight ..... 16

    Session 2: From Insight to Action..... 18

    Session 3: From Prediction to Protection ..... 21

Wednesday, June 30 ..... 23

    Session 1: California Chapter of the Society for Freshwater Science ..... 23

    Session 2: Using Data to Address Water and Racial Inequities ..... 26

    Bay-Delta Data Sandbox Workshop..... 27

Presenter and Panelist Index ..... 28

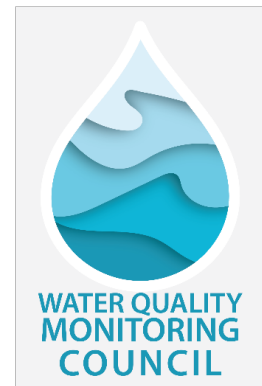
About The 2021 Mascot..... 41

Thank you for joining the 2021 California Water Data Science Symposium!..... 41





Event Partners



## Presenter Acknowledgements



**Society for Freshwater Science**  
CALIFORNIA CHAPTER





**Agenda**  
**California Water Boards**  
**6th Annual California Water Data Science Symposium**  
**Beyond Open Data: Radical Inclusivity for Water Data Equity**  
**Monday, June 28, 2021**

**Paya: The Water Story of the Paiute**  
**Film Screening & Panel Discussion**

Please [register to attend](#) this film screening and panel discussion.

After registering, you will receive a confirmation email containing instructions on how to join the webinar.

**Virtual Attendance for Non-registered Viewers: [YouTube Live Stream](#)**

Time	Topic
3:45 - 4:00	Sign-on using information provided via your customized confirmation email
4:00 - 4:05	Welcome & Logistics <i>Greg Gearheart</i> <i>State Water Resources Control Board</i>
4:05 - 4:45	Film Screening <i>Paya: The Water Story of the Paiute</i>
4:45 - 5:30	Panel Discussion <i>Panelists: Teri Red Owl<sup>1</sup>, Paul Huetten<sup>1,2</sup>, Monty Bengochia<sup>1,3</sup></i> <i>Moderators: Kyndall Noah<sup>1</sup>, Amanda Ford<sup>4</sup></i> <i>(1) Owens Valley Indian Water Commission, (2) Big Pine Paiute Tribe of the Owens Valley, (3) Bishop Paiute Tribe Board Representative, (4) State Water Resources Control Board</i>

**California Water Boards**  
**6th Annual California Water Data Science Symposium**  
**Beyond Open Data: Radical Inclusivity for Water Data Equity**  
**Tuesday, June 29, 2021**

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**Plenary Session**

Time	Topic
8:45 - 9:00	Sign-on using information provided via your customized confirmation email
9:00 - 9:05	Symposium and Webinar Logistics <i>Greg Gearheart</i> <i>State Water Resources Control Board</i>
9:05 - 9:20	Welcome <i>E. Joaquin Esquivel</i> <i>State Water Resources Control Board</i>
9:20 - 10:00	<i>Keynote Conversation</i> <i>Ebony Harper</i> <i>California TRANScends</i>
10:00 - 10:05	<b>Break</b>

**Session 1: From Data to Insight**

**Examples of data visualization, exploration, and application**

Time	Topic
10:05 - 10:25	Bay-Delta data sandbox: a web-based analytics and visualization environment for accessing and experimenting with integrated Bay-Delta data <i>Emily Richardson, Jeffrey A. Hansen, Jeniffer Soto Perez, Tom Bergamaschi, Brendan F. Wakefield, Brian Bergamaschi</i> <i>United States Geological Survey</i>



Time	Topic
10:25 - 10:45	DELVE: a cloud-based data management and visualization system for standardization, exploration, and collaboration <i>Mike Leech<sup>1</sup>, Laura Nickelhoff<sup>2</sup></i> <i>(1) Environmental Science Associates, (2) Sitka Technology Group</i>
10:45 - 10:55 <i>Lightning Talk</i>	Untangling the multi-variable microplastics toxicity issue with an interactive data exploration application <i>Scott Coffin<sup>1</sup>, Leah Thornton Hampton<sup>2</sup></i> <i>(1) State Water Resources Control Board, (2) Southern California Coastal Water Research Project</i>
10:55 - 11:15	Groundwater Quality Map <i>Hung Bui</i> <i>State Water Resources Control Board</i>
11:15 - 11:35	Advancing sustainable groundwater management with open-source technology: from vision to reality <i>Christina Babbitt<sup>1</sup>, John Burns<sup>2</sup></i> <i>(1) Environmental Defense Fund, (2) Sitka Technology Group</i>
11:35 - 11:55	<a href="http://gspdrywells.com">gspdrywells.com</a> : an open-source tool to estimate impacts to vulnerable wells and support gsp development <i>Rich Pauloo<sup>1</sup>, Darcy Bostic<sup>2</sup>, Amanda Monaco<sup>3</sup>, Kaylon Hammond<sup>3</sup></i> <i>(1) Water Data Lab, (2) Pacific Institute, (3) Leadership Counsel for Justice and Accountability</i>
11:55 - 12:30	<b>Lunch</b>

## Session 2: From Insight to Action

### Example tools that support data-driven decision making

Time	Topic
12:30 - 12:50	Unnatural water balance and biological beneficial uses: a data driven framework to support flow management decisions <i>Amanda Aprahamian<sup>1</sup>, Aaron Poresky<sup>2</sup></i> <i>(1) Orange County Public Works, (2) Geosyntec Consultants</i>

Time	Topic
12:50 - 1:10	Water budget development: putting data to work <i>Paul Shipman, Abdul Khan</i> <i>California Department of Water Resources</i>
1:10 - 1:30	OC stormwater tools: an open-source platform for stormwater asset inventory and performance modeling <i>Austin Orr<sup>1</sup>, Eric Rademacher<sup>2</sup></i> <i>(1) Geosyntec Consultants, (2) Orange County Public Works</i>
1:30 - 1:40 <i>Lightning Talk</i>	Waste discharge requirement data management: past, present, future <i>TJ Middlemis-Clark<sup>1</sup>, Kristina Olmos<sup>2</sup>, Stephanie Torres<sup>3</sup>, Laurel Warddrip<sup>3</sup></i> <i>(1) Lahontan Regional Water Quality Control Board, (2) Central Coast Regional Water Quality Control Board, (3) State Water Resources Control Board</i>
1:40 - 2:00	Open-source dashboards for operational control at wastewater facilities <i>Ryan Shepherd<sup>1</sup>, Patrick McGrath<sup>2</sup></i> <i>(1) Databrook LLC, (2) San Luis Obispo Water Resource and Reclamation Facility</i>
2:00 - 2:20	Beach water quality data in the County of San Diego and the future directions <i>Farnaz Farhang</i> <i>County of San Diego</i>
2:20 - 2:35	<b>Break</b>

### **Session 3: From Prediction to Protection**

#### **Using machine learning to improve California's water resources**

Time	Topic
2:35 - 2:55	Identifying meaningful water quality parameters for resource constrained local government's data collection using large open access state datasets: a Clear Lake case study, Lake County, CA. <i>Liam Healey, Angela De Palma-Dow</i> <i>Lake County Water Resources Department</i>

Time	Topic
2:55 - 3:15	<p>A day at the beach: enabling coastal water quality prediction with high-frequency sampling and data-driven models</p> <p><i>Ryan T. Searcy, Dr. Alexandria Boehm</i></p> <p><i>Stanford University</i></p>
3:15 - 3:35	<p>Leveraging big data to predict microplastics toxicity for aquatic organisms</p> <p><i>Scott Coffin<sup>1</sup>, Leah Thornton Hampton<sup>2</sup>, Bart Koelmans<sup>3</sup>, Merel Kooi<sup>3</sup>, Win Cowger<sup>4</sup></i></p> <p><i>(1) State Water Resources Control Board, (2) Southern California Coastal Water Research Project, (3) Wageningen University, Netherlands, (4) University of California, Riverside</i></p>
3:35 - 3:55	<p>Detecting cigarette butts from an eye in the sky</p> <p><i>Lorenzo Flores</i></p> <p><i>San Francisco Estuary Institute</i></p>
3:55 - 4:00	<p>Daily wrap-up and adjourn</p> <p><i>Greg Gearheart</i></p> <p><i>State Water Resources Control Board</i></p>



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**Plenary Session**

Time	Topic
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9:00 - 9:05	Welcome and Webinar Logistics <i>Greg Gearheart</i> <i>State Water Resources Control Board</i>

**Session 1: California Chapter of the Society for Freshwater Science**

Time	Topic
9:05 - 9:15	Introduction to Cal-SFS: the future of freshwater facilitated through Cal-SFS Fellowships <i>Angela De Palma-Dow<sup>1</sup>, John Olson<sup>2</sup></i> <i>(1) Cal-SFS Chair/President; County of Lake Water Resources, (2) Cal-SFS Treasurer; California State University, Monterey Bay</i>
9:15 - 9:30	What is a “natural” river? Understanding ecological opportunities and cultural values as flows decrease in Southern California urban rivers <i>Melissa von Mayrhauser</i> <i>University of California, Berkeley</i>
9:30 - 9:45	Ecological racism: seeking equity and justice via social and cultural competency <i>Robin López</i> <i>University of California, Berkeley</i>

Time	Topic
9:45 - 10:00	Thermal vulnerability in Sierra Nevada streams: spatial scales and drivers <i>Kyle Leathers</i> <i>University of California, Berkeley</i>
10:00 - 10:15	Using functional flows to establish flow criteria in California's South Fork Eel River watershed <i>Alyssa Obester</i> <i>California Department of Fish and Wildlife</i>
10:15 - 10:30	The Santa Ana River: opportunities from working in an extremely disturbed system <i>William Ota</i> <i>University of California, Riverside</i>
10:35 - 10:45	Cal-SFS follow-up and upcoming events <i>Angela De Palma-Dow</i> <i>Cal-SFS Chair/President; County of Lake Water Resources</i>
10:45 - 11:00	<b>Break</b>

**Session 2: Using Data to Address Water and Racial Inequities**

Time	Topic
11:00 - 11:05	Welcome, panelist introductions and panel objectives <i>Panel Moderator: Greg Gearheart</i> <i>State Water Resources Control Board</i>
11:05 - 11:35	Indigenous data sovereignty: how researchers can empower data governance <i>Lydia Jennings</i> <i>University of Arizona</i>

Time	Topic
11:35 - 12:40	<p>Brief panelist presentations and panel discussion</p> <p><i>Panelists: Anna Holder<sup>1</sup>, Jaimie Huynh<sup>2</sup>, Lydia Jennings<sup>3</sup>, Tara Moran<sup>4</sup>, Walker Wieland<sup>5</sup></i></p> <p><i>Moderator: Greg Gearheart<sup>1</sup></i></p> <p><i>(1) State Water Resources Control Board, (2) CalRecycle, (3) University of Arizona, (4) California Water Data Consortium, (5) California Office of Environmental Health Hazard Assessment</i></p>
12:40 - 12:50	<p>Symposium wrap-up and upcoming events</p> <p><i>Greg Gearheart</i></p> <p><i>State Water Resources Control Board</i></p>

### **Bay-Delta Data Sandbox Workshop**

Please [register to attend](#) this workshop. After registering, you will receive a confirmation email containing instructions on how to join the webinar.

Time	Topic
1:30 - 4:00	<p>Bay-Delta data access: a how-to workshop for accessing and analyzing environmental data in the U.S. Geological Survey Bay-Delta Data Sandbox</p> <p><i>Brendan F. Wakefield, Jeffrey A. Hansen, Emily Richardson, Jeniffer Soto Perez, Tom Bergamaschi, Brian Bergamaschi</i></p> <p><i>United States Geological Survey</i></p>



## Welcome and Keynote Speakers

### E. Joaquin Esquivel, Chair, State Water Resources Control Board



E. Joaquin Esquivel was appointed to the State Water Resources Control Board by Governor Jerry Brown in March 2017 and designated by Governor Gavin Newsom as Chair in February 2019. Previously, he served as Assistant Secretary for federal water policy at the California Natural Resources Agency in the Governor's Washington, D.C. office, where he facilitated the development of policy priorities between the agency, the Governor's Office, the California Congressional delegation, and federal stakeholder agencies. For more than eight years prior to that he worked for U.S. Senator Barbara Boxer of California, most recently as her legislative assistant covering the agriculture, Native American, water, oceans, and nutrition portfolios, in addition to being the director of information and technology. He was born and raised in California's Coachella Valley. He holds a B.A. from the University of California, Santa Barbara in English.

### Ebony Harper, Director, California TRANScends



Ebony is the Director and founder of [California TRANScends](#). She's the recipient of the 2019 Stonewall Four Freedoms Award, the first-ever trans person to host the 2019 State Capitol Tree Lighting ceremony with Governor Gavin Newsom, and served as the 2019 Grand Marshal of Sacramento's Pride Parade, and recognized by the California legislature for her work.

Harper has been a speaker and facilitator at the Global Alliance for Banking on Values Summit in Vancouver, written articles for Forbes and other news sources, been highlighted on NBC and other media outlets, sits on the board of Mirror Memoirs, and serves as the newest board member for the Transgender Law Center.

Monday, June 28

## Paya: The Water Story of the Paiute

Film Screening & Panel Discussion Presented By:

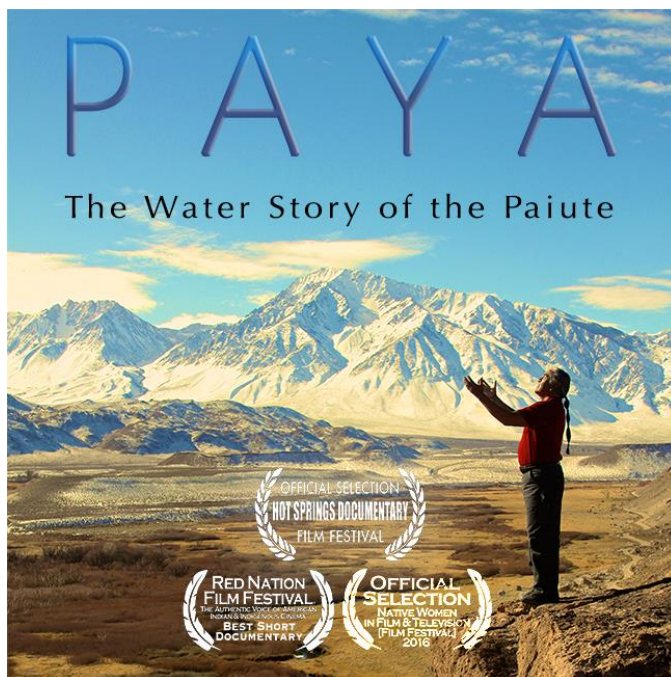
**Owens Valley Indian Water Commission  
& California Water Boards**

4:00 pm – 5:30 pm

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*[Paya: The Water Story of the Paiute](#)* tells the untold story of America’s longest lived water war between the Owens Valley Paiute and the city of Los Angeles. Using in-depth interviews, 2-d animation, archival footage and photography, Paya documents the history of the Owens Valley Paiute who constructed and managed sixty square miles of intricate irrigation systems for millennia, long before Los Angeles diverted the Owens River through the Los Angeles Aqueduct, 220 miles across the Mojave Desert. After the Indian War of 1863, surviving Paiute returned to the valley from the Eastern Sierra and White Mountains to find their ancient waterworks taken over by white

settlers. Over 150-years later, the Paiute continue the fight to save their waterworks, which are remnant in the Owens Valley landscape. Using archival maps from 1856, the filmmakers spent four years working with Paiute elders to locate and map their remnant irrigation systems using GIS technology, ultimately laying the foundation for a ‘first use’ water rights case now underway. Paya is currently being used by the Owens Valley Paiute and the Native American and academic communities nationally to mobilize tribes.

Panelists:

**Teri Red Owl, Executive Director of Owens Valley Indian Water Commission**



Teri Red Owl is an enrolled member of the Bishop Paiute Tribe. She lives in Bishop, California with her husband and children. Teri has worked for the [Owens Valley Indian Water Commission](#), a Tribal Consortium that provides water, environmental, and agricultural services to its member Tribes, for 26 years and has served as the Executive Director for the past 22 years. Teri is at the forefront of efforts to negotiate tribal land and water for the Bishop, Big Pine, and Lone Pine tribes and advocates for environmental protection and policy change in Payahuunadü, in Los Angeles, and at the state and federal levels.

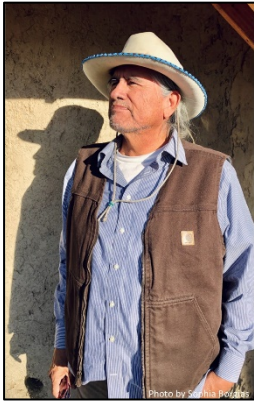
Teri has extensive experience in grant management and oversight and has two business degrees. Teri has successfully managed and implemented a variety of projects and grants while maintaining sound financial management. Teri has served on numerous boards, committees, and commissions including Bishop Paiute Gaming Corporation, Inyo County Water Commission, Inyo/Los Angeles Standing Committee, California Indian Manpower Consortium, U.S. Environmental Protection Agency Region 9 Regional Tribal Operations Committee, California Department of Water Resources – Water Plan Update Committee, Contributing Author Committee for 4th California Climate Change Assessment Indigenous Communities Report, Bishop Indian Utility Organization, Red Nation Celebration Institute, and Bishop Paiute Development Corporation. Teri is a licensed Tribal Court Advocate and in her spare time she volunteers as the Secretary for the local Cub Scouts and a youth cheerleader head coach.

**Paul Huette, Big Pine Paiute Tribe of the Owens Valley Board Representative and Vice-Chairman for the Owens Valley Indian Water Commission**



Paul Huette is an enrolled member of the Big Pine Paiute Tribe of Owens Valley. He understands the interconnectedness Native American leaders needs to have in their community. Paul is Big Pines water and wastewater operator and takes pride in the tribe’s award-winning water quality which can be symbolic to the essential nature of leadership as it relates to addressing people’s needs. He continues to be an advocate in the Owens Valley water rights struggles through his role as Vice-Chairman of the Owens Valley Indian Water Commission. He has been vocal about the impacts of Los Angeles groundwater pumping in the valley through his role on the Big Pine Environmental Protection Committee. Paul’s dedication to public service extends to all parts of the water system, from regional environmental stewardship and valley wide water management to tribal water rights and water supply systems. He also sits on multiple boards to ensure these decision-making forums are inclusive to Indigenous voices and needs.

## **Monty Bengochia, Bishop Paiute Tribe Board Representative and Chairman for the Owens Valley Indian Water Commission**



Monty Bengochia has been working on tribal land and water rights issues in Payahuunadü for more than three decades. He was involved in the water rights negotiations with Los Angeles during the 1990s and has advocated on those ongoing issues ever since. Today he is the Chairman of the Board of Water Commissioners for the Owens Valley Indian Water Commission and is also the Tribal Historic Preservation Officer for the Bishop Paiute Tribe. Monty has served multiple terms as a tribal council member and chairman for the Bishop Paiute Tribe and has been an advocate for tribal youth programs and tribal food sovereignty. In meetings, Monty is known for helping people see the big picture, drawing connections between the past and the present and between environmental and human wellbeing. He reminds us that all of California’s water comes from Indigenous territories, that public lands are also ancestral homelands, and that there is much we can learn from Indigenous stewardship practices.

Moderators:

## **Kyndall Noah, Communication Specialist/Project Coordinator for the Owens Valley Indian Water Commission**

Kyndall Noah is a member of the Choctaw Nation of Oklahoma. He graduated from Haskell Indian Nations University (HINU), the only fully federally funded Tribal College University in the United States with a degree in Indigenous American Indian Studies. While studying there he interned as an ecoAmbassador working on a variety of environmental issues such as assisting with the stewardship of the Haskell Wetlands and leading the development of a sustainable composting program. Kyndall received his master’s degree in American Indian/Alaskan Native Social Work from the Brown School of Social Work at Washington University in St Louis. He has a strong background in community engagement and working with communities to address social issues. Kyndall works as the Communication Specialist/Project Coordinator for the Owens Valley Indian Water Commission to ensure the story of Owens Valley is inclusive and told from the perspective of the Indigenous people.

## **Amanda Ford, State Water Resources Control Board**



Amanda Ford is the program manager for the Water Board’s Office of Public Participation SAFER Drinking Water and Tribal Affairs units. She has an M.A. in Sustainable International Development and Environmental Peacebuilding from Brandeis University, and 20 years' experience working with environmental justice and indigenous communities worldwide. You can find her enjoying the nearest body of water with her family and dogs.

## Tuesday, June 29

### Session 1: From Data to Insight

#### Examples of data visualization, exploration, and application

##### BAY-DELTA DATA SANDBOX: A WEB-BASED ANALYTICS AND VISUALIZATION ENVIRONMENT FOR ACCESSING AND EXPERIMENTING WITH INTEGRATED BAY-DELTA DATA, **Emily Richardson**

A multitude of scientific efforts collect ecological and water quality data to improve our understanding of the Bay-Delta, often at great effort and financial cost. The value of these data sets grows as more results are published, allowing future comparisons and analyses. However, a perennial problem with integrating data from different sources is that time scales, geospatial alignments, types, formats, and units are often incompatible for immediate analysis, leaving data integration to programming experts or forgone entirely. The U.S. Geological Survey California Water Science Center is piloting a data integration effort to combine diverse sources of Bay-Delta data in an interactive, open-sourced, web-based portal. The visualizations in this 'data sandbox' are integrated spatially and temporally across projects, agencies, and scientific disciplines, allowing users to obtain data from multiple sources, view and filter those data in an interactive environment, and download the filtered dataset as a single, flat file. Our common geospatial framework relates nearby data, allowing the user to dynamically assign varying resolutions or meaningful locations to their visualization. The accessibility of the portal means that users of varying backgrounds can obtain diverse, compatible data sets, improving access for both Delta scientists and ecosystem managers.

##### DELVE: A CLOUD-BASED DATA MANAGEMENT AND VISUALIZATION SYSTEM FOR STANDARDIZATION, EXPLORATION AND COLLABORATION, **Mike Leech**

The California Department of Water Resources Operations and Maintenance staff are supporting the development of a new cloud-based data management and visualization system called DELVE that will serve as the long-term repository for existing and future datasets including fisheries, biotelemetry, hydrodynamic, water quality and other constituents. In addition to complying with the AB 1755 Open and Transparent Water Data Act requirements, the system centralizes storage of environmental data collected by DWR to increase accessibility and promote data use. DELVE's intuitive web interface allows users to explore, visualize and aggregate data that was previously inaccessible. DELVE enforces best practices for data management by applying data standards through automated data validation and data transformation functionality in data publishing workflows. DELVE supports a range of data visualizations, including charts, graphs, and interactive maps to assist with quality control and quality assurance of uploaded data and allow for visual exploration of data across projects. Overall, DELVE is intended to guide users through more standardized, accessible, and effective data collection processes, while increasing collaboration between project teams. The system

will improve data access through integration with the CA Open Data Portal and enhance communication directly to project partners.

#### UNTANGLING THE MULTI-VARIABLE MICROPLASTICS TOXICITY ISSUE WITH AN INTERACTIVE DATA EXPLORATION APPLICATION, **Scott Coffin**

Assessing threats of microplastics to ecosystems and humans is challenging due to the multi-factorial nature of the emerging contaminant suite. Included in the microplastics universe are particles composed of thousands of unique polymers with known and unknown associated chemicals, ranging in size from 5 millimeters to single nanometers, along with a diversity of additional characteristics such as shape, color, charge, and more. To visualize these complex relationships and develop health-protective thresholds for regulatory use, we mined data from all peer-reviewed microplastics toxicity studies and build an interactive RShiny web application which dynamically visualizes toxicity relationships based on the user's filtering of the dataset. This tool, the Toxicity of Microplastics Explorer (ToMEx), provides deeper understandings of the complex relationships between microplastics and humans and ecosystems for regulators, policymakers, researchers, and students alike.

#### GROUNDWATER QUALITY MAP, **Hung Bui**

Groundwater Quality Map is a webpage that allows users to view the latest detections of any chemicals in any district, section, or in entire state of CA. These chemical detections are the latest water quality data from the DDW's water quality database and can be reviewed visually on the webpage or downloaded to user computers.

#### ADVANCING SUSTAINABLE GROUNDWATER MANAGEMENT WITH OPEN-SOURCE TECHNOLOGY: FROM VISION TO REALITY, **Christina Babbitt**

In 2019, Environmental Defense Fund (EDF) began working with water managers and landowners in the Rosedale-Rio Bravo Water Storage District (Rosedale) with the goal of creating the first open-source water accounting and trading platform in California. From the start, Rosedale and EDF envisioned expanding the platform to meet the needs of water districts across the state.

The Water Accounting & Trading Platform helps water managers and landowners develop more accurate water budgets, simplify water trading, and more efficiently manage water usage. In 2020, the platform tracked over 120,000 acre-feet of water usage on 674 billing accounts across 1,107 separate parcels. This scale of water usage tracking is made possible through remotely sensed estimates of water usage provided by OpenET, a web platform being developed by NASA, EDF, and the Desert Research Institute that uses satellite-based data to calculate evapotranspiration. The open-source platform integrates with OpenET, providing users with near-real-time access to basin-wide water usage metrics.



The presentation includes representatives from EDF and the platform developer, Sitka Technology Group. Attendees will gain insight on how what started as a visionary idea for groundwater management in California is now available for landowners and water managers across the state and beyond.

#### GSPDRYWELLS.COM: AN OPEN-SOURCE TOOL TO ESTIMATE IMPACTS TO VULNERABLE WELLS AND SUPPORT GSP DEVELOPMENT, **Rich Pauloo**

Drought and unsustainable groundwater use threaten vulnerable groundwater wells, yet many Groundwater Sustainability Plans (GSPs) lack adequate well protection programs. Designed to accelerate vulnerable well protection planning, [gspdrywells.com](https://gspdrywells.com) is an open-source tool that allows users to interactively explore how groundwater level changes (including minimum thresholds set by GSPs) may impact domestic well failure in California. The site provides interactive maps of active and failing wells, cost estimates, and downloadable well failure data and model output for further analysis. The methodology and code to reproduce the analysis and website are provided via GitHub. Currently, only critical priority basins are supported. Estimates of domestic well failure count, percentage, and cost agree with two recent studies (Bostic, et. al. 2020 and EKI 2020) and suggest failure on the order of thousands of wells in critical priority basins if groundwater levels fall to minimum threshold levels specified in GSPs. Unlike other studies, [gspdrywells.com](https://gspdrywells.com) is web-based, and allows users to run adaptive management scenarios in a web browser to plan for differing amounts of well failure. To democratize data and model access, and to reduce friction in incorporating domestic well protection measures into GSPs, a “Data” subpage is provided with downloadable datasets and model output. This project is supported by funding from Microsoft's AI for Earth grant.

#### Session 2: From Insight to Action

##### Example tools that support data-driven decision making

#### UNNATURAL WATER BALANCE AND BIOLOGICAL BENEFICIAL USES: A DATA DRIVEN FRAMEWORK TO SUPPORT FLOW MANAGEMENT DECISIONS, **Amanda Aprahamian**

The South Orange County Water Quality Improvement Plan identifies unnatural water balance and flow regime as key stressors for biological integrity. Similarly, the local MS4 Permit prohibits many sources of dry weather runoff. However, outfall discharges and streamflows are composed of both groundwater and urban runoff, with proportions that vary in space and time (and may change in the future). This necessitates a careful approach to ensure that MS4 actions are supportive of riparian ecosystems and consistent with regional water management strategies.

To help inform flow management decisions, the MS4 Permittees have conducted two related studies:

- 1) The Flow Ecology Study is developing ecologically-based environmental flow recommendations for waterbodies across the South OC. It has included hydrologic model calibration (considering flow sources and magnitudes), scenario evaluation

(including future water conservation and climate change scenarios), and ecological synthesis.

- 2) Detailed outfall studies have combined several lines of evidence to assess flow sources, magnitudes, and pathways, including flow monitoring, stable isotopes, pharmaceuticals and personal care products, ionic chemistry, and human DNA markers.

We will discuss the utility of these monitoring and assessment methods and how this data-driven framework can support decision making for near- and longer-term actions in these urbanized stream systems.

#### **WATER BUDGET DEVELOPMENT: PUTTING DATA TO WORK, Paul Shipman, Abdul Khan**

Total water budgets are critical tools to advance water resilience in California. This presentation illustrates the value of data to build total water budgets using concepts in the "Draft Handbook for Water Budget Development: With or Without Models," which is a single-volume, technical reference that systematically presents existing information on methods and data sources for developing water budgets. This presentation will also demonstrate how the use of water budget data can bring better understanding, improve communications, and inform decision making for water managers.

#### **OC STORMWATER TOOLS: AN OPEN-SOURCE PLATFORM FOR STORMWATER ASSET INVENTORY AND PERFORMANCE MODELING, Austin Orr, Eric Rademacher**

Thousands of structural stormwater assets exist in the watersheds of Orange County. These features are critical for water quality improvement; however, the previous data systems used to track these assets did not adequately support emerging needs for watershed plan implementation including:

- 1) to provide transparency and visibility about assets and their conditions, and
- 2) to quantify the performance of these assets relative to water quality improvement goals.

In response, the Orange County stormwater permittees built an open-source, cloud-based platform to enhance asset inventory efforts and quantify the performance of these assets for stormwater capture and pollutant load reduction. The OC Stormwater Tools platform provides features and workflows to perform asset inventory, watershed delineations, inspections, and maintenance tracking. Combining user-entered data with enterprise GIS resources, the system prepares modeling inputs and performs calculations on the full network of BMPs, including automatic updates when the inventory changes. Modeling results are returned to the user for individual BMPs and summarized in PowerBI at watershed and jurisdiction scales.

In this presentation, we will describe the system architecture and components used to achieve this functionality and how Permittees are using the system to increase transparency and streamline workflows for watershed plan implementation.

WASTE DISCHARGE REQUIREMENT DATA MANAGEMENT: PAST, PRESENT, FUTURE,  
**TJ Middlemis-Clark, Kristina Olmos, Stephanie Torres, Laurel Warddrip**

Open and accessible data is critical to evaluating a program's effectiveness in protection of water quality. The Statewide Waste Discharge Requirement program is working on a collaborative effort to re-envision the program's data management with the goal of increasing efficiency, consistency, and transparency. Learn from the project leads about the challenges and rewards along the project's journey and next steps!

OPEN-SOURCE DASHBOARDS FOR OPERATIONAL CONTROL AT WASTEWATER FACILITIES,  
**Ryan Shepherd**

The City of San Luis Obispo's Water Resource Recovery Facility was looking for a tool to help focus resources and prioritize operational activities. They collaborated with local data science company Databrook to create a tool to consolidate the facility's key performance indicators (KPIs), calculate "Health Scores" for plant processes, and visualize these parameters in a dashboard.

These scores have helped front-line operators prioritize the day's activities: if their unit's score is 95% or more, they know their core duties are met and they are available for general operational support. Conversely, if their unit's score is sub-optimal, they review additional dashboard metrics to determine the root cause and whether it requires action.

The system works as follows: Existing software generates a report on a nightly basis. The report is sent to a cloud function, which processes it and stores the results in a time series database. A second function analyzes the data, compares parameters to upper and lower control limits, and assigns points based on pre-configured weights. The algorithm calculates scores for each process at the plant (primary, secondary, and tertiary treatment) as well as overall facility health. The scores are visualized alongside other metrics using an open source dashboard tool.

BEACH WATER QUALITY DATA IN THE COUNTY OF SAN DIEGO AND THE FUTURE DIRECTIONS,  
**Farnaz Farhang**

Beach and Bay Water Quality Monitoring Program, County of San Diego will share information about the program and how they aim to protect public health through the daily water quality sampling.

### Session 3: From Prediction to Protection

#### Using machine learning to improve California's water resources

##### IDENTIFYING MEANINGFUL WATER QUALITY PARAMETERS FOR RESOURCE CONSTRAINED LOCAL GOVERNMENT'S DATA COLLECTION USING LARGE OPEN ACCESS STATE DATASETS: A CLEAR LAKE CASE STUDY, LAKE COUNTY, CA, **Liam Healey**

Clear Lake is the largest natural freshwater lake located entirely within California and provides drinking water for approximately 38,000 Lake County residents, including multiple tribal and disadvantaged communities. Clear Lake has notoriously suffered from harmful algal blooms, fire impacts, droughts, and historic mining. From 1964-2019, Clear Lake ambient water quality (WQ) was consistently sampled by the California Department of Water Resources (DWR). At the termination of this large state-funded program, local managers were left wondering what specific WQ data parameters should be maintained considering limited local resources. Using the historical DWR dataset, available on the open access Water Data Library, we will summarize, organize, and pre-process data in R, using the caret package. The caret package provides functions for training and plotting data, including correlation testing. By identifying highly correlated variables, using multiple defined constraints, we can streamline which parameters to include in future sampling efforts, in addition to considering temporal and spatial factors. We aim to identify the most useful and meaningful WQ data to continue collecting in Clear Lake, to both maximize limited resources and effectively best manage this valuable aquatic resource.

##### A DAY AT THE BEACH: ENABLING COASTAL WATER QUALITY PREDICTION WITH HIGH-FREQUENCY SAMPLING AND DATA-DRIVEN MODELS, **Ryan T. Searcy**

To reduce the incidence of recreational waterborne illness, fecal indicator bacteria (FIB) are measured to assess water quality and inform beach management. Recently, predictive FIB models have been used to aid managers in making beach posting and closure decisions. However, those predictive models must be trained using rich historical data sets consisting of FIB and environmental data that span years, and many beaches lack such data sets. Here, we investigate whether water quality data collected during discrete short duration, high-frequency beach sampling events (e.g., samples collected at sub-hourly intervals for 24–48 h) are sufficient to train predictive models that can be used for beach management. We use data collected during six high-frequency sampling events at three California marine beaches and train a total of 126 models using common data-driven techniques. Tide, solar irradiation, water temperature, significant wave height, and offshore wind speed were found to be the most important environmental variables in the models. We validate the predictive performance of models using withheld data. Random forests are consistently the top performing model type. Overall, we find that data-driven models trained using high-frequency FIB and environmental data perform well at predicting water quality and can be used to inform public health decisions at beaches.

## LEVERAGING BIG DATA TO PREDICT MICROPLASTICS TOXICITY FOR AQUATIC ORGANISMS, **Scott Coffin**

Microplastics is one of the most diverse and complicated contaminant suites- encompassing 6 orders of magnitude in size (nanometer to millimeter), hundreds of unique polymer types, a continuum of shapes, densities, associated contaminants, and more. Despite there being >200 independent toxicity studies on >150 unique species, many fundamental questions remain regarding how microplastics affect organisms, such as: What drives toxicity? How important is size? What dose metric best predicts toxicity (i.e. mass, particle count, or volume)? A critical barrier to answering these questions and extrapolating laboratory studies to the environment is that nearly all laboratory studies are done with monodisperse (i.e. single shape, size, polymer type) particles, whereas microplastics occur as a polydisperse mixture in the environment.

To answer these questions, a variety of models were built to predict the toxicity of microplastics. A training database including >6,000 monodisperse microplastics toxicity measurements was used to predict toxicity of an environmentally realistic polydisperse mixture of microplastics. While random a forest model most accurately predicts toxicity (~92%), binomial logistic regression (~72% accuracy) was found to be more generalizable and interpretable. This novel approach provides critical understanding of how microplastics affect aquatic organisms and directly informs decision making worldwide.

## DETECTING CIGARETTE BUTTS FROM AN EYE IN THE SKY, **Lorenzo Flores**

With the advent of the State Water Board's Trash Amendments in 2015, cities, counties, and state agencies have set their sights on a target of zero waste escaping into our receiving waters. Most recognize, however, that this progress will take work. And that work will require evidence. For many municipalities interested in monitoring their management actions designed to reduce the release of trash, automation is an attractive proposition. After all, monitoring trash over broader areas with greater frequency is challenging and often costly.

With funding from the Ocean Protection Council and the California Department of Public Health, the San Francisco Estuary Institute and Southern California Coastal Water Research Project developed two new publicly available machine learning algorithms that can advance the detection of trash in general and cigarette butts in particular. The team leveraged both aerial imagery and coordinated fieldwork to measure the effectiveness of the algorithms in identifying the target items. The results are very promising and have been featured in a Trash Monitoring Playbook, issued by the Ocean Protection Council, which provides guidance for the adoption of trash monitoring methods to complement programmatic objectives.

During development, the team shared information and approaches with colleagues conducting similar work in West Sacramento, the Central California Coast, and across the state. This sharing of approaches from the State Water Board, 2ndNature, and Caltrans has opened the field of artificial intelligence to new audiences as public agencies seek to implement solutions that can benefit from these technological advances.

The team will also share the results of the specific trash studies while also discussing the implications for the refinement and operationalizing of this work on trash monitoring in the Bay-Delta region and beyond.

## **Wednesday, June 30**

### Session 1: California Chapter of the Society for Freshwater Science

INTRODUCTION TO CAL-SFS: THE FUTURE OF FRESHWATER FACILITATED THROUGH CAL-SFS FELLOWSHIPS, **Angela De Palma-Dow, John Olson**

The [California Chapter of the Society for Freshwater Scientists](#) (Cal-SFS) has a clear purpose: to promote a better understanding of freshwater ecosystems like rivers, lakes, and wetlands in California and in adjacent western deserts and mountains. Understanding the structure and function of these ecosystems and their connection to watersheds and landscapes will lead to improved assessment, conservation, and restoration of these important environments and natural resources. Cal-SFS encourages and facilitates the use of biota (fish, invertebrates, and algae) in assessing the condition of freshwater aquatic resources and natural resource management. One of the goals of SFS and the California chapter is to promote, encourage, support, and provide for the next generation of freshwater scientists. To help achieve that goal, this year Cal-SFS leadership started a Fellowship Program with funds and support from the Parent SFS Long Range Planning Committee. This Fellowship Program is meant to foster and support the next generation of dedicated Cal-SFS members and satisfies several chapter values and goals, including the promotion and development of students and early career freshwater scientists and practitioners through specific programs and actions. In this session, these Fellows present on their current activities, research, policies and applications, as well as their experiences so far as a fellow and member of SFS.

More information about Cal-SFS, including previous or upcoming activities can be found on the [Cal-SFS website](#) or in our most recent [newsletter](#). Learn how to [become a member](#) of SFS and the California Chapter, and be sure to follow us on Twitter! @CalSFSsocial

WHAT IS A “NATURAL” RIVER? UNDERSTANDING ECOLOGICAL OPPORTUNITIES AND CULTURAL VALUES AS FLOWS DECREASE IN SOUTHERN CALIFORNIA URBAN RIVERS,

**Melissa von Mayrhauser**

Streamflow in the Los Angeles River, San Gabriel River, and Santa Clara River has been dominated by wastewater effluent since the mid-to-late 20th Century. However, water reclamation plant operators plan to increase water recycling to fulfill drought-inspired water conservation mandates along these rivers starting as early as 2022. Greatly diminished effluent discharges may mean significant segments of these rivers will run dry for most of the year, affecting these novel ecosystems, people’s relationships with them, and revitalization efforts. Particularly in urban and suburban settings, dry river ecosystems are poorly understood in



California and public perceptions of them remain under-studied. I will present about the first year of my Ph.D. research and plans for upcoming research, as I seek to combine aquatic-terrestrial invertebrate monitoring, iNaturalist data analysis, remote sensing, and community partnership building to address gaps in understanding of intermittent river restoration potential.

**ECOLOGICAL RACISM: SEEKING EQUITY AND JUSTICE VIA SOCIAL AND CULTURAL COMPETENCY,  
Robin López**

While robust research in freshwater science is focused on predicting and assessing ecological integrity, much less attention has focused on the nuanced dynamics of social and cultural integrity in freshwater research. In particular, equity and justice have remained at the periphery of freshwater science research agendas. Ecological racism in freshwater research, restoration, and community engagement is seldom acknowledged due to a lack of representation and decision-making power not equitably afforded to Black, Indigenous, Latinx, and Asian (BILA) people. Ecological racism refers to ecosystems largely occupied and utilized by BILA people that are exploited, extracted, or restored without regard to impacted BILA communities. Consequently, these critical identities and voices are missing from the spaces of Environmental Science. Therefore, there is a need for addressing issues of ecological racism via social and cultural competency. We present approaches to increasing competency, including education and training of rising scholars in freshwater science, that can catalyze change in the field. Just as freshwater ecology recognizes that biological and functional diversity underpins ecological integrity, sustained meaningful effort to advance justice, equity, diversity, and inclusion has the potential to bring integrity to our research community.

**THERMAL VULNERABILITY IN SIERRA NEVADA STREAMS: SPATIAL SCALES AND DRIVERS,  
Kyle Leathers**

Climate change threatens thermal regimes in Sierra Nevada streams, but the spatial scales and environmental drivers controlling vulnerability are uncertain. Many regional scale modeling projects have predicted stream temperature, but few studies have examined temperature across spatial scales. Elevation, channel morphology, and air temperature are regarded as possible drivers of water temperature, but studies disagree on their importance. This study investigates the temporal, spatial, and environmental drivers of stream temperature in a Sierra Nevada watershed using Dynamic Linear Model (DLM), Multivariate Auto-Regressive State-Space (MARSS), and Spatial Stream Network (SSN) models. We deployed 52 temperature sensors over July and August in Bull Creek during a low snowpack year in combination with historic data to answer these questions. Air temperature significantly impacts water temperature throughout most of the year, peaking in influence during spring snowmelt. We found that the reach scale (~50 m) best predicts water temperature metrics and incorporating air temperature improved models. Elevation reduced temperature while conductivity increased temperature because of its relationship with snowmelt. Headwaters at low elevations may be

the most vulnerable to warming maximum water temperatures, as they have reduced thermal buffering. Climate change threatens Sierra Nevada stream thermal regimes due to predicted increases in air temperature and declines in discharge and snowmelt. Managers and modelers should consider the reach scale as the spatial unit of temperature variation to distinguish thermal refugia for the future.

#### USING FUNCTIONAL FLOWS TO ESTABLISH FLOW CRITERIA IN CALIFORNIA'S SOUTH FORK EEL RIVER WATERSHED, **Alyssa Obester**

In California, variable hydrology, climate change, and water demand have created complex challenges for aquatic ecosystem management. A key piece of water management is the development of quantitative instream flow criteria that protect aquatic ecosystem health. However, lack of resources has limited the number of streams in California that currently have instream flow protections. In addition, many existing methods may only produce criteria for a portion of the year or for a single species and life stage, and these criteria typically do not specify the required timing or duration of flows. The recently established California Environmental Flows Framework (CEFF) provides guidance and a set of hydrologic tools for developing ecological flow criteria statewide using functional flows, or flows that perform important ecological and geomorphic functions. Examples of these flows include winter peak flows, the spring recession, and summer baseflows. Tools associated with the Framework also quantify expected magnitude, timing, duration, frequency, and rate of change of these functional flows under unimpaired conditions. The California Department of Fish and Wildlife is using functional flows to establish instream flow criteria for watersheds throughout California. Here, a case study is presented that uses functional flows for locations within the South Fork Eel River watershed. Functional flow metrics are compared with additional data to develop flow criteria. This case study demonstrates a process for integrating functional flows with traditional methods to identify broadly protective flow criteria.

#### THE SANTA ANA RIVER: OPPORTUNITIES FROM WORKING IN AN EXTREMELY DISTURBED SYSTEM, **William Ota**

The Santa Ana River is an effluent-dominated managed urban river. Within the Santa Ana River live two threatened native fishes, Santa Ana sucker (*Catostomus santaanae*) and Arroyo Chub (*Gila orcutti*). Threats to these fish include habitat loss due to modification and fragmentation, water quality degradation, the introduction of nonnative species, and large-scale water removal for municipal purposes. These threats are driven by the ongoing urbanization and human population growth in Southern California. I am examining freshwater community structure, trophic interactions, and feeding within this system through collaborations with local agencies. This work has demonstrated current differences between the wastewater channels that maintain flow in the urban Santa Ana River and key shifts within the invasive committee. Future work will further demonstrate how urbanization is altering the freshwater community and its function.

## Session 2: Using Data to Address Water and Racial Inequities

### INDIGENOUS DATA SOVEREIGNTY: HOW RESEARCHERS CAN EMPOWER DATA GOVERNANCE, **Lydia Jennings**

Indigenous land management practices result in higher species richness, less deforestation, and land degradation than non-Indigenous strategies. Many environmental researchers, data repositories, and data service operations recognize the importance of collaborating with Indigenous nations, supporting their environmental stewardship practices, and aligning land stewardship mechanisms with Indigenous rights. Yet these individuals and organizations do not always know the appropriate processes to achieve these partnerships. Calls for government agencies to collaborate with Indigenous land stewards require an increasing awareness of what Indigenous data are and how to manage these data. Indigenous data sovereignty underscores Indigenous rights and interests and can provide a structure for data practices. In this talk, Dr. Lydia Jennings will introduce what constitutes Indigenous data, how to apply an Indigenous data sovereignty framework to environmental research, examples of Indigenous data governance, and how environmental scientists can co-create with Indigenous communities to answer community-driven research questions.

### BRIEF PANELIST PRESENTATIONS AND PANEL DISCUSSION

Racial equity work is data driven and this Symposium's Water Data Community is all about using water data to drive better outcomes. This panel will explore some recent work being done throughout the state related to water data equity, data sovereignty, and insights into the intersection of systemic racism and environmental outcomes. After the presentations we will conduct an experiment - can we develop a roadmap to figure out where we go from here and how we - the Water Data Community - can work together to achieve racial equity in our work? All participants are welcome and encouraged to contribute to the discussion! We will plan on reporting back on this experiment at next year's Symposium.

#### Panelists:

Anna Holder, State Water Resources Control Board

Jaimie Huynh, CalRecycle

Lydia Jennings, University of Arizona

Tara Moran, California Water Data Consortium

Walker Wieland, California Office of Environmental Health Hazard Assessment (OEHHA)

#### Moderator:

Greg Gearheart, State Water Resources Control Board

# Bay-Delta Data Sandbox Workshop

Presented By:

**U.S. Geological Survey California Water Science Center  
& California Water Boards**

Wednesday, June 30, 2021

1:30 pm – 4:00 pm

Please [register to attend](#) this workshop. After registering, you will receive a confirmation email containing instructions on how to join the webinar.

**BAY-DELTA DATA ACCESS: A HOW-TO WORKSHOP FOR ACCESSING AND ANALYZING ENVIRONMENTAL DATA IN THE U.S. GEOLOGICAL SURVEY BAY-DELTA DATA SANDBOX, Brendan F. Wakefield, Jeffrey A. Hansen, Emily Richardson, Jeniffer Soto Perez, Tom Bergamaschi, Brian Bergamaschi**

The U.S. Geological Survey (USGS) California Water Science Center is working to expand the availability and interoperability of San Francisco Bay Delta environmental data by providing harmonized data sets from multiple sources through a unified source and portal. Several government, nonprofit, and university research efforts currently collect and compile ecological and water-quality data throughout the state, but often times data sets are disparate and challenging to relate across space, time, and differing measurement units. The USGS has been working with several technologies to relate data sets in the Bay Delta and develop a web-based “Bay-Delta Data Sandbox,” which will provide access to harmonized data sets and web services for processing and visualization. We are hosting a workshop to demonstrate how users can access data through the sandbox portal for their own analyses and visualizations and to ask for feedback on ways to improve the state of data access and analysis in California.

## Presenter and Panelist Index

### **Aprahamian, Amanda; Orange County Public Works**



Amanda Aprahamian is an Environmental Resources Specialist with the County of Orange. She works with the South Orange County Watershed Management Area’s Stormwater Program to incorporate monitoring, assessment, public education, and Integrated Regional Water Management concepts into their Water Quality Improvement Plan implementation. Her focus is the Unnatural Water Balance highest priority water quality condition in South Orange County. She received her B.S. in earth system science from the University of California, Irvine while minoring in civic and community engagement.

### **Babbitt, Christina; Environmental Defense Fund**



Christina Babbitt is a Senior Manager for the California Groundwater Program, Environmental Defense Fund. Christina works to advance and scale groundwater sustainability policies and practices across the Central Valley. In these efforts, Christina focuses on building partnerships among NGOs, agencies, water districts and agricultural partners in ways that enhance collective impact. She currently serves on the steering committee of the California Water Data Consortium and on the board of the Aquaya Institute, a nonprofit research and consulting organization dedicated to advancing global health through universal access to safe water and sanitation. Christina has a Ph.D. in natural resources from the University of Nebraska – Lincoln.

### **Bui, Hung; State Water Resources Control Board**



Hung Bui is a registered civil engineer with B.S. degrees in civil engineering and construction engineering management and a MBA degree from California State University, Long Beach. His professional career of 30 plus years spans various industries such as construction, transportation, and water. He joined the State Water Resources Control Board’s Division of Drinking Water, Santa Ana District in 2004 (then Department of Health Services) as an associate sanitary engineer.

Hung is also a self-trained programmer who is passionate about coding. Since 2009, he has been helping to program the Division’s Drinking Water Watch websites where he takes pride in making the websites more relevant and useful to staff and the public.

### **Burns, John; Sitka Technology Group**



John Burns is the Engagement Manager for Sitka Technology Group. John has extensive experience managing delivery and developing custom web applications for public agencies in the environmental and natural resource sectors. He has served as the project manager for water resource projects across the U.S., including Oregon, California, Nebraska, and Florida. John is also a registered professional engineer in the State of Oregon. Prior to joining Sitka, he worked as a civil engineer focusing on stormwater system planning, green infrastructure analysis, and hydraulic / hydrologic modeling. John has a M.S. in environmental science and engineering from Oregon Health & Science University and a B.S. in computer engineering from Oregon State University.

### **Coffin, Scott; State Water Resources Control Board**



Dr. Scott Coffin serves as a Research Scientist at the California State Water Resources Control Board, where he performs research and develops drinking water regulations for microplastics and other contaminants. Scott completed his Ph.D. in environmental toxicology at the University of California, Riverside. Scott's expertise are in data science, analytical chemistry, ecotoxicology, and risk assessment.

### **DePalma-Dow, Angela; Lake County Water Resources Department**



Angela De Palma-Dow is a Program Coordinator in the County of Lake Water Resources Department where she coordinates various programs such as aquatic invasive species, stormwater, surface-water quality monitoring, cyanobacteria outreach, water resources data management, and post-fire water quality monitoring. Angela has a B.S. in biological science and chemistry minor from California State University, Sacramento and a M.S. in fisheries and wildlife with an emphasis on limnology from Michigan State University. Angela has conducted aquatic surveys and monitoring in over six states with multiple universities, state and local agencies, and non-profits. Angela is also the Chair and President of the California Chapter of the Society for Freshwater Science (Cal-SFS). Angela has swum from Alcatraz island twice and has two cats.



### **Farhang, Farnaz; County of San Diego**



Farnaz is the program lead with the Beach and Bay Water Quality Monitoring Program, at the County of San Diego. As an Environmental Health Specialist with the Department of Environmental Health and Quality (DEHQ), Farnaz’s role is to coordinate the daily behind the scenes operations for the beach water sampling and work with the partnering agencies to protect public health for the beachgoers. Farnaz completed her M.S. in marine biology at Scripps Institution of Oceanography, where she became interested in environmental pollution issues and later her MPH degree from San Diego State University with a concentration in environmental and occupational health.

### **Flores, Lorenzo; San Francisco Estuary Institute**



Lorenzo works as a Software Engineer within the Environmental Informatics (EI) Program at the San Francisco Estuary Institute (SFEI). He holds a B.A. in physics from the University of California, Berkeley, and a M.S. in computer science from San Francisco State University. As a member of the Software Engineering team, Lorenzo uses a variety of technologies to operationalize the science that SFEI and partners cultivate. Beyond serving as the technical lead for automated detection efforts, he develops and maintains a variety of web applications, websites, data processing scripts, and data analysis scripts.

### **Gearheart, Greg; State Water Resources Control Board**



Greg Gearheart is the Deputy Director at the California State Water Resources Control Board’s Office of Information Management and Analysis and considers his job to be the chief data liberator for all the Water Boards’ data. He has been the director of the Office of Information Management and Analysis since 2015. Prior to this appointment Greg served in many functions in his 27 years at this organization, including stormwater, wetlands, watershed management, organizational development, and enforcement. Greg received a B.S. in environmental resources engineering from Humboldt State University and also grew up behind the redwood curtain.

**Hansen, Jeffrey; United States Geological Survey**



Jeffrey (Chuck) Hansen is a hydrologist with the U.S. Geological Survey California Water Science Center. He holds a M.S. in geology from California State University, Sacramento and a B.S. in economics from the University of Iowa. Currently focusing on the Sacramento-San Joaquin Delta, Chuck is leading an effort to expand the accessibility and usability of U.S. Geological Survey water-quality, geochemical, and biological data for the Delta community, and to integrate those data with that of other local agencies and stakeholders. His team is developing an interactive web platform for discrete and real-time scientific data delivery and analysis for use by researchers, regulators, and the general public.

**Healey, Liam; Lake County Water Resources Department**



Liam Healey is a CivicSpark AmeriCorps Fellow in the Lake County Water Resources Department, where he coordinates the Clear Lake Shoreline Inventory and Assessment and works in the stormwater and surface-water quality monitoring programs. He also conducts research on avian population trends throughout restored habitats in the San Francisco Bay Area. Liam has a B.S. in environmental science/studies from Santa Clara University, where he worked in the Restoration Ecology Lab on projects assessing the economic benefit of hunting in the Bay Area and non-herbicidal methods of invasive species control. He has worked in Tanzania analyzing conservation agriculture practices amongst local farmers. His main research interests include quantitative and spatial ecology, and environmental economics.

**Holder, Anna; State Water Resources Control Board**



Anna Holder is an Environmental Scientist in the Office of Information Management and Analysis (OIMA) at the State Water Resources Control Board. She is the Program Coordinator for the SWAMP Bioaccumulation Monitoring Program (Program) and OIMA's Tribal Coordinator. Anna is leading the Program through a realignment process, which is focused on incorporating the perspectives and needs of subsistence-dependent communities and Tribes into Program monitoring efforts. Anna obtained her M.S. and B.S. from California State University, Monterey Bay in applied marine and watershed science. Regardless of role, Anna uses data science, ecology, and science communication to inform the sustainable and equitable management of California's natural resources.

**Huynh, Jaimie; CalRecycle**



Jaimie Huynh is the Environmental Justice Enforcement Liaison for CalRecycle’s Waste Permitting, Compliance, and Mitigation Division. Prior to her time at CalRecycle, she was a California Sea Grant Fellow at the California State Lands Commission. Her focus was working on the environmental justice policy and climate change mitigation measures. She received her M.S. degree from the University of California, San Diego, Scripps Institution of Oceanography and her B.S. from the University of California, San Diego.

**Jennings, Lydia; University of Arizona**



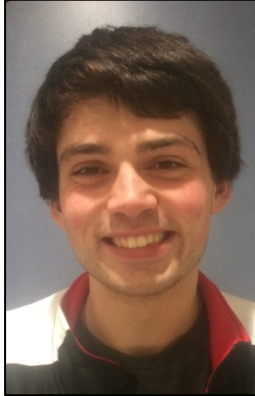
Dr. Lydia Jennings is a transdisciplinary scholar, braiding together the fields of soil ecology, environmental law, and American Indian studies. She earned her Ph.D. in environmental sciences from the University of Arizona with a minor in American Indian studies. Currently, she is a Postdoctoral Researcher in Community Environment and Policy at the University of Arizona.

**Khan, Abdul; California Department of Water Resources**



Dr. Abdul Khan has over 30 years of experience in leading and directing teams in water resources planning and management. Since 1992, he has been working in California and has conducted numerous planning, operations, and modeling studies that involved SWP/CVP operations, flood studies, analysis and modeling of groundwater flow and contaminant transport, reservoir operations, temperature and fisheries, and salinity intrusion. He led the development of the Sustainability Indicators Framework for Water Plan Update 2013. In the development of California’s Groundwater, Update 2013, he played a leadership role by coordinating the technical work of DWR staff and managed a 60-person external Groundwater Caucus. He has been moderating the California Water Plan session for California Water and Environmental Modeling Forum’s annual meeting for the past several years. He manages the Water Budget & Analytics Section in DWR and is leading technical staff for developing the Water Budget Handbook and the Water Budget Dashboard. He has a Ph.D. from the University of Kentucky, an M.S. from Clarkson University, and a B.S. from Bangladesh University of Engineering & Technology, all in civil engineering. He is a registered professional engineer in California.

**Leathers, Kyle; University of California, Berkeley**



Kyle is a graduate student interested in how environmental stressors and species interactions affect communities. He has a broad research background in aquatic ecology and utilizes experiments, field studies, and modeling in combination for his work. Kyle is currently investigating the effects of extended low flows on community composition and food web dynamics in the Sierra Nevada for his Ph.D. at the University of California, Berkeley.

**Leech, Mike; Environmental Science Associates**



Mike is the Director of Geospatial Services at Environmental Science Associates, where he oversees geospatial, data analysts and software development teams on a range of projects for water and natural resource management applications. Mike serves as a technical lead on projects that include large field survey and monitoring, landscape-level remote sensing and environmental tracking and management systems. He has also developed curriculum and taught hands-on intensive courses in areas of GIS software applications, spatial analysis, and information management. Mike has a M.S. in resource management and conservation from Western Washington University and B.A. in biology and environmental studies from Indiana University (Bloomington).

**López, Robin; University of California, Berkeley**



Born in Oakland, CA and raised in Richmond, CA, his academic and research background are invested locally with respects to his upbringings. He earned A.S./A.A. degrees at Contra Costa College; B.S. in civil engineering at San Francisco State University; and M.S. in water resources engineering at San José State University. Currently, he is pursuing a Ph.D. in environmental science, policy, and management at the University of California, Berkeley. Professionally, he has been working with the U.S. Department of Energy at the Lawrence Berkeley National Laboratory since 2012. Such pursuits were not without obstacles though – which has served as motivation for outreach and advocacy with historically marginalized communities, to improve equity and access within environmental science and ecology.

### **McGrath, Patrick; San Luis Obispo Water Resource and Reclamation Facility**



Patrick McGrath is a husband to one, a father to two, a friend to many and a Grade V Wastewater Treatment Plant Operator. After working in post-Katrina New Orleans and receiving a B.A. in American studies from University of California, Berkeley, he applied his energies toward a climate resilient future in his hometown. He has worked with a core group of operators and data scientists to upend data collection, storage, and analysis at the San Luis Obispo Water Resource Recovery Facility. His passions revolve around providing front line staff with the mechanical and digital tools we need to efficiently conserve and recover resources for the benefit of the region.

### **Middlemis-Clark, TJ; Lahontan Regional Water Quality Control Board**



TJ is a PE, Water Resource Control Engineer, and oversees wastewater compliance at domestic, municipal, and agricultural facilities in the southern portion of the Lahontan Region. He has previous Water Boards experience regulating cannabis cultivation facilities and spearheading data optimization projects. He also has previous experience leading hydrologic and hydraulic studies and designs in a previous life as a consultant. Born in the Midwest and wilted in the summer humidity of the Northeast and Midwest, he earned a B.S. in environmental engineering and an M.S. in water resources engineering from the University of Iowa. When not working, he enjoys riding south Tahoe neighborhood trails with his kids and camping in the eastern Sierras with his family.

### **Moran, Tara; California Water Data Consortium**



Tara Moran is the Chief Executive Officer for the California Water Data Consortium where she advances the Consortium's goals of high quality, interoperable water data to support a sustainable and resilient water future for all Californians.

Prior to joining the Consortium, Tara led the Sustainable Groundwater Program with Water in the West at Stanford University. Her research focuses on the technical requirements of sustainable water management, including data collection, sharing, and integration. She is a founding partner and Board member for the Groundwater Exchange. Tara holds a first-class honors B.Sc. in environmental science and a Ph.D. in geography from the University of Calgary, Canada.



### **Nickelhoff, Laura; Sitka Technology Group**



Laura is an Engagement Manager at Sitka Technology Group, where she leads the development of software applications for clients in environmental monitoring and resource conservation. Her portfolio includes field applications for monitoring data collection, project tracking tools for land management programs, and environmental and water data management systems. Prior to joining Sitka, Laura worked as a consultant in the healthcare industry. She has a B.A. in public policy from Duke University and lives in Portland, Oregon, where she enjoys reading, running, and hiking.

### **Obester, Alyssa; California Department of Fish and Wildlife**



Alyssa Obester is an Environmental Scientist at the California Department of Fish and Wildlife's (CDFW) Instream Flow Program. At CDFW, she conducts instream flow studies and develops flow criteria for watersheds across the state. She is also a member of the California Environmental Flows Framework technical team. Prior to joining CDFW, she worked on projects focused on environmental flows, river restoration, and western water management. Alyssa holds a M.S. in environmental science and management from the Bren School of Environmental Science & Management at the University of California, Santa Barbara, where she studied water resources management and was a Sustainable Water Markets Fellow. She also holds a B.S. in environmental science and management and a minor in environmental policy from the University of California, Davis. In her free time, Alyssa enjoys hiking Sierran peaks, cooking, and spending time with her cats.

### **Olmos, Kristina; Central Coast Regional Water Quality Control Board**



Kristina is a PE, Water Resource Control Engineer, and oversees domestic and industrial wastewater treatment plants in Monterey County. She has worked in wastewater at the Central Coast Regional Water Quality Control Board for three years, and prior to that worked in the Site Cleanup Program. She's lived in San Luis Obispo since attending California Polytechnic State University, where she earned an M.S. and B.S. in civil and environmental engineering. When not working, she enjoys playing Legos with her two young boys, and bike riding all over the Central Coast.



**Olson, John; California State University, Monterey Bay**



John Olson is a freshwater scientist at California State University, Monterey Bay who studies the ecology of streams and rivers and how they are influenced by the landscape around them. He examines freshwater ecosystems using a variety of tools like DNA, satellites, and models to better understand how they function. He then applies this knowledge to developing ways to improve the management and health of rivers and streams. John is also the Treasurer for the California Chapter of the Society for Freshwater Science (Cal-SFS).

**Orr, Austin; Geosyntec Consultants**



Austin Orr is a stormwater resources engineer (PE, California) with Geosyntec Consultants. Mr. Orr has over 7 years of experience providing services related to stormwater infrastructure performance measures and much of his consulting career has been on behalf of municipalities in the Bay Area and throughout Southern California. His engineering practice focuses on stormwater modeling, GIS services, and in the design, development, and deployment of stormwater-related software tools.

**Ota, William; University of California, Riverside**



William Ota is a Ph.D. Candidate in the Evolution, Ecology, and Organismal Biology Department at University of California, Riverside. He studies the effects of urbanization on freshwater communities using the Santa Ana River in Riverside and San Bernardino Counties. He collaborates closely with U.S. Geological Survey, the San Bernardino Valley Municipal Water District, and the Riverside-Corona Resource Conservation District to preserve native fishes within this effluent-dominated river. In addition to being a 2021 Cal-SFS Fellow, William is the Government Relations Officer for University of California, Riverside Science to Policy, a member of his departmental Diversity, Equity, and Inclusion committee, and the Scholarship Program Coordinator for the National Science Policy Network.

### **Pauloo, Rich; Water Data Lab**



Dr. Rich Pauloo ([richpauloo.com](http://richpauloo.com)) is a hydrogeologist and data scientist developing scientific methods to monitor, model, and manage regional-scale aquifers. His work has won awards from NASA, Microsoft ([gspdrywells.com](http://gspdrywells.com)), NSF, AGU and the California Water Data Challenge ([calwaterquality.com](http://calwaterquality.com)). Rich's background spans physical simulation of groundwater flow and contaminant transport, open frameworks for real-time natural resource monitoring, and models that simulate the impact of drought and water management on groundwater wells. Rich latest project, [r4wrds.com](http://r4wrds.com), addresses the need for water resources data science curriculum.

### **Poresky, Aaron; Geosyntec Consultants**



Aaron Poresky is a Principal Engineer with Geosyntec Consultants. He has 15 years of experience in watershed management, integrated planning, and applied research, including high-profile and complex projects for a wide range of clients. Mr. Poresky has assisted municipal stormwater permittees throughout the west coast. In Orange County, Mr. Poresky has supported the municipal stormwater permittees with development and implementation of the South Orange County Water Quality Improvement Plan. In collaboration with municipal stormwater permittees and the Moulton Niguel Water District, he has led the development of two innovative software tools - the OC Stormwater Tools and the Urban Drool Tool - to integrate datasets, improve watershed understanding, and streamline workflows.

### **Rademacher, Eric; Orange County Public Works**



Eric Rademacher is an environmental scientist (CPP, QISP) with Orange County Public Works. He graduated from the University of California, Irvine with a B.S. in chemical engineering, specializing in biomolecular engineering, and a B.S. in materials science and engineering. Eric began his journey in the environmental field as an industrial environmental consultant, providing engineering support for air quality, water, and hazardous waste regulatory compliance. In his current role with Orange County Public Works he is responsible for data analysis and reporting for several programs described under the South Orange County Water Quality Improvement Plan.

### **Richardson, Emily; United States Geological Survey**



Emily Richardson is a physical scientist at the U.S. Geological Survey's California Water Science Center. She received a B.S. in environmental science from the University of Texas at San Antonio and M.S. in wildlife, aquatic, and wildlands science and management at Texas Tech University. She has a background in trail maintenance in the Adirondacks and at Great Smoky Mountains National Park, where she was also a GIS and Data Management Technician. Her scientific research has primarily revolved around phytoplankton, both in Texas and California. Recently, she is exploring new ways to visualize and serve diverse California water quality data.

### **Searcy, Ryan; Stanford University**



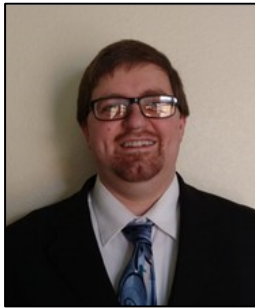
Ryan Searcy is currently a Ph.D. candidate at Stanford University. His research focuses on monitoring and modeling threats to coastal health. His current projects involve developing data-driven models to predict beach water quality, using environmental DNA (eDNA) to assess native salmonid populations in a coastal stream, and collecting physical oceanographic data to measure circulation at a chronically-polluted beach. Previously, Ryan worked for Heal the Bay where he built and managed the NowCast system which provides beachgoers and health agencies daily water quality predictions for dozens of California beaches. Ryan is a frequent user of the coast and surfs whenever weather and work allow.

### **Shepherd, Ryan; Databrook LLC**



Ryan Shepherd caught the water-data bug while working as Conservation Director for a camp on Catalina Island, where water was scarce and expensive. Shortly after initiating a meter tracking program, it clicked: better data management enables better resource management. Ten years later, after a side-journey with a healthcare startup, Ryan decided to return to water. Through his company Databrook LLC, he offers data science skills to the water sector, with a particular focus on time series visualization and analysis.

**Shipman, Paul; California Department of Water Resources**



Paul Shipman graduated with high honors from California State University, Sacramento with a B.S. in civil engineering in 2012. Since then, he has worked for the Department of Water Resources, and is currently a Senior Water Resources Engineer with the Division of Planning. Paul has worked on a variety of water management and planning related tasks including: the Strategic Plan for Integrated Regional Water Management, Standards for Geothermal Heat Exchange Wells, the Central Valley Flood Protection Plan, the California Water Plan (Bulletin 160), implementation of the Sustainable Groundwater Management Act, California’s Groundwater Report (Bulletin 118), and Implementation of the Open and Transparent Water Data Act. Most recently, Paul has been an integral part of the development of the Water Budget Handbook, the Water Budget Dashboards, and associated pilot projects. He has also been a subject matter expert for the update of various models including the updated California Central Valley Simulation Model or C2VSim. Paul is passionate about serving the people of California by improving the methodologies and documentation behind our technical analyses to support more productive conversations and solutions to real water management problems.

**Torres, Stephanie; State Water Resources Control Board**



Stephanie is an Engineering Geologist and supports the Waste Discharge Requirements Program as a technical resource for the Onsite Wastewater Treatment Systems Policy and with data management efforts. She has prior student experience with Central Valley Regional Water Quality Control Board Irrigated Lands and Site Cleanup Programs, as well as groundwater data management, supporting basin and Sustainable Groundwater Management Act (SGMA) efforts with the California Department of Water Resources. Born and raised in Sacramento, she earned a B.S. in geology and a B.A. in geographic information systems and analysis from California State University, Sacramento. When not working, she enjoys supporting her friends and family, sports, and seeing how long her plants will live each season.

**von Mayrhauser, Melissa; University of California, Berkeley**



Melissa von Mayrhauser is a freshwater ecology Ph.D. student at the University of California, Berkeley. She researches the ecological and social dimensions of “restoration” in urban rivers with a focus on Southern California. Central themes of her research include intermittent stream ecology and community-based biodiversity data collection. Previously as the Watershed Programs Manager at the NGO Los Angeles Waterkeeper, she tied together scientific fieldwork, policy change, and community

participation to improve the health of the Los Angeles River and surrounding communities. She has an M.S. in water science, policy, and management from the University of Oxford. She enjoys making iNaturalist observations on meandering walks.

### **Warddrip, Laurel; State Water Resources Control Board**



Laurel is a Senior Environmental Scientist and oversees the State Water Board Waste Discharge Requirement Program currently focused on policy work for domestic wastewater, winery operations, and updating the Program's data processes and workflows. She has previous experience in overseeing the implementation of the Water Board National Pollutant Discharge Elimination System (NPDES) industrial and construction stormwater program, including the related data management. Born in Northern California, Laurel migrated to the University of California, Santa Cruz where she earned her B.S. in plant sciences and became a Banana Slug for life while working summers at the Central Valley Regional Water Quality Control Board. She then came back home and started her State Water Resources Control Board career and earned an A.A. in geographic information systems. When not working, she enjoys working around the yard and garden, seeing family/friends, and enjoying music virtually and hopefully in-person again someday.

### **Wieland, Walker; California Office of Environmental Health Hazard Assessment**



Walker Wieland is a Research Scientist with the Office of Environmental Health Hazard Assessment. He is also the Office's Environmental Justice Liaison. He has been involved in the development of CalEnviroScreen, a statewide cumulative impacts mapping tool, since its inception in 2010. He serves as the Office Geographic Information Systems (GIS) lead and has led mapping initiatives in a variety of topic areas, including environmental justice, public health, climate change vulnerability, and state investment programs. He routinely collaborates with stakeholders across the state to improve CalEnviroScreen, and also conducts training to state and local agencies, as well as community organizations. He consults with entities across the country on developing methods in cumulative impacts analysis. He believes effective communication is more important than any other skill and has held various leadership positions and acquired speaking awards in Toastmasters International. He is also an avid disc golfer.

Walker received his B.S. from California State University, Sacramento in environmental science, and a secondary A.S. from American River College in GIS. He is a certified GIS professional.



## About The 2021 Mascot

Brine shrimp and vernal pool fairy shrimp are this year's symbol of hope because of their amazing resilience, abundance, and support of life for California's original inhabitants, and their (sometimes under celebrated) beauty for being themselves.



Did you know?

1. Two species of brine shrimp (*Artemia monica* and *A. franciscana*) can be found in California's saltwater lakes; the Mono Lake brine shrimp (*A. monica*) is endemic to Mono Lake in Mono County, California. Vernal pool fairy shrimp (*Branchinecta lynchi*) are endemic to vernal pools in California and Oregon.
2. These freshwater crustaceans may be tiny, but they are a crucial food source for millions of birds during their arduous annual migrations along the Pacific coast. This Water Data Community continues to grow, but no matter how large we get we will continue to embody the "small but mighty" spirit!
3. Brine shrimp eggs were taken on the Apollo 16 and Apollo 17 missions to the moon to test the impact of radiation on life. Likewise, this Water Data Community continues to experiment and innovate to find water data solutions that will benefit all Californians.
4. These hearty little crustaceans can tolerate living in very salty waters, and their eggs can survive for extended periods without being exposed to any water at all! Similarly, this Water Data Community is resilient and has become a place where we can discuss and - most importantly - work together to overcome the environmental and social challenges we are facing now and will continue to face in the future.

## Thank you for joining the 2021 California Water Data Science Symposium!

Stay connected with the water data science community by:

Registering for the [Water Boards College of Water Informatics Email List](#)  
(under the General Interests drop down)

Attending future [water data science events!](#)



@cawaterdatadive @CaMonitoring @swamp\_water\_ca  
#cawaterdatadive #caswamp #waterdata #cawater

