Water UCI Annual Report AY 2023-2024

Research

During 2023-24, Water UCI engaged in several projects that contributed impactful research to the region and nation. We collaborated with investigators from the Schools of Social Ecology, Samueli School of Engineering, Information and Computer Science, and Social Sciences – as well as with scholars outside UC Irvine.

1. Inclusive, Diverse, Equitable and Able Leaders for Water (IDEAL) project

In May 2024, Water UCI conducted a workshop featuring participants from across the state to explore challenges, opportunities, and actions needed to promote diversity, equity and inclusion (DEI) in California's water sector. Funded by the General Assembly through UC's Office of the President, IDEAL seeks to enhance education at all levels to help equip the state's future water workforce and link students to employment opportunities through networking, internship, and career building programs. We are also conducting a statewide stakeholder survey to identify current DEI efforts, the challenges they face, and best practices that can be more widely adopted. To aid in the next phase of the IDEAL Project, we are excited to welcome Mayra Jimenez as our new Project Advisor! Mayra was formally the Chief of Staff at Moulton Niguel Water District and has extensive knowledge of the water sector's innerworkings, DEI research and practices. Our long-term goal is to work with water agencies and educators to promote education and career advancement for under-represented groups in the water sector to help ensure that our water resources are managed in a socially- and environmentally-just manner and ensure that operational practices better reflect California in its variety and diversity.



lypes and degree of support provided are sufficient relative to the needs of the underrepresented in a group.

Figure 1. Major DEI issues in the water sector

2. Determining the Per- and polyfluoroalkyl substances (PFAS) contribution of residents to municipal wastewater in our region – Final Report¹

Supported by nine water agencies in Orange, Riverside, and San Bernardino counties and completed in July 2024, this study illuminates household contributions to Per- and polyfluoroalkyl substances (PFAS) to sub-sewersheds in the region. PFAS pose risks to human health due to their persistence, toxicity, and bioaccumulation. Major household activities contributing to PFAS were found to be laundries, showers, and urine. Eliminating PFAS from households should include purging PFAS from consumer products and adopting portable devices that remove PFAS from residential wastewater discharges. The presence of PFAS in wastewater will continue to be a challenge for municipal systems that reuse wastewater. While new regulations will likely limit PFAS in treated wastewater, determining how much PFAS ultimately ends up in household wastewater is challenging due to variations in its sources, a lack of standardized methods for investigating PFAS in household products, and product use. Future research should evaluate the ability of agencies to meet more stringent regulations while also determining variations in households' PFAS contribution by socioeconomic status.



Figure 2. A summary of the mass contributions of different household activities/wastes to the PFAS in residential wastewater

3. Creating an Extensible Data Exchange and Analytics Sandbox for Smart Water Infrastructures (SWADE)

Led by investigators from the *School of Information and Computer Science*, this project, funded by the National Science Foundation, examines the Internet-of-things as applied to the water industry. Urban water supply is increasingly dependent on the security of digitized data stored and managed on virtual platforms. In 2023, we completed a survey of 13 water agencies in California to determine how they manage large data sets, the challenges they face in ensuring cyber-security, the kinds of data they collect, how they share data with other entities, and the priority they accord cyber-security as well as the methods used to protect data. We also

¹ https://bpb-us-e2.wpmucdn.com/sites.uci.edu/dist/2/3949/files/2024/08/PFAS1-4.png also, https://water.uci.edu/

coordinated an outreach workshop with regional water agencies in early 2023 to present key components of the SWADE platform. Three key cases were discussed to illustrate how the platform could be implemented. The cases were: 1) a resilience assessment tool to allow agencies to assess their exposure to earthquake hazards; 2) a tool for detecting water quality impairments during dry weather; and 3) the challenge of preserving institutional knowledge within an organization despite turnovers of key personnel.

4. Using Data to Understand Water Efficiency – investigating an outdoor irrigation tool in collaboration with Rachio, Inc.

Improving outdoor water use efficiency is a fundamental aim of water agencies in SoCal where upwards of one-half of residential use is for landscape irrigation. Funded by Rachio, a leading smart sprinkler controller, this study sought to improve the efficiency of outdoor watering by analyzing potential factors affecting sprinkler use and comparing the ideal amount of water used for irrigation versus actual use. Our goal was to create operational recommendations to save water, reduce water bills, and achieve other customer goals. Estimated usage was based on nozzle or flow), irrigation duration, and square footage of irrigated landscape. To account for varying climatic conditions, we sampled devices from cities in California, Washington, and Florida and found that the most important factors affecting water use efficiency are water rates and landscape factors, followed by water scheduling. Our findings underscore the importance of users entering accurate information about their landscape in order to enhance water use efficiency. to provide insights for future water efficiency improvements.

5. A Framework for Water Quality Improvement–Identifying Best Practices for China & U.S.²

In collaboration with researchers from China's Tsinghua and Fudan Universities and UCI investigators from the Schools of Social Ecology and Social Science we are developing a framework of best practices for managing disinfection byproducts (DBPs). These chemicals, present in U.S. and Chinese drinking water supplies, are carcinogenic at low concentrations and produced during the water treatment process posing serious human health risks. Funded by the *Cyrus Tang Foundation, our* project encompasses three tasks: 1) a surveying key regulatory and other stakeholders to ascertain the challenges of obtaining compliance with rules governing DBPs, including practices that work well and those less effective 2) a comprehensive review of U.S. and Chinese national, provincial and state regulations assessing the tools they utilize to comply with rules intended to mitigate DBPs and their governance style– e.g., monitoring, prescribing technological requirements, imposing financial penalties, incentives, sanctions); and 3) development of a decision-support tool to assist policymakers in making effective operational decisions regarding DBPs, tracking overall water quality, and rendering evidence-based DBP management.

² https://water.uci.edu/cyrus-tang-project/



Figure 3. Number of DBP regulations by state in U.S.

Education

This past year witnessed a new education endeavor for Water UCI – we have assembled a proposal for a new continuing education endeavor, described below.

1. Water Leadership for the 21 Century – forthcoming Continuing Ed Certificate Program

Water industry leaders face growing economic, regulatory, environmental and technological challenges. To effectively meet them, new tools, approaches and training for leaders and wouldbe leaders in the water industry are required. Water UCI has developed an academic certificate program that will be offered through *UCI Continuing Education* starting Fall 2023. The curriculum encompasses courses on climate change and its impacts on water supply and quality, financial management, public engagement, likely regulatory changes, the growing role of technology and cyber-systems, environmental justice, and workforce diversity/equity/ inclusion (DEI). The courses feature a variety of guest speakers from the water industry, governmental and for-profit commercial sectors as well as academics from UC Irvine. We will feature a variety of extracurricular events, programs and project-based learning exercises.

Public Outreach

1. Speaking of Water

As multiple water crises of various sorts grow in severity throughout the region, nation, and planet, *Water UCI* serves as a critical facilitator of discussion among thought leaders from the worlds of research, education, government, industry and the NGO sector who can articulate solutions and engage with diverse audiences. During 2023-24, *Speaking of Water* – our re-named colloquium series – has brought together leading experts in water science, economics, and policy in vibrant discussions on critical topics to educate and inform the public and the UCI community. Most recently, we had the pleasure of hosting Dr. James Earthman's Colloquium Event in October 2024 discussing Antifouling Nanobubbles for Water Purification and Desalination.



Cows, Crops, and the Colorado: Thirsty Practices in a Time of Crisis

The unprecedented decline of the Colorado River has precipitated a crisis affecting the people and ecology that rely on this vital water source. While recent levels of rain- and snowfall have provided a temporary respite, addressing the causes and consequences of sustained reductions in the Colorado River's flow, coupled with climate uncertainties, requires long-term cooperation and collaboration among numerous stakeholders including governments, agriculture, sustainability advocates and critical infrastructure managers. To this end, this colloquium convenes representatives from diverse backgrounds in a thoughtful discourse on these enduring and pressing challenges.

Figure 4. Example of Speaking of Water Colloquium Event abstract from the RSVP page on the Water UCI website.

2. Water UCI Media

Communication is one of Water UCI's focus points as an interdisciplinary center working to engage individuals from different academic fields and sectors. One of the key issues regarding the barrier to entry of the water sector has historically been a lack of communication between the water sector and the public. Water UCI has taken the initiative of generating media posts on several platforms to act as a bridge to this barrier by supplying the public easy access to waterrelated news and developments. Using platforms such as Instagram, Facebook, Twitter, and YouTube, allows Water UCI to be active as a messenger to the public furthering water education, awareness, and opportunities in a more casual format.

Organizational and Infrastructural Growth

1. Water UCI Leadership Board

Water UCI recruited five new members to its Leadership Board in 2021/2022, and four additional members in Fall of 2022 for a total of 15 distinguished leaders from the public, private and non-profit sectors. The board is diverse with regard to background and experience and has been a source of critical advice, insights, wisdom, and financial support. The detailed list is available on our website.

2. UC Division of Agricultural and Natural Sciences Cooperative Extension Specialist Position: Water Quality, Health and Justice Specialist

We are delighted to announce the recruitment of Monica Palta as a first-ever Cooperative Extension (CE) specialist for water at UCI devoted to *Urban Water Quality, Health and Equity* to begin fall 2024. Monica has considerable experience in collaborative research with ecologists, engineers, and social scientists examining ecosystem services, watershed processes, and watershed restoration - among other subjects. This joint appointment in the *Department of Civil and Environmental Engineering (CEE)* and *School of Social Ecology* will connect faculty interested in water supply and quality, water treatment and reuse, low impact development, and health and social equity. It will also facilitate greater collaboration with the South Coast Research and Extension Center's (REC). The position will also expand *Water UCI's* efforts in policy research for State Water Resources Control Board activities affecting local water agencies' efforts to address a wide-range of water quality, access and affordability challenges. Lastly, the CE Specialist will enhance collaboration between UCI faculty and regional water and environmental entities.