

# ANNUAL REPORT

2021  
2022



# Contents

---

**04** About Us

---

**08** From My Desk: Ramzi Mahmood  
50 Years & Counting!

---

**10** Spotlight: OWP Celebrates 50 Years  
by Looking Ahead

---

**12** Training Services

---

**14** Popular Training Materials

---

**16** Spotlight: Revisions Improve  
Learning Pathways & Respond to  
Student Needs

---

**18** Technical Tools & Services

---

**24** Applied Research

---

**30** Spotlight: Helping Child Care  
Centers Identify & Prevent Lead  
Exposure from Drinking Water

---

**32** Water Seminar Series

---

**34** Professional Activities

# About Us

**T**he Office of Water Programs (OWP) at California State University, Sacramento (Sacramento State) publishes the industry standard in drinking water and wastewater training materials and provides valuable, science-based applied research services for water management in California and elsewhere.

Our team of approximately 60 professionals, trained in a variety of academic disciplines, collaborates to produce high-caliber work that furthers OWP's mission and values. The next three pages highlight the local, national, and international universities, colleges, and degree programs from which OWP staff made their start.



## California State University, Sacramento

MS, Civil Engineering (3)  
MS, Civil & Environmental Engineering  
MS, Environmental Engineering  
MBA, Management  
BA, Mathematics  
BA, Communication Studies (2)  
BA, Economics  
BA, English  
BS, Business Administration  
BS, Civil Engineering (2)  
BS, Geology  
BS, Graphic Design (2)  
Instructional Design for eLearning Certificate

## University of California, Davis

PhD, Civil & Environmental Engineering (2)  
MA, Creative Writing  
MS, Civil & Environmental Engineering  
MS, Hydrologic Sciences  
BA, English Language and Literature  
BS, Civil & Environmental Engineering (2)  
BS, Environmental Biology and Management  
BS, Geology  
BS, Computer Science

## University of California, Berkeley

PhD, Civil & Environmental Engineering  
MS, Civil & Environmental Engineering  
Professional Technical Editing Certificate

## University of California, Santa Cruz

BA, Biology

## California State University, San Francisco

BS, Computer Information Systems

## Stanford University

MS, Environmental Engineering (2)  
MS, Civil & Environmental Engineering  
BA, Human Biology  
BS, Civil Engineering with Honors (2)

## California State Polytechnic University, Humboldt

MS, Environmental Resources Engineering

## California State University, Chico

BS, Civil Engineering



**California Polytechnic State University, San Luis Obispo**

BS, Animal Science  
BS, Environmental Management & Protection

**California State Polytechnic University, Pomona**

BS, Civil Engineering (Environmental Focus)

**University of California, Los Angeles**

BS, Political Science

**California State University, Fresno**

BA, Mass Communication & Journalism

**California State University, Northridge**

BA, English (Writing)

**Folsom Lake College**

AS, General Studies

**Sierra College**

AA, Liberal Arts  
AA, Humanities

**Yuba College**

AA, Accounting

**El Camino College**

AS, Zoology

**Monterey Peninsula College**

AA, General Education

**Mills College**

MFA, English & Creative Writing



**Washington State University**

MS, Geology

**Spokane Community College**

AA, Legal Secretarial Science



**Utah State University**

PhD, Environmental Engineering  
MS, Mathematics  
MS, Environmental Engineering



**University of Wisconsin, Madison**

BS, Civil & Environmental Engineering



**University of Maryland, College Park**

MS, Environmental Management



**New York University**

MS, Integrated Marketing

**St. John's College**

BA, Liberal Arts



**George Mason University**

MPP, Science & Technology Public Policy



**University of Oregon**

BS, Journalism

**Oregon State University**

MS, Civil & Environmental Engineering



**University of Arizona**

MS, Chemical Engineering



**Colorado Technical University**

PhD, Environmental Sustainability

**Colorado State University**

BS, Business Management



**University of Georgia**

PhD, Water Resources & Remote Sensing



**University of Tennessee, Memphis**

PhD, Biological Sciences  
MS, Biological Sciences  
BS, Biology Sciences



**Capella University**

PhD, Biological Sciences



**Harvard University**

MA, History

**Brandeis University**

BA, English and History



**Tufts University**

BS, Chemical Engineering

**University of Nebraska, Lincoln**

PhD, English



**Southern New Hampshire University**

BA, Graphic Design & Media Arts (Web Design)



**Zhytomyr State Technological University**

MS, Computer Engineering



**American University of Beirut**

BS, Geology



**University of Baghdad**

BS, Civil Engineering (Structures Division)



**Queen Mary University of London**

PhD, Water Quality Management

**Imperial College London**

MS, Engineering Hydrology

**University of Leeds**

MS, Engineering Geology

**University of Surrey**

BS, Chemical Engineering

*Professionals  
from around  
the globe...*

# From My Desk:

Ramzi Mahmood



## 50 YEARS & COUNTING!



The year 2021–2022 marks OWP’s 50th anniversary. It is good to reflect back on our history and see how far we have come to propel us forward into our next 50 years. Our founder, the late Ken Kerri, started the organization with a single focus: to establish a training program for water and wastewater treatment operators that would be second to none. Dr. Kerri established a successful program by collaborating with our professional community, including utility operators and managers nationwide.

About seven years ago, OWP staff continued that commitment to excellence by embarking on a mission to transform our training manuals into learning tools with a modern design and up-to-date content. Today, OWP is an internationally recognized training leader that publishes a continually evolving library of print, electronic, and online training materials to meet the changing needs of water sector operators, managers, and administrators seeking professional development. OWP’s distance learning courses provide accredited opportunities for state certification preparation, academic credit, continuing education units, and contact hours.

Our tradition of service and excellence expanded, along with our staff, when the research group was formed in the late 1990s. The California Department of Transportation (Caltrans) funded the first research projects addressing

stormwater characterization and stormwater quality control. Today, OWP provides technical assistance and applied research services for the drinking water, wastewater, stormwater, groundwater, and watershed planning disciplines.

Our primary funding agencies include Caltrans, the California State Water Resources Control Board (State Water Board), the California Department of Water Resources (DWR), and the California Department of Parks and Recreation (State Parks). OWP also serves as the Environmental Protection Agency (EPA) Region 9 Environmental Finance Center (EFC). Like all EFCs, EFC at Sac State receives funding from the EPA to support the region’s rural, disadvantaged, and tribal communities in asset management and financial planning for their water utility operations.

This annual report shows that our growth and evolution support our success in updating training manuals, developing tools, providing technical assistance to disadvantaged communities, and supporting efforts to protect water quality for human consumption and environmental benefits. The details of these projects are covered in the body of this report. Here, I will highlight the successes of just a handful of our projects over the last fiscal year. Our training group completed new and revised content for editions of *Operation and Maintenance of Wastewater Collection Systems*,

*Volume 2*, and *Utility Management*. They’ve also completed a major reorganization of our flagship series, *Operation of Wastewater Treatment Plants*, into three comprehensive, up-to-date volumes. Our research group continued their work on drinking water lead testing at child care centers, the environmental and economic effects of water conservation, and increasing small water system capacities through the EFC.

In 1997, when I started as the director of OWP after Dr. Kerri’s retirement, 11 of us worked at OWP. Today, OWP is over 60 strong including staff, students, and faculty affiliates. OWP is a major contributor to Sac State’s mission and its aim to be an anchor university. OWP is also the largest self-supported center in the California State University system.

Since our establishment in 1972, our in-house expertise, relationships with faculty at Sac State and other universities, professional community collaboration, and student mentoring programs have enabled OWP to support regional, state, and national efforts to meet challenges in the water sector. We look forward to building new capacities on this solid foundation to serve communities into the future. I hope you enjoy reading about our work.

# Spotlight:

## OWP Celebrates 50 Years by Looking Ahead



OWP Founder,  
the late Ken Kerri

**F**rom its beginnings in 1972 as a bare-bones training manual producer for water treatment plant operators, OWP has become an internationally recognized provider of water sector training materials in a variety of media, as well as a source of water-related engineering and scientific research.

The organization that grew out of discussions between the late Dr. Ken Kerri and a handful of wastewater treatment plant operators now draws on many more people passionate about serving the water sector, improving people's lives, and protecting the environment. That intersection of dedicated people and inspiring mission brought OWP to its 50th anniversary in 2022 and guides the organization's sustainable growth into the future.

OWP editorial and graphics staff continue to work with subject matter experts to update and improve the library of water and wastewater operator training manuals and related courses to offer the best information on the ever-evolving technology in the water sector. A recent major redesign incorporates effective learning techniques, color to connect similar learning elements and improve navigation, and high-resolution graphics and photos. OWP also offers online math courses to give operators more instruction and practice in this challenging aspect of their jobs. New online courses that supplement the printed training manuals and provide learners another way to access training material are in development. Almost 20 specialty staff, support staff, expert collaborators, and student assistants continue the work of updating, improving, and delivering 20 training manuals and nearly 50 associated courses that operators and operators-in-training can take for continuing education units, contact hours, and college credit.

OWP's research activities started in 1997 when OWP staff, led by Dr. Ramzi Mahmood—who became OWP director the same year—assisted the California Department of Transportation (Caltrans) in planning experiments and interpreting data from Caltrans' extensive monitoring program for runoff quality and treatment best management practices (BMPs) and advised on incorporating scientific results into Caltrans' statewide stormwater program. Over time, OWP has added staff to provide research services to a variety of mainly governmental partners addressing needs in water quality, data analysis, cost assessment, watershed planning, modeling, water policy issues, and technical assistance to disadvantaged communities (DACs) in California. As the designated Environmental Finance Center (EFC) for EPA Region 9, OWP provides resources, training, and technical assistance to build capacity and expertise in communities facing environmental challenges, particularly those related to managing local utilities. Over 25 staff scientists and researchers, support staff, undergraduate and graduate student assistants, and faculty collaborators from Sacramento State and other universities offer an expanding range of services.

Building on the seeds of success that were planted 50 years ago, the people who make up OWP continue to expand and adapt the organization to serve the water sector on campus, in the community, around the state, and throughout the region.

# Training Services

## 2021–2022 Highlights

Offering nearly 50 print, online, and video courses for water and wastewater sector professionals, OWP delivers affordable training materials that help operators, managers, and inspectors do their jobs better.

### Training Manual Sales & Course Enrollments



### Key Highlights 2021–2022

- Training manual orders reached 31,416, with 84% of orders placed outside California.
- 14,884 adult learners were enrolled in our courses for continuing education units, contact hours, or academic credit, accounting for more than 22,800 of our course enrollments.
- With the majority of our US students residing outside of California, OWP continues to be a leading national training provider.
- International orders from the United Kingdom, Canada, Belize, New Zealand, the Cayman Islands, and others accounted for 8% of our manual sales and 12% of our course enrollments this year.

# Popular Training Materials

## Wastewater Courses

Operation of Wastewater Treatment Plants, 2 volumes (training manual, CD, course enrollment, online)

Advanced Waste Treatment (training manual, course enrollment)

Membrane Bioreactors (training manual, course enrollment)

Operation and Maintenance of Wastewater Collection Systems, 2 volumes (training manual, DVD, course enrollment)

Collection Systems: Methods for Evaluating and Improving Performance (training manual, course enrollment)

Small Wastewater System Operation and Maintenance, 2 volumes (training manual, course enrollment)

Industrial Waste Treatment, 2 volumes (training manual, course enrollment)

Treatment of Metal Wastestreams (training manual, course enrollment)

Pretreatment Facility Inspection (training manual, DVD, course enrollment)

## Drinking Water Courses

Water Treatment Plant Operation, 2 volumes (training manual, course enrollment)

Water Distribution System Operation and Maintenance (training manual, course enrollment, online)

Small Water System Operation and Maintenance (training manual, DVD, course enrollment, online)

Water Systems Operation and Maintenance Video Training Series (training manual, DVD, course enrollment)

Basic Small Water System Operations (training manual)

## Management Courses

Manage for Success (training manual, course enrollment)

Utility Management (training manual, course enrollment)

## Online Math Courses for Operators

Step-by-step examples with audio notes



Start screen menu with lesson topics

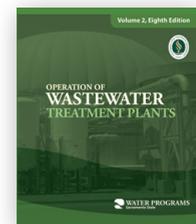
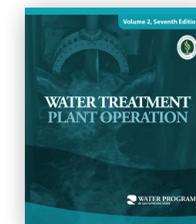
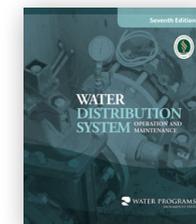
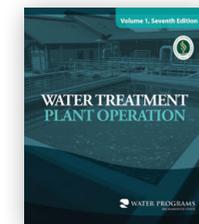
### Math applications in:

- Water Treatment
- Water Distribution Systems
- Collection Systems
- Wastewater Treatment

### Courses feature:

- Detailed, step-by-step example problems
- Example problems include audio notes, figures, and tables to expand your learning experience
- US and metric versions available

## Most Popular



- Water Treatment Plant Operation, Volume 1
- Water Distribution System Operation and Maintenance
- Water Treatment Plant Operation, Volume 2

- Operation of Wastewater Treatment Plants, Volume 1
- Operation of Wastewater Treatment Plants, Volume 2

# Spotlight:

## Revisions Improve Learning Pathways & Respond to Student Needs

As part of OWP's commitment to improving operator training materials and protecting public health and the environment, editorial staff and subject matter experts substantially revised the Operation of Wastewater Treatment Plants series to offer a clearer learning pathway that mirrors the experience of many operators as they progress in their careers from operator-in-training to certified operator to lead operator to utility manager.

The flagship series is now three volumes, each highlighting different aspects of wastewater treatment:

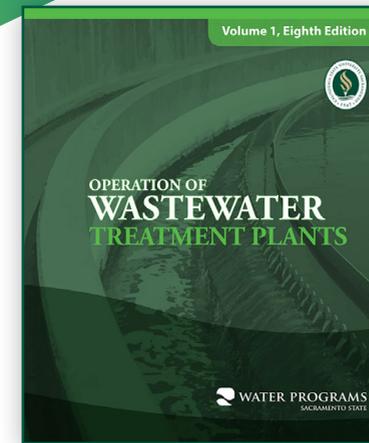
- Volume 1 covers treatment of liquids, including preliminary, primary, and secondary treatment, as well as disinfection and laboratory procedures.
- Volume 2 presents information on nutrient removal, treatment and handling of solids, and plant maintenance.
- Volume 3 discusses effluent discharge and reuse as well as plant-wide processes and procedures such as odor control, instrumentation, and utility management.

In response to operator needs, the staff also created multiple, shorter correspondence courses. The new courses use selected chapters from each volume. These shorter courses with fewer continuing education units (CEUs) offer operators a stepwise approach to obtaining or maintaining professional certifications, as well as a way to focus their learning on the topics most applicable to their jobs or aspirations. For instance, an operator-in-training can take "Volume 1, Course A—Safety, Beginning Treatment, and Lagoon Systems" as part of their entry-level certification and use the content to run preliminary and primary treatment processes. Alternately, a more experienced operator who is applying to become an activated sludge process specialist can start with "Volume 1, Course B—Secondary Treatment," which covers that treatment process in detail.

Because of the positive feedback on these changes to the training manuals and the courses, OWP staff will be applying similar revisions and updates to other training materials.

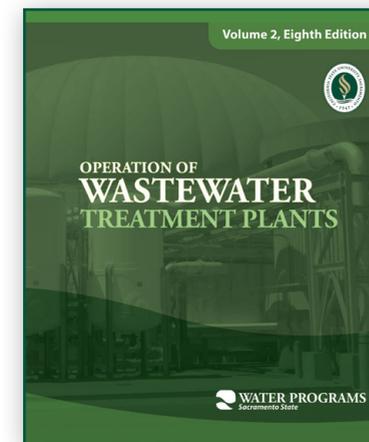
Volume 2 and its associated correspondence courses are scheduled for release in late 2022. Volume 3 and its courses are scheduled for release in early 2023.

*More information at:*  
[owp.csus.edu/courses/wastewater.php](http://owp.csus.edu/courses/wastewater.php) >



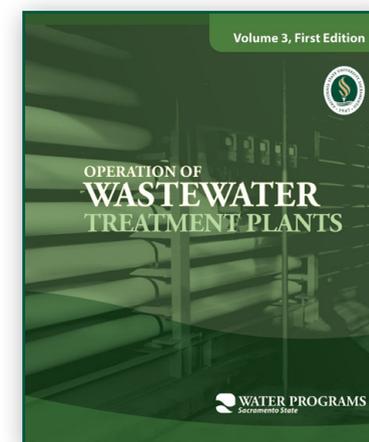
### Operation of Wastewater Treatment Plants, Vol. 1

- Treatment of liquids
- Preliminary, primary, and secondary treatment
- Disinfection
- Laboratory procedures



### Operation of Wastewater Treatment Plants, Vol. 2

- Nutrient removal
- Treatment and handling of solids
- Plant maintenance



### Operation of Wastewater Treatment Plants, Vol. 3

- Effluent discharge and reuse
- Odor control
- Instrumentation
- Utility management
- Other plant-wide processes and procedures

# Technical Tools & Services

Our robust, science-based, and customizable resources for water sector professionals focused on research, design, and planning include numerical modeling, permit compliance, and stormwater design software tools developed and maintained by OWP's research engineers.

ERU Structure	# of SF Properties	# of MF Properties
Tiers (Changes by Property Type)		
1 ERU	4000	700
2 ERUs	2000	300
3 ERUs	1000	300

PROGRAM REVENUE PROJECTIONS*			
Year	1	2	3
Estimated Change (based on 55 gpd indoor sewer)	\$ 54,821	\$ 57,212	\$ 59,603
<b>Residential</b>			
Monthly Bill Estimate (or reported rate increases)	\$ 56,871	\$ 59,262	\$ 61,653
Annual Bill Estimate (or reported rate increases)	\$ 682,452	\$ 711,144	\$ 739,836
Subtotal Revenues from SF Properties	\$ 281,200	\$ 289,420	\$ 297,640
Subtotal Revenues from MF Properties	\$ 82,500	\$ 84,210	\$ 85,920
<b>Commercial &amp; Mixed Use</b>			
Subtotal Revenues from Commercial Properties	\$ 67,000	\$ 68,400	\$ 69,800
Subtotal Revenues from Industrial Properties	\$ 2,100	\$ 2,100	\$ 2,100
<b>TOTALS - STORMWATER PROGRAM REVENUE</b>	<b>\$ 432,800</b>	<b>\$ 444,130</b>	<b>\$ 456,160</b>

TOTALS ACROSS ERU CATEGORIES			
Year	1	2	3
<b>SF Residential</b>			
Subtotal ERU Tier 1	\$ 103,200.00	\$ 105,264.00	\$ 107,328.00
Subtotal ERU Tier 2	\$ 189,200.00	\$ 195,264.00	\$ 201,328.00
Subtotal ERU Tier 3	\$ 77,400.00	\$ 79,544.00	\$ 81,688.00
<b>MF Residential</b>			
Subtotal ERU Tier 1	\$ 18,000.00	\$ 18,420.00	\$ 18,840.00
Subtotal ERU Tier 2	\$ 41,200.00	\$ 42,120.00	\$ 43,040.00
Subtotal ERU Tier 3	\$ 23,200.00	\$ 23,680.00	\$ 24,160.00
<b>Commercial &amp; Mixed Use</b>			
Subtotal ERU Tier 1	\$ 18,000.00	\$ 18,420.00	\$ 18,840.00
Subtotal ERU Tier 2	\$ 10,300.00	\$ 10,520.00	\$ 10,740.00
Subtotal ERU Tier 3	\$ 26,700.00	\$ 27,240.00	\$ 27,780.00

## Toolkit for Stormwater Asset Management and Funding

OWP's Environmental Finance Center (EFC) developed a free toolkit to assist municipal stormwater practitioners in implementing asset management. The toolkit includes a guidance report and worksheets that help record data on system assets, from pipes to gutters to green infrastructure. The toolkit also helps prioritize maintenance needs, estimate long-term costs, and evaluate revenues from various rate scenarios.

## California Stormwater Quality Association Stormwater Funding Resources Webpages

OWP's EFC collaborated with SCI Consulting and Larry Walker Associates to develop stormwater funding resources webpages for the California Stormwater Quality Association (CASQA). These provide municipal stormwater practitioners with comprehensive resources to explore opportunities for and obtain program and project funding. Program funding topics include stormwater utility fees, realignment of services, local development impact fees, and special taxes. Project funding topics include ways to achieve multiple benefits, resources for estimating costs, and opportunities for grants and loans.



### Artes

A Model of Water Resources Management in Los Angeles

[View the Project on GitHub](#) [wikipedia/Artes](#)

### Modeling Water in Los Angeles

*The history of the growth and development of Los Angeles... reveals its conscious use of water as a tool to build the "great metropolis of the Pacific"*  
- Vincent Dstrom, 1962

Welcome to the repository for Artes, an integrated model of urban water resources in metropolitan Los Angeles. It analyzes the potential for enhanced local water supplies in LA.

The model is a product of the California Center for Sustainable Communities at UCLA.

Learn more about LA water management at the The LA Water Hub  
GitHub site: <https://erikporse.github.io/artes/>

## Artes: A Model of Water Resources Management in Los Angeles

Artes is an integrated model of urban water resources in metropolitan Los Angeles that analyzes the potential for enhanced local water supplies. The model is a product of the California Center for Sustainable Communities at UCLA, where OWP's Erik Porse is a visiting assistant researcher. In 2019–2020, the model was used to support several published research articles, including an assessment of energy use for urban water management and an assessment of the effects of stormwater capture and use on urban stream flows.

## Data Tables and Analysis for Costs of California Stormwater Programs

OWP's EFC accumulated, standardized, and analyzed costs for stormwater management across California municipalities. Reported spending activities and the data used in the analysis are available as executable files. The database serves as the basis for statewide assessments of municipal permit compliance costs by the California State Water Resources Control Board (State Water Board).

### Estimating Benefits and Costs of Stormwater Management

Part I: Methods and Challenges



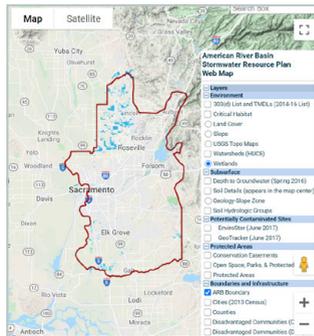
## The Stormwater Funding Storyboard

The EFC at Sac State developed an interactive storyboard with tools and information that stormwater utilities can use to create effective and sustainable stormwater programs, including resources for early-stage stormwater utility planning and rate development systems.

## Caltrans Stormwater Tools and Utilities

OWP develops and maintains multiple stormwater analysis and data management tools for Caltrans. Many of these tools are developed to meet specific requirements for the collection, management, and analysis of data for various regulatory monitoring and compliance tasks. Other tools assist designers with meeting stormwater design requirements and documentation.

<b>Hydrologic Utility</b>  The Caltrans Hydrologic Utility was originally developed to meet the monitoring and reporting requirements of the California Department of Transportation (Caltrans) for stormwater management. It provides a user-friendly interface for conducting hydrologic modeling.	<b>PSTM Utility</b>  Data collected for the monitoring and reporting requirements of the California Department of Transportation (Caltrans) for stormwater management. It provides a user-friendly interface for conducting PSTM modeling.
<b>Infiltration Tool</b>  The Caltrans Infiltration Tool is a hydrograph-based model developed to assist designers in estimating infiltration rates for various soil types. It is used to determine the required infiltration capacity for stormwater management systems.	<b>TMDL Reach Tool</b>  Caltrans is identifying TMDLs for various water bodies. The TMDL Reach Tool is used to determine the required infiltration capacity for stormwater management systems.



## American River Basin Stormwater Resource Plan Web Map

This web-based geographic information system (GIS) map assists users in identifying and evaluating stormwater capture and use project opportunities for the American River Basin Stormwater Resource Plan. The interactive map provides multiple layers of surface, subsurface, environmental, and community characteristics for eastern Sacramento County, western Placer County, and surrounding regions. OWP developed the tool with funding awarded from the State Water Board Proposition 1 Storm Water Planning Grant Program.

## Basin Sizer

Assisting stormwater practitioners in sizing stormwater basins anywhere in California, Basin Sizer is a software tool that calculates water quality volumes and water quality flows using various methods and data obtained from rainfall stations throughout the state. Users can easily select project locations using the interactive map.



## California Phase II Low Impact Development Sizing Tool - v1.2

Welcome to the California Phase II Low Impact Development (LID) Sizing Tool. This is a web-based tool that assists stormwater practitioners in selecting and sizing LID Best Management Practices (BMPs) that meet the sizing requirements set forth in California's National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges from small municipal separate storm sewer systems (MS4s).

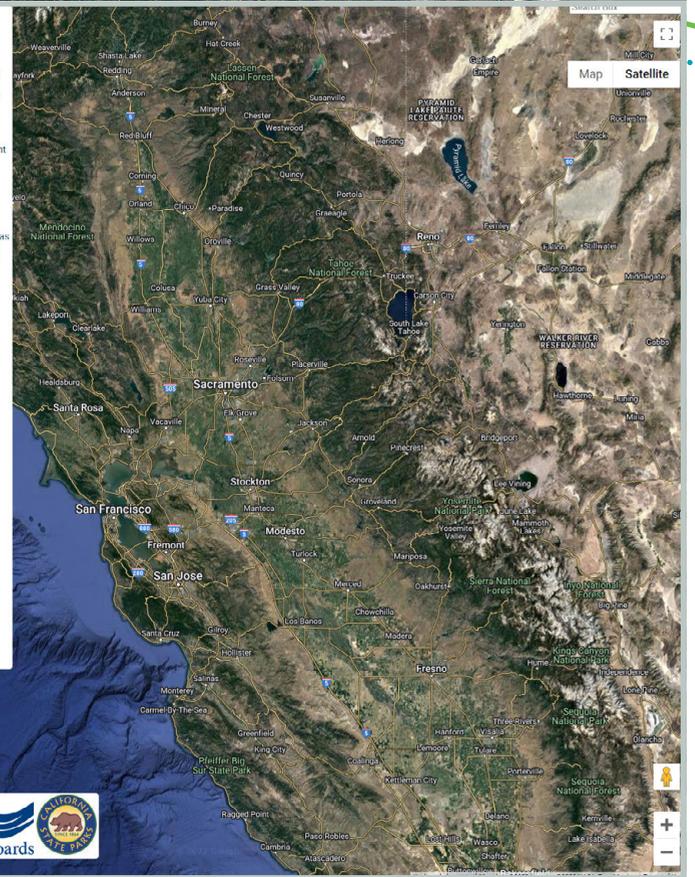
Development of this tool was funded by the California State Water Resources Control Board's (SWRCB) Proposition 84 Stormwater Grant Program (SWGFP) and the California Department of Parks and Recreation.

Changes from v1.1 to v1.2

The continuous simulation results for porous pavement were improved. SWMM 5.0 had an error where water would not infiltrate correctly in porous pavements. SWMM 5.1 has fixed this error and was used for porous pavement calculations. In some cases, the required porous pavement LID BMP footprint area is now much less. The other LID BMP calculations and results have not changed.

Details & Help +

**START**

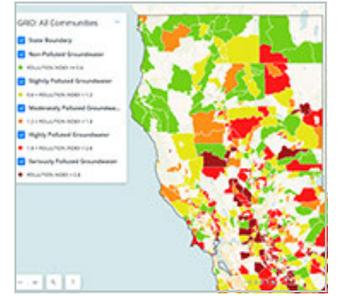


## California Phase II Low Impact Development Sizing Tool

The Low Impact Development (LID) Sizing Tool assists stormwater practitioners with selecting and sizing LID best management practices that meet sizing requirements in California's National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges from small municipal separate storm sewer systems. OWP developed the tool with funding awarded from the State Water Board's Proposition 84 Stormwater Grant Program.

## The California Groundwater Risk Index

The California Groundwater Risk Index (GRID) is an interactive map that shows disadvantaged communities at risk of exposure to contaminated groundwater. Developed to support grant-funded groundwater remediation projects, GRID combines and maps multiple data sources, including California's Groundwater Ambient Monitoring and Assessment (GAMA) Program data and the CalEnviroScreen tool, to identify disadvantaged and severely disadvantaged communities.



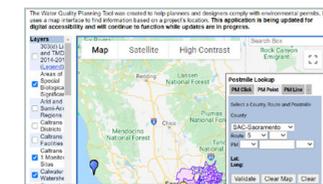
## Stormwater Practitioner Training and Exam Administration

In partnership with the California Stormwater Quality Association and the State Water Board, OWP developed and continues to coordinate training and exam administration programs for Construction and Industrial Permit compliance. The program has certified over 10,000 Qualified Stormwater Developers, Qualified Stormwater Practitioners, and Qualified Industrial Stormwater Practitioners since its inception in 2011.



## Struvite Tool

The Struvite Tool makes struvite control planning easier by calculating the struvite precipitation potential for a facility based on user-input water quality parameters. The user can vary input parameters to examine "what-if" scenarios when conditions are changed to control struvite precipitation.



## Water Quality Planning Tool

This tool provides planners with an easy-to-use website that makes available the watershed information required to create and comply with stormwater permits. A feature of the website enables the user to find a watershed through interactive maps or by entering the postmile number of a project location.

## Hydrologic Analysis Tool

Originally developed to prepare hydrographs for stormwater-related studies conducted by OWP, the Hydrologic Analysis Tool (HAT) standardizes complex calculations required for event-based stormwater monitoring. HAT is freely available to the public for NPDES permit monitoring and stormwater studies.



For more information about software tools, visit us online at: [www.owp.csus.edu/research/software-tools.php](http://www.owp.csus.edu/research/software-tools.php)



**Sediment Control Chemical Maximum Expected Concentration Calculator: Block-form Chemical Water Application (blocks placed in a channel)**

This calculator predicts unbound or unreacted (e.g., dissolved or suspended but not bound to sediment) sediment control chemical concentration in runoff flow over time, chemical concentration in a treated runoff held in a hypothetical downstream pond empty at start over time, chemical concentration in a hypothetical downstream basin containing co-mingled flows from treated and untreated areas over time, and remaining mass of chemical after treating a user-defined storm/flow event with a user-defined chemical block treatment application.

**DIRECTIONS:** Work through all green input categories along the left side of the calculator until reaching the END OF INPUTS cell. Inputs are pre-populated with default values, but should be checked thoroughly and overridden by the user as necessary. Further user guidance are provided to the right of each input as applicable. Detailed calculations at each timestep are provided in the "Block Calc's" tab.

**Cell Legend:**   Light green cells are user inputs  
  Light blue cells are outputs  
  White cells are intermediate calculations or values requiring no input

**Use with caution after reviewing the following assumptions and limitations:**

- 1.) Chemical blocks have been pre-saturated according to manufacturer specifications.
- 2.) Chemical blocks remain saturated and submerged for the duration of use. Dissolution is a function of surface area and the calculator does not adjust for partial or non-submergence at low flows.
- 3.) Chemical block performance is not affected by sediment encapsulation.
- 4.) Concentration calculations depend heavily on the "dissolution rate" of the chemical blocks. However, available information or empirical data on this parameter is limited. Although a number of options are provided in the calculator for polycrylam applications, dissolution rates vary widely between products and manufacturers, and provided information or data may not be representative of actual product performance. Some manufacturers may recommend lab testing outflow concentrations before full implementation to ensure concentrations remain below toxicity limits.

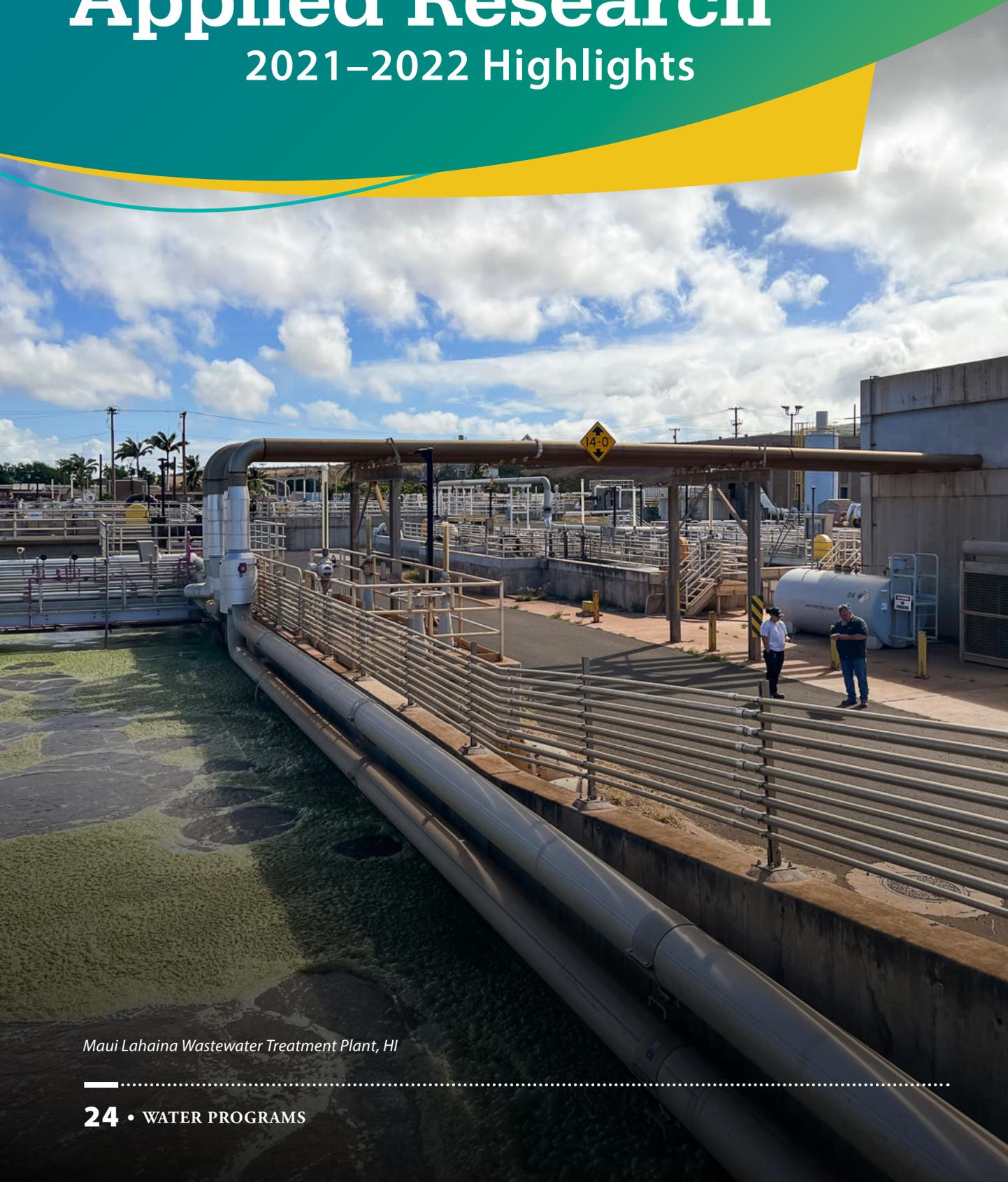
STORM/FLOW EVENT AND WATERSHED INPUTS			SUMMARY OF CUSTOM, USER-DEFINED vs. KNOWN PRODUCT INPUTS		
Flow volume option	SCS Curve Number Method	SCS Curve Number Method calculates runoff volume based on rainfall, drainage area, and hydrologic soil group. User-specified volume overrides this value.	Did the user use a pre-determined, known product dissolution rate?	Yes, user used the pre-determined empirical dissolution rate for a APS 705/ah P.	
SCS Watershed/Acres/area (ac)	1	SCS Curve Number Method input	Did the user use a pre-determined, known product toxicity?	Yes, user used the known 705 Series P (Copolymer Blend) toxicity of 420 mg/L.	
SCS Rainfall, P (in)	1	SCS Curve Number Method input	<b>OUTPUTS</b>		
SCS NRCS Hydrologic soil group	C	SCS Curve Number Method input	Maximum unbound chemical concentration in channel (mg/L)	25.05	A value of zero means all chemical before the end of the flow event.
SCS Curve number, CN	91	SCS Curve Number Method calculation	Minimum unbound chemical concentration in channel (mg/L)	4.50	
SCS Potential maximum retention, S (in)	0.20	SCS Curve Number Method calculation	Treated pond chemical concentration at end of storm/flow event (mg/L)	7.53	
SCS Runoff, Q (in)	36.329	SCS Curve Number Method calculation	Co-mingled (treated + untreated) basin chemical concentration at end of storm/flow event (mg/L)	7.53	
SCS Runoff volume, Q (ft <sup>3</sup> )	36.329	SCS Curve Number Method calculation	Percent of chemical mass remaining after storm event	98%	
User-inputted volume (ft <sup>3</sup> )	36.329	SCS Curve Number Method calculation	Remaining mass of each chemical block (g)	3,804	
Duration of runoff at treatment site (hr)	6	Note that it is not storm duration, but flow duration at the chemical block treatment site.	Total remaining mass of all chemical blocks (g)	3,804	
Flow hydrograph type at treatment site	Triangular (Rational Method)	"Channel Flow" uses a simple volume per time calculation held constant for the duration of treatment, most appropriate for treatment downstream of a pipe or hydraulic control structure. Triangular (Rational Method) simulates a runoff hydrograph with rising/falling limbs and a peak occurring halfway through the hydrograph.	<b>FIGURE 1: UNBOUND (UNREACTED) CHEMICAL CONCENTRATION OVER TIME</b>		
Percent of watershed/runoff volume treated	100%	Unreacted runoff volume is assumed to co-mingle with treated downstream of the channel and pond. Co-mingled flow chemical concentration is provided as a separate output on the chart.	"Channel (treated runoff) chemical concentration" is the concentration just downstream of the chemical applied (treated runoff) chemical concentration" is a cumulative average concentration representative of a theoretical pond downstream of the chemical treatment location and does not include any untreated runoff. "Co-mingled basin (pre-runoff) chemical concentration" is a cumulative average concentration representative of the treated pond volume and untreated runoff from the untreated area of the watershed that may co-mingle with treated runoff to a further (theoretically) basin. If 100% of the watershed is treated, the treated pond and co-mingled basin concentrations, color duration of the runoff.		
Total treated volume in channel/pond	36.329	Calculated from "Percent of watershed/runoff volume treated" above	— Channel (treated) chemical concentration		
Total untreated volume, to be co-mingled downstream of channel/pond		Calculated from "Percent of watershed/runoff volume treated" above	— Pond (treated) chemical concentration		
Maximum flow in channel/into pond (gpm)	54	This value may be used as a starting point to estimate required number of chemical blocks below as appropriate with manufacturer guidance. It does not include untreated runoff co-mingled downstream of the			

## Passive Chemical Dosing Discharge Calculator

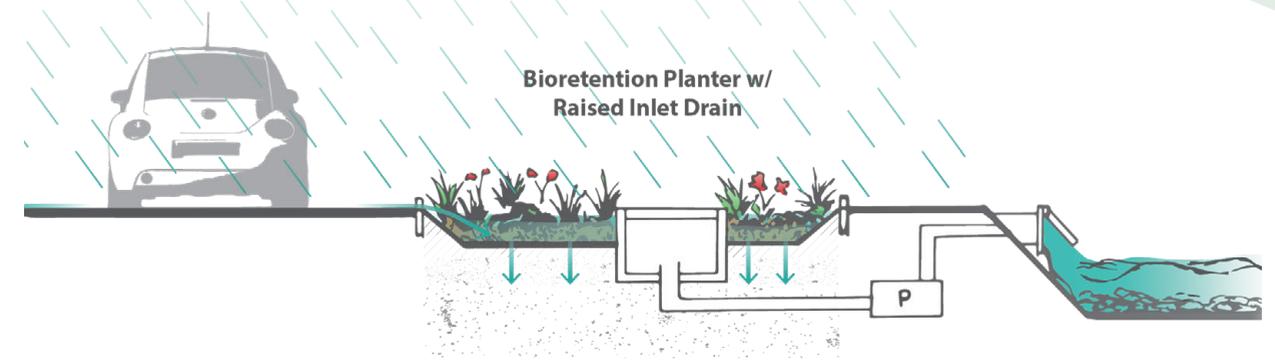
The passive chemical dosing discharge calculator employs a mass balance timestep modeling approach to predict the maximum expected concentration of erosion control treatment chemicals in effluent water following a user-defined pre-storm application for erosion control or enhanced treatment via sedimentation. The tool, developed using information gathered from a literature review of existing empirical data and existing best management practices, manufacturer and vendor guidance, and input from a technical advisory committee, demonstrates the benefits of using basins to attenuate spikes in concentration over a larger volume. This planning tool assists users in designing environmentally safe erosion and sediment controls that use treatment chemicals at construction and industrial sites.

# Applied Research

## 2021–2022 Highlights



Maui Lahaina Wastewater Treatment Plant, HI



Bioretention Planter model designed for stormwater filtration.

OWP performed **dam breach inundation modeling** for over 35 separate dams throughout the State of California. The modeling was done to assist the California Department of Water Resources' Division of Safety of Dams (DSOD) in support of their review and approval of inundation maps. Many of the dams were modeled for multiple breach scenarios, helping to assess potential downstream impacts and determine the appropriate hazard classification.

OWP's Environmental Finance Center (EFC) **assessed the needs of Hawaii's (HI's) drinking water systems** and developed recommendations for expanding the capacity development program administered by the HI Safe Drinking Water Branch. The program helps water systems acquire and maintain adequate technical, managerial, and financial (TMF) capacity, supporting the systems in consistently providing safe and affordable drinking water to the public. The EFC also continued assisting California's Clean Water State Revolving Fund (CWSRF) program in **evaluating grant and loan application and funding disbursement processes**. In June 2022, the EFC was selected

to lead the EPA's **Community Solutions Teams (CST) pilot program** for drinking water and wastewater systems in the western US. The program involves developing and implementing a process to help systems identify infrastructure needs, begin project planning, and develop their TMF capacity, enabling them to access the unprecedented infrastructure funding approved through the 2021 Bipartisan Infrastructure Law. The pilot program seeks to support up to 30 systems in the western US.

OWP **documented current state departments of transportation (DOTs) practices for the implementation and use of bioretention stormwater control measures** to assist DOTs in developing or improving their bioretention specifications and deployment guidance. Bioretention includes a range of measures aimed at removal of contaminants and pollutants using materials such as soils, plants, and other filtering media that are increasingly being used by state DOTs to meet stormwater permit requirements. The work is managed by the National Cooperative Highway Research Program (NCHRP) and reviewed by a panel of DOT practitioners.

# Applied Research Funded Grants & Contracts

## Impacts of Water Conservation Project

The State Water Board contracted \$2,000,000 with OWP (10/11/19–1/31/22) to support analyzing the environmental and economic impacts of proposed water conservation regulations.

## Lead in Drinking Water Projects

The State Water Board contracted \$4,900,000 with OWP (10/1/19–1/31/23) to provide technical assistance to Licensed Child Care Centers to collect and analyze drinking water samples and, subsequently, remediate lead contamination that exceeds thresholds.

The California Department of Social Services (CDSS) contracted \$5,891,520 with OWP (7/1/21–10/31/23) to provide the Community Care Licensing Division Child Care Program (CCP) with assistance in outreach and technical assistance to priority licensed child care centers to collect and analyze drinking water samples for lead.

## Asset Management Technical Assistance Project

2NDNATURE, LLC, contracted \$10,000 with OWP (6/10/20) to provide technical assistance for a plan to implement stormwater infrastructure asset management for the City of Salinas.

## Santa Monica Basin Groundwater Sustainability Project

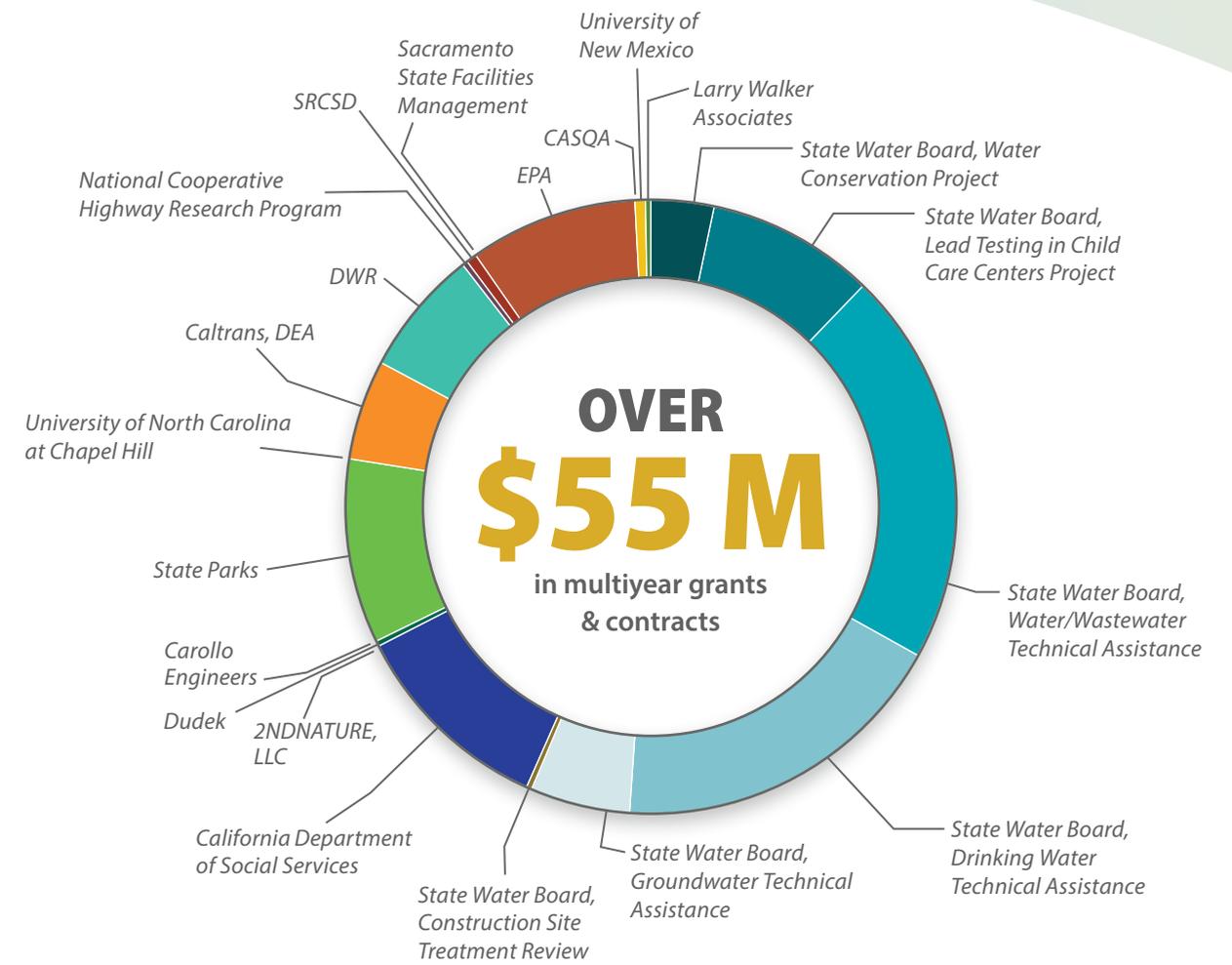
Dudek Engineering and Environmental contracted \$148,400 with OWP (starting 9/3/19) to assist the City of Santa Monica and the Santa Monica Basin Groundwater Sustainability Agency in achieving their goals of long-term sustainability and water independence by analyzing potential projects and basin management strategies.

## Stormwater Technical Assistance Project

Larry Walker Associates contracted \$87,500 with OWP (12/20/19–12/31/22) to assist with regulatory and monitoring services for the Sacramento Stormwater Quality Partnership.

## Geographic Information Systems Training for Disadvantaged Communities

The University of North Carolina at Chapel Hill contracted with OWP (9/1/18) to provide comprehensive training on and technical assistance for geographic information systems (GIS) to disadvantaged communities.



\* Individual funded grants and contracts range from \$10K to \$11.5M

## Stormwater Program Technical Assistance

The California Department of Parks and Recreation (State Parks) contracted \$5,300,000 with OWP (6/29/21–6/28/24) to provide technical assistance for its stormwater program.

## Stormwater Research Technical Assistance

The California Department of Transportation, Division of Environmental Analysis (DEA) contracted \$3,002,000 with OWP (12/1/19–11/30/22) to provide technical assistance with stormwater research focusing on discharge characterization, source identification and control, and treatment control studies.

### **Division of Safety of Dams Mapping Project**

The California Department of Water Resources (DWR) contracted \$3,750,000 with OWP (1/1/13–6/30/25) to assist the Division of Safety of Dams (DSOD) with dam break flood analysis and emergency action plan development.

### **Environmental Compliance Support**

Sacramento State Facilities Management contracted \$25,071 with OWP to assist with stormwater pollution prevention plan (SWPPP) development, trash assessments, and other related tasks.

### **Wastewater Technical Expertise**

The Sacramento Regional County Sanitation District (SRCSD) contracted \$400,000 with OWP (executed on 6/11/03) to provide technical assistance, with a focus on wastewater characterization and treatment.

### **Wastewater Generation Rates Study**

Carollo Engineers contracted \$40,181 with OWP (starting 5/15/18) to assist with a project designed to determine wastewater generation rates from different sources.

### **Qualified SWPPP Developer and Qualified SWPPP Practitioner Testing and Certification**

The California Stormwater Quality Association (CASQA) contracted with OWP (executed on 1/21/11) to develop and implement an online training delivery system to administer and grade tests and issue certifications for Qualified SWPPP Developers and Qualified SWPPP Practitioners.

### **Qualified Industrial Stormwater Practitioners Training and Testing**

CASQA contracted with OWP (executed on 05/23/16) to develop and implement an online system to train and test Qualified Industrial Stormwater Practitioner certificate candidates.

### **Environmental Finance Center (Region 9)**

The US Environmental Protection Agency (EPA) contracted \$4,800,000 with OWP (7/1/16–9/30/23) to develop, operate, and maintain an Environmental Finance Center for Region 9.

### **Small Systems Technical Assistance Projects**

The University of New Mexico contracted \$285,000 with OWP (8/1/21–1/31/23) to provide technical assistance for building technical, managerial, and financial (TMF) capacity for small water systems throughout the United States.

The University of New Mexico contracted \$125,000 with OWP (8/1/21–1/31/23) to provide technical assistance for building TMF capacity for small wastewater systems throughout the United States.

### **Drinking Water and Wastewater Technical Assistance and Outreach**

The State Water Board, under a Proposition 1 grant, contracted \$11,500,000 with OWP (9/1/16–2/29/24) to provide water and wastewater technical assistance to disadvantaged communities in California.

### **Drinking Water Technical Assistance and Outreach**

The State Water Board, under the Safe and Affordable Funding for Equity and Resilience (SAFER) grant, contracted \$10,000,000 with OWP (3/9/20–2/29/24) to provide drinking water technical assistance to disadvantaged communities in California.

### **Groundwater Technical Assistance and Outreach**

The State Water Board, under a Proposition 1 grant, contracted \$3,000,000 with OWP (9/1/16–12/31/22) to provide groundwater technical assistance to disadvantaged communities in California.

### **Construction Site Passive Dosing Chemical Treatment Literature Review and Study Plan**

The State Water Board contracted \$196,630 with OWP (6/30/20–1/30/22) to study the benefits and potential adverse effects on the environment of water treatment chemicals used at construction sites, including whether the use of best management practices (BMPs) for water treatment chemicals are protective of water quality.

### **Trash Rapid Assessment Data Exchange**

OWP is assisting Dr. Julian Fulton (Sacramento State Environmental Studies) with an EPA contract for the Trash Rapid Assessment Data Exchange (TRADE) project. OWP is acting as the liaison to the State Water Board and stormwater permittees for the duration of the project (10/1/20–9/30/23).

### **Bioretention Stormwater Control Measures Synthesis**

The National Cooperative Highway Research Program contracted \$45,000 with OWP (executed on 3/2/22) to synthesize current state department of transportation practices for the implementation and use of bioretention stormwater control measures.

# Spotlight:

## Helping Child Care Centers Identify & Prevent Lead Exposure from Drinking Water

**O**WP is working with the California Child Care Resource and Referral Network (R&R Network) and California Rural Water Association (CRWA) to prevent lead exposure in young children through water testing, replacing fixtures, and retesting water at licensed child care centers (CCC) in California.



In the 2021–2022 fiscal year, OWP received over 1,200 applications from licensed CCC requesting water sampling and lead analysis. Samples were collected over nearly 300 site visits.

The Lead Testing in Child Care Centers program was implemented after Assembly Bill 2370 required that licensed CCC operating in buildings (facilities) constructed before January 1, 2010 have their drinking water tested for excessive lead levels by January 1, 2023. This requirement applies to centers only, not to Family Child Care Homes. If lead levels in water exceed an action level of 5 parts per billion, centers will be required to take further actions, such as replacing fixtures with new fixtures containing no lead or removing the fixtures from use as a drinking or cooking water supply.

The California State Water Resources Control Board (State Water Board) funded a program for testing, fixture replacement, and retesting for CCC meeting certain eligibility requirements for funding assistance. The California Department of Social Services also procured federal funding, allowing for substantial expansion in testing services and technical assistance. An assistance

team comprising OWP, the R&R Network, and CRWA operates the program. The R&R Network is partnering with several local child care resource and referral agencies. Per Senate Bill 862, funding assistance is prioritized based on a combination of factors, such as economic need and age of the children served.

CCC can apply through a website ([ab2370-assistance.owp.csus.edu](https://ab2370-assistance.owp.csus.edu)) developed by OWP that serves CCC, state agencies, and the AB 2370 Assistance Team. This full-service website, programmed with the help of six student assistants, handles CCC applications, sampling data, and communication back to the CCC. The website has many dynamic functions to provide immediate feedback to the user, such as assignment of a priority tier based on the CCC's application data. The website also supports sample visit scheduling, report documentation, fixture approvals, and other program tasks.

*More information at:*  
<https://ab2370assistance.owp.csus.edu> >



# Water Seminar Series

## Exploring Water Use, Management, & Protection in California

**O**WP's Water Seminar Series brings together expert speakers, water sector professionals, the Sacramento State community, and the public to explore key California water issues.

*In compliance with COVID-19 public health guidelines, the seminars were presented in a virtual format.*

### October 2021:

James Peifer, Executive Director of the Regional Water Authority (RWA) and the Sacramento Groundwater Authority (SGA), speaks on the Sacramento Regional Water Bank, an innovative groundwater storage program that will improve regional water supply reliability in the near-term and into the future.

### November 2021:

Tessa Maurer, Senior Project Scientist at Blue Forest Conservation, and Joanna Lessard, Project Manager at the Yuba Water Agency, talk about funding water supply protection through conservation finance in the Yuba River watershed.

### April 2022:

Brian Rickards, Planning & Development Services Manager at Placer County Water Agency, and Ibrahim Khadam, Senior Principal Engineer at Stantec Consulting Services, share details on the purpose and goal of the American River Basin Study.

### May 2022:

Heidi Oriol, Senior Civil Engineer in the Legislative and Regulatory Affairs workgroup for Regional San and the Sacramento Area Sewer District, explains the Harvest Water Project and its mission to increase water supply reliability and ecological resiliency through collaboration.



Listen now at:  
[www.owp.csus.edu/water-seminars/](http://www.owp.csus.edu/water-seminars/)



# Professional Activities

Conferences, Forums, & Webinars



*Conferences give insight into the latest trends and technologies relevant to the water sector.*



## July 2021

California Stormwater Quality Association (CASQA) Quarterly Meeting, webinar (presenter)

## August 2021

Tri-State Seminar, Clark County, NV (presenter)

## September 2021

California Technical Assistance Providers (CalTAP) Fair, Grass Valley, CA (presenter)

## October 2021

Cal-Nevada American Water Works Association (AWWA) Conference, webinar

WEFTEC Conference 2021 (paper)

California Stormwater Quality Association (CASQA) 2021 Conference, webinar (3 presenters, 3 moderators, and 1 panelist)

## March 2022

California Technical Assistance Providers (CalTAP) Fair, Temecula, CA (presenter)

## April 2022

California Water Environment Association (CWEA) Conference and Expo, Sacramento, CA

California Rural Water Association (CRWA) Expo, Lake Tahoe, NV (presenter)

## May 2022

California State Water Resources Control Board Meeting (2 presenters)

## June 2022

California Water Environment Association (CWEA) Pretreatment, Pollution Prevention, and Stormwater (P3S) Conference, Long Beach, CA (presenter)

EWRI Congress 2022 (2 presenters and 1 poster)

# Professional Activities

## Committees & Meetings

### ASCE Environment and Water Resources Institute, Sustainability Committee

### Association of Pacific Rim Universities, Sustainable Cities and Landscapes, Water and Wastewater Working Group

### ASTM Committee E64 on Stormwater Control Measures

### California Stormwater Quality Association

- Strategic Planning Committee
- BMP Effectiveness Subcommittee
- BMP Handbook Subcommittee
- True Source Control Subcommittee

- Conference Subcommittee
- Construction Subcommittee
- Funding Subcommittee
- Industrial Subcommittee
- Non-Traditional Phase II Subcommittee
- Phase II Subcommittee
- Policy and Permitting Subcommittee
- Scholarship and Fellowship Working Group

### Calleguas Creek Watershed TMDL Stakeholder Group

### Civil Engineering and Environmental Systems (peer-reviewed journal) Editorial Board member

### EFC Network

### Frontiers in Water (peer-reviewed journal) Editorial Board member

### State Water Resources Control Board (State Water Board)

- Construction General Permit Training Team
- Industrial General Permit Training Team
- Northern CA Water Quality Monitoring Group
- Southern CA Beach Water Quality Work Group
- Lean Sigma Six Team for Technical Assistance Planning Improvement Project

### Transportation Research Board—Hydraulics, Hydrology, and Stormwater Committee

### Washington State TAPE External Board of Reviewers

### Water Environment Federation

- Stormwater Committee
- Industrial Subcommittee

*We encourage growth by sharing knowledge and helping bring change.*

# Professional Activities

## Publications

Porse, Erik, Cristina Poindexter, Christian Carleton, and Michael Stephens. 2021. "Climate change risk and adaptation costs for stormwater management in California coastal parklands." *Sustainable and Resilient Infrastructure*. <https://doi.org/10.1080/23789689.2021.1996811>.

Muller, Brook, Adell Amos, Joshua F. Cerra, Chingwen Cheng, David L. Feldman, Tatum Lau, Noelwah R. Netusil, and Erik Porse. 2022. "Redrawing our urban waters: Merging design, law, and policy in advancing distributed water systems." In *The Routledge Handbook of Sustainable Cities and Landscapes in the Pacific Rim*, edited by Yizhao Yang and Anne Taufen, 307–320. New York: Routledge.

Porse, Erik, Maureen Kerner, Joel Shinneman, Jonathan Kaplan, Samuel Stone, and Mary L. Cadenasso. 2022. "Stormwater utility fees and household affordability of urban water services." *Water Policy*. <https://doi.org/10.2166/wp.2022.024>.

Babchanik, David, Danielle Salt, Maureen Kerner, Brian Currier, and Erik Porse. 2022. "Municipal Stormwater Management Spending in California: Data Extraction, Compilation, and Analysis." *Environmental Management* 69, no. 6: 1053–1065. <https://doi.org/10.1007/s00267-022-01621-y>.

*Writing the future of the water sector and providing solutions for protecting and enhancing water resources, public health, and the environment...*



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