

NATIONAL WATER RESEARCH INSTITUTE

Final Report for Panel Meeting #1:

Independent Advisory Panel for
Soquel Creek Water District's
Groundwater Replenishment Project

Based on an Independent Advisory Panel Meeting Held
February 27, 2017

Prepared By:
Independent Advisory Panel to Evaluate
Soquel Creek Water District's Groundwater Replenishment Project

Prepared For:
Soquel Creek Water District
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Submitted:
May 16, 2017

Submitted By:
National Water Research Institute
Fountain Valley, California

DISCLAIMER

This report was prepared by an Independent Advisory Panel administered by the National Water Research Institute (NWRI). Any opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

ABOUT NWRI

A 501c3 nonprofit organization, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies and to protect public health and improve the environment. NWRI's member agencies include Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

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ACRONYMS AND ABBREVIATIONS

AFY	Acre feet per year
AO	Advanced oxidation
CEC	Constituent of emerging concern
DWR	Department of Water Resources (California)
GSA	Groundwater sustainability association
GSP	Groundwater sustainability plan
IPR	Indirect potable reuse
MF	Microfiltration
NWRI	National Water Research Institute
ppb	Parts per billion
ppt	Parts per trillion
RO	Reverse osmosis
SCCSD	County of Santa Cruz Sanitation District
SCWWTF	Santa Cruz Wastewater Treatment Facility
SGMA	Sustainable Groundwater Management Act
SqCWD	Soquel Creek Water District
SWA	Surface water augmentation
UF	Ultrafiltration
USEPA	United States Environmental Protection Agency
UV	Ultraviolet

1. BACKGROUND AND OVERVIEW OF THE PROJECT

The National Water Research Institute (NWRI) of Fountain Valley, California, a 501c3 nonprofit, appointed water industry experts to an Independent Advisory Panel (Panel) to provide scientific and technical review of the proposed PUREWater Soquel Groundwater Replenishment Project for Soquel Creek Water District (SqCWD) in western Santa Cruz County, California. As part of the project, SqCWD is evaluating the feasibility of implementing a groundwater replenishment reuse project^{1,2} to address groundwater overdraft of the Soquel-Aptos Groundwater Basin (Basin) – a source of municipal water supply – and sustainably manage the Basin over the long-term. The goal of the Panel review is to help SqCWD staff and local policymakers make informed decisions about the proposed PUREWater Soquel project that would be protective of public health and the environment.

1.1 Project Background

SqCWD relies entirely on groundwater to meet customer needs. The Basin, which provides SqCWD's water supply, is designated as "critically overdrafted" by the California Department of Water Resources (DWR). The Basin became overdrafted after many years of pumping out nearly 6,000 acre feet per year (AFY) of water, a volume that exceeds the estimated sustainable yield of approximately 3,000 AFY³. In 2014, the SqCWD Board of Directors declared a groundwater emergency because seawater was intruding into the groundwater aquifer, causing salt contamination, increased water treatment costs, and reduced water security. In response, SqCWD reduced pumping to 3,000 AFY by implementing a public water conservation program to ease demands on the Basin.

To ensure a reliable water supply, SqCWD intends to provide one-third of its total water needs from an alternate water source, such as recycled water. Through the Recycled Water Policy, the State of California has adopted goals to increase the beneficial use of recycled water, including groundwater recharge, to supplement local community water supplies.⁴ Other water supply projects in California, such as the Groundwater Replenishment System in Orange County,⁵ use or are planning to use recycled water to replenish local groundwater basins. SqCWD is taking this opportunity to evaluate the feasibility of undertaking a groundwater replenishment reuse project using recycled water as the source water supply.⁶

¹ As defined in the California Code of Regulations, Title 22, Division 4, Chapter 3, Article 1, §60301.390, "Groundwater Replenishment Reuse Project" or "GRRP" means a project involving the planned use of recycled municipal wastewater that is operated for the purpose of replenishing a groundwater basin designated in the Water Quality Control Plan [as defined in Water Code section 13050(j)] for use as a source of municipal and domestic water supply.

² Regulatory information about Groundwater Replenishment Using Recycled Water in California is available at <http://www.cdph.ca.gov/services/DPOPP/regs/Pages/DPH14-003EGroundwaterReplenishmentUsingRecycledWater.aspx>. Please click on "Approved Regulation Text" to review the regulations.

³ Soquel Creek Water District 2015 Urban Water Management Plan, prepared by Water Systems Consulting, Inc., dated 24 June 2016.

⁴ Refer to http://www.swrcb.ca.gov/water_issues/programs/water_recycling_policy/ for more information about the Recycled Water Policy.

⁵ Refer to <https://www.ocwd.com/gwrs/> for more information about the Groundwater Replenishment System.

⁶ Originally, SqCWD evaluated three options for supplementing existing water supplies: (1) ocean desalination; (2) river water transfers and conjunctive use; and (3) groundwater augmentation with recycled water. Based on an assessment of public

In addition, as required by the California Sustainable Groundwater Management Act of 2016 (SGMA),⁷ local stakeholders (including SqCWD, Central Water District, City of Santa Cruz, County of Santa Cruz, and private well representatives) formed the Santa Cruz Mid-County Groundwater Sustainability Association (GSA) to develop and implement a plan to manage the use of water within the Basin. Currently, the Santa Cruz Mid-County GSA⁸ is working to create a groundwater sustainability plan (GSP) designed to bring the Basin into compliance by 2040.

1.2 PUREWater Soquel

SqCWD has proposed the PUREWater Soquel Groundwater Replenishment Project to meet water supply needs. The PUREWater Soquel project would use advanced water treatment processes to produce highly treated recycled water (or “advanced treated water”) and inject it into the groundwater basin. The advanced treated water would mix with groundwater and eventually become part of the domestic water supply that is delivered to customers. By replenishing the groundwater basin with advanced treated water, the PUREWater Soquel project would help the basin rebound to sustainable water levels, protect the Basin from additional seawater intrusion (and the resulting impacts on water quality), and prevent future overdraft.

The conceptual components of the PUREWater Soquel project include:

- *Source Water:* Source water for the PUREWater Soquel project would include either treated secondary effluent from the Santa Cruz Wastewater Treatment Facility (SCWWTF) or wastewater from the County of Santa Cruz Sanitation District (SCCSD).
- *Treatment Facilities:* Various treatment options could involve treating the source water through multiple treatment processes that may include secondary wastewater treatment, tertiary wastewater treatment, and advanced water treatment, depending on the source water.
- *Advanced Treated Water and Recharge Wells:* The advanced treated water would be conveyed to new recharge wells that would transmit the water into the Basin to create a seawater intrusion barrier and replenish the Basin.
- *Conveyance Systems:* New pipelines and conveyance improvements would transport (1) the source water to the treatment facility and (2) the concentrate discharge flow to the SCWWTF. New pipelines and conveyance also would be needed to transport the advanced treated water to the recharge wells.

1.3 Role of the Independent Advisory Panel

NWRI brought together experts from relevant disciplines to provide independent, third-party review of components of the proposed PUREWater Soquel project, including the proposed sampling plan for

support, water rights, multi-jurisdiction/multi-agency coordination, habitat conservation, and other issues, SqCWD identified Option 3 as the most viable approach to address groundwater basin overdraft and provide a local, sustainable supply of water.

⁷ More information on California’s Sustainable Groundwater Management Act (SGMA) can be found at <http://www.water.ca.gov/groundwater/sgm/>.

⁸ More information about the Santa Cruz Mid-County Groundwater Sustainability Association can be found at <http://www.midcountygroundwater.org/>.

constituents of emerging concern (CECs). The Panel will meet with the Project Team once in person at SqCWD's facilities in Soquel Creek and twice via web-enabled conference call. At the conclusion of each meeting, the Panel will prepare a report summarizing the Panel's findings and recommendations. Refer to **Appendix A** for background information about the NWRI Panel process.

1.4 Panel Members

The Panel is composed of experts in disciplines related to groundwater replenishment with recycled water, including microbiology, drinking water quality standards, public health, risk assessment, regulatory issues, hydrogeology, toxicology, public perception, and advanced treatment technologies. Panel members include:

- Chair: Channah Rock, Ph.D. (University of Arizona)
- Joseph Cotruvo, Ph.D., BCES (Joseph Cotruvo & Associates)
- Jason Dadakis, PG, CHG (Orange County Water District)
- Michael Dourson, Ph.D., DABT, FATS, FSRA (University of Cincinnati)
- Kara Nelson, Ph.D. (University of California, Berkeley)
- Gordon Thrupp, Ph.D., PG, CHG (Geosyntec Consultants)

Brief biographies of the Panel members are provided in **Appendix B**.

2. PANEL MEETING #1

The Panel met for the first time (Meeting #1) via web-enabled conference call on February 27, 2017. The purpose of this first meeting was for SqCWD staff to present the Panel with an overview of the proposed PUREWater Soquel project, review the Geochemical Characterization report prepared by the Project Team, and discuss the scope of work for the CEC Sampling Plan prepared by the Project Team.

2.1 Pre-Meeting Material for Review

Prior to Meeting #1, the following background material on the PUREWater Soquel project was provided to the Panel:

- District Community Water Plan (slide presentation by Melanie Schumacher of SqCWD).
- PUREWater Soquel Project Overview (informational flyer distributed by SqCWD).
- Groundwater Replenishment Feasibility Study (executive summary of final draft report prepared by Carollo Engineers, March 2016).
- Potential Injection Aquifer Geochemical Characterization (slide presentation by Sunny Wang of Brown and Caldwell and report prepared by Brown and Caldwell, October 2016).
- CEC Sampling Plan with Appendices (draft report prepared by Carollo Engineers, October 2016).
- Statement Regarding the Use of Recycled Municipal Wastewater in Santa Cruz (letter written by Jude Todd, 2015).

2.2 Panel Meeting #1 Agenda

Staff from NWRI, the Panel Chair, and the SqCWD Project Team collaborated on the development of the agenda for Panel Meeting #1, which is included in **Appendix C**.

The objectives for the meeting were as follows:

- Present an overview of the PUREWater Soquel project.
- Review the results provide in the report on “Potential Injection Aquifer Geochemical Characterization.”
- Discuss and solicit feedback on (1) the scope of work for the CEC Sampling Plan and (2) conducting a bench-scale demonstration as part of the CEC Sampling Plan.

SqCWD’s Project Team provided presentations on the following:

- District Community Water Plan
- Groundwater Replenishment Feasibility Study
- Potential Injection Aquifer Geochemical Characterization
- CEC Sampling Plan with Appendices

The majority of the meeting was devoted to the presentations; however, time was provided for the Panel members to ask questions and provide preliminary feedback. The Panel agreed to schedule a Panel-only follow-up call to discuss the information presented at the meeting and propose recommendations to SqCWD regarding: (1) the CEC Sampling Plan; and (2) the proposed bench-scale demonstration to be conducted in a university laboratory as part of the CEC Sampling Plan.

2.3 Panel Meeting #1 Attendees

All Panel members participated at Meeting #1. Other attendees included NWRI staff and SqCWD Project Team members. A complete list of attendees is included in **Appendix D**.

2.4 Meeting Outcomes

The products of Meeting #1 include both (1) this report and (2) a separate memorandum with the subject line “Findings and Recommendations of Meeting #1 of the NWRI Independent Advisory Panel for Soquel Creek Water District’s PUREWater Soquel Groundwater Replenishment Project,” which was submitted to SqCWD on March 28, 2017.

3. PANEL FINDINGS AND RECOMMENDATIONS

The principal findings and recommendations of the Panel regarding the proposed PUREWater Soquel project, as derived from the material presented and discussed during Panel Meeting #1, are provided in Sections 3.1 to 3.4. The findings and recommendations are organized under the following section headings:

- Proposed Bench-Scale Demonstration
- Sampling Plan for Constituents of Emerging Concern
- Potential Injection Aquifer Geochemical Characterization
- Additional Recommendations

3.1 Proposed Bench-Scale Demonstration

SqCWD proposed the use of a bench-scale demonstration test that would treat secondary effluent from the SCWWTF using microfiltration (MF), reverse osmosis (RO), and ultraviolet (UV)/advanced oxidation processes (AOP). It would be used to assess the potential removal of CECs and is not a test of design parameters. The Panel concluded that the proposed bench-scale demonstration is not necessary to demonstrate the feasibility and safety of the treatment technologies for the PUREWater Soquel project based on the following:

- Regulatory authorities in California have permitted several groundwater replenishment reuse projects that employ the treatment processes proposed by SqCWD for this project.
 - As a result, multi-year performance data are available for these treatment processes, including recent pilot-scale and full-scale projects using the proposed treatment processes for secondary-treated wastewater effluent.
 - At present, the Orange County Water District (OCWD) is pilot testing the treatment of 100-percent trickling filter effluent using MF and ultrafiltration (UF) at the Groundwater Replenishment System. Additionally, the Pure Water Monterey project has been designed to accept 100-percent trickling filter effluent. These efforts should provide valuable data applicable to the PUREWater Soquel project related to trickling filter effluent.
- The limited bench-scale treatment of wastewater is not the same as the treatment of wastewater through a pilot-scale or full-scale treatment train. The suggested system for the bench-scale demonstration will not effectively simulate the short-term/long-term performance and operational conditions of the full-scale system; therefore, the scientific and/or engineering value of the bench-scale demonstration is limited.
- Funding for the bench-scale demonstration may be better used on building capacity for a future large-scale pilot project (see the Panel's comments in Section 3.4) or on enhancing the water quality monitoring program.

- The Panel understands that, although not necessary to demonstrate the safety of the PUREWater Soquel project, the bench-scale demonstration could prove beneficial in building confidence with SqCWD’s customers and community stakeholders. For example:
 - Processing SqCWD’s wastewater through the bench-scale demonstration system may be viewed as more predictive of the potential impact on public health protection than evaluating data from existing treatment systems that use other sources of wastewater.
 - Comparing CEC removal data from the bench-scale demonstration to data from similar potable reuse pilot-scale and full-scale projects may provide an additional assurance of treatment efficacy; however, some design and operational questions may be better assessed by a large-scale pilot study (see the Panel’s comments in Section 3.4).
- If SqCWD decides to pursue the bench-scale demonstration, the specific operating conditions for the system must be defined carefully and should be consistent with existing potable reuse projects. For example:
 - For the RO system, the percent recovery and percent salt rejection should be defined and measured.
 - For the UV system, both the UV dose and initial peroxide dose need to be defined and measured.

3.2 Sampling Plan for Constituents of Emerging Concern

The following recommendations and comments from the Panel address the Project Team’s request for feedback on the CEC Sampling Plan for the PUREWater Soquel project.

- The CEC Sampling Plan is appropriate for this stage of the project.
- The Panel recommends that SqCWD compare its upcoming CEC sampling data with the literature summary that has already been compiled. The Panel did not identify any gaps in the background data collection.
- The Panel recommends comparing the SqCWD CEC sampling data to CEC sampling data from other California projects. This comparison will provide a useful frame of reference. In addition, consider:
 - Sampling data from similar water reuse projects in California.
 - Results from studies published in the peer-reviewed literature.
 - Other relevant studies on the quality of recycled water.
- The Panel recommends that the Project Team select a single set of optimal analytical procedures and a highly qualified laboratory to perform the analytical studies. Because of variances in analyses for trace chemicals, using multiple methods to measure one analyte and/or using multiple laboratories to analyze samples are likely to produce results that may not be consistent and/or comparable.
- The Panel recommends consulting with the contract laboratory to determine the most reliable methods (e.g., methods that use isotopic dilution, where available), which may not always be the most sensitive methods (i.e., the methods with the lowest detection limits).
- Caution is advised when using the U.S. Environmental Protection Agency’s (USEPA) drinking

water methods (e.g., EPA 522, 537, 539, etc.) to characterize secondary effluent, as these methods were not originally designed or intended for wastewater matrices. The Panel recommends that the Project Team consult with the contract laboratory regarding any potential limitations and issues with quality control/quality assurance.

- The Project Team should consider using the units “parts per billion” (ppb) rather than “parts per trillion” (ppt) to report concentrations of CECs at trace levels. Members of the public may be misled by the implied precision, accuracy, and significance of values reported in ppt, and the public is more likely to understand the concept of ppb than ppt.
 - Note that ppt is one one-thousandth (1/1000) of the magnitude of ppb.
 - This difference is akin to expressing a distance of multiple miles in feet.

3.3 Potential Injection Aquifer Geochemical Characterization

The following comments from the Panel are provided in response to the Project Team’s request for feedback on the report on Potential Injection Aquifer Geochemical Characterization.

- The soil samples tested may have been oxidized during storage for many months prior to analysis; therefore, the results of the geochemical testing may not be representative of *in situ* conditions and should be investigated further.
- The geochemical report, or future presentations and/or reports on this topic, would be enhanced through the inclusion of a hydrogeologic cross-section indicating the aquifer(s) targeted for injection and the aquifer(s) and/or aquitard(s) from which the archived samples were retrieved for geochemical analysis.
- The non-stabilized deionized (DI) water used for the soil leaching analysis may not necessarily represent the “worst case” scenario of potential mineral leaching or dissolution. For example, the relatively low pH of DI water may not promote as much desorption of arsenic from metal oxide surfaces as would a higher pH water, depending on the oxidation state of the arsenic. Future soil leaching and/or column tests should be performed with a water quality that best approximates the quality of future injection water, especially for parameters such as pH, oxidation-reduction potential, and divalent cation concentrations.
- The Panel supports the four proposed follow-on activities: (1) geochemical modeling; (2) gathering available data; (3) bench-scale geochemical testing; and (4) additional geochemical mineralogical analysis. These activities should be conducted under the guidance of an aqueous geochemist familiar with the fate and transport of metals in groundwater.

3.4 Additional Recommendations

The Panel suggests that SqCWD consider implementing a large-scale pilot project to demonstrate the advanced treatment technologies, assess water quality, inform design parameters, and engage the public on the PUREWater Soquel project. At the same time, the Panel recognizes that the cost to implement a large-scale pilot is substantial. Although not needed to demonstrate feasibility or safety, a large-scale pilot would provide the following benefits:

- Reliable performance data useful for the final design and testing of MF and UF for the full-scale

system. The Panel could recommend which CECs to evaluate during the pilot.

- An *in situ* assessment of water quality challenges associated with purifying the trickling filter effluent supplied by the SCWWTF.
- An opportunity to build the capacity needed to operate the full-scale system and improve SqCWD's understanding of treatment capacity.
- An opportunity for SqCWD to obtain experience operating the proposed advanced treatment technologies, including experience for SqCWD operators. This training will facilitate the successful operation of the full-scale system for the PUREWater Soquel project.
- An opportunity for the public to tour the pilot facility and learn about the treatment processes and resulting water quality.

In lieu of constructing its own pilot, SqCWD could evaluate data from relevant pilots and/or projects collected by other agencies.

- Evaluating related data can provide insights on treatment and training opportunities for SqCWD operators.
- Operational and water quality data from other pilot-scale and full-scale facilities providing advanced treatment of trickling filter effluent (e.g., Pure Water Monterey, Groundwater Replenishment System in Orange County; see Section 3.1) would inform the planning and design of the full-scale system for the PUREWater Soquel project.
- In lieu of a pilot being conducted, it will be important for SqCWD to communicate early on with the State Water Resources Control Board on the requirements for start-up validation monitoring and operational performance testing in permitting the full-scale system for the PUREWater Soquel project.

APPENDIX A: PANEL BACKGROUND

About NWRI

For more than 20 years, NWRI – a science-based 501c3 nonprofit located in Fountain Valley, California – has sponsored projects and programs to improve water quality, protect public health and the environment, and create safe, new sources of water. NWRI specializes in working with researchers across the country, such as laboratories at universities and water agencies, and are guided by a Research Advisory Board (representing national expertise in water, wastewater, and water reuse) and a Board of Directors (representing water and wastewater agencies in Southern California).

Through NWRI's research program, NWRI supports multi-disciplinary research projects with partners and collaborators that pertain to treatment and monitoring, water quality assessment, knowledge management, and exploratory research. Altogether, NWRI's research program has produced more than 300 publications and conference presentations.

NWRI also promotes better science and technology through extensive outreach and educational activities, which includes facilitating workshops and conferences and publishing White Papers, guidance manuals, and other informational material.

More information on NWRI can be found online at www.nwri-usa.org.

About NWRI Panels

NWRI also specializes in facilitating Independent Advisory Panels on behalf of water and wastewater utilities, as well as local, county, and state government agencies, to provide credible, objective review of scientific studies and projects in the water industry. NWRI Panels consist of academics, industry professionals, government representatives, and independent consultants who are experts in their fields.

The NWRI Panel process provides numerous benefits, including:

- Third-party review and evaluation.
- Scientific and technical advice by leading experts.
- Assistance with challenging scientific questions and regulatory requirements.
- Validation of proposed project objectives.
- Increased credibility with stakeholders and the public.
- Support of sound public-policy decisions.

NWRI has extensive experience in developing, coordinating, facilitating, and managing expert Panels. Efforts include:

- Selecting individuals with the appropriate expertise, background, credibility, and level of commitment to serve as Panel members.
- Facilitating hands-on Panel meetings held at the project's site or location.
- Providing written report(s) prepared by the Panel that focus on findings and comments of various technical, scientific, and public health aspects of the project or study.

Over the past five years, NWRI has coordinated the efforts of more than 30 Panels for water and wastewater utilities, city and state agencies, and consulting firms. Many of these Panels have dealt with projects or policies involving groundwater replenishment and potable (indirect and direct) reuse. Specifically, these Panels have provided peer review of a wide range of scientific and technical areas related water quality and monitoring, constituents of emerging concern, treatment technologies and operations, public health, hydrogeology, water reuse criteria and regulatory requirements, and outreach, among others.

More information about the NWRI Independent Advisory Panel Program can be found on the NWRI website at www.nwri-usa.org/panels.htm

APPENDIX B: EXPERT PANEL MEMBER BIOGRAPHIES

Channah Rock, Ph.D. (Panel Chair). Channah Rock serves as a Water Quality Extension Specialist and Associate Professor in the Department of Soil, Water, and Environmental Science at the University of Arizona. Her research interests include microbiology, molecular biology, and wastewater treatment. She evaluates water quality for the protection of public health and promotes water reuse as a safe and practical resource. Her background in both microbiology and civil and environmental engineering has focused her work on understanding the factors that influence the survival of pathogens through water treatment and their persistence in the environment. Rock received a B.S. in Microbiology from New Mexico State University and an M.S. and Ph.D. in Civil and Environmental Engineering from Arizona State University. She conducted post-doctoral research at the U.S. Department of Agriculture's Agricultural Research Service.

Joseph Cotruvo, Ph.D., BCES. Joe Cotruvo is President of Joseph Cotruvo & Associates, an environmental and public health consulting firm in Washington, DC, and is active in the World Health Organization (WHO)/National Science Foundation (NSF) International Collaborating Centre for Drinking Water Safety and Treatment. Previously, he served as director of the Criteria and Standards Division of the U.S. Environmental Protection Agency (EPA) Office of Drinking Water, where his organization developed the Drinking Water Health Advisory System and numerous National Drinking Water-Quality Standards and Guidelines. He directed the EPA's Risk Assessment Division and was a former vice president for Environmental Health Sciences at NSF International. He is a member of the WHO Drinking Water Guidelines development committees, and led the recently published monograph, "Desalination Technology: Health and Environmental Impacts." He also led studies on bromate metabolism through the American Water Works Association Research Foundation and on recycled water contaminants for the WaterReuse Foundation. In addition, he chaired the Water Quality and Water Services Committee of the Board of Directors of the District of Columbia Water and Sewer Authority. Cotruvo also chaired the WaterReuse Association National Regulatory Committee. He received a B.S. in Chemistry from the University of Toledo and a Ph.D. in Physical Organic Chemistry from Ohio State University, and is Board Certified in Environmental Sciences.

Jason Dadakis, PG, CHG. Jason Dadakis is Director of Health & Regulatory Affairs for the Orange County Water District (OCWD) in Fountain Valley, California, where he has worked since 2004. He is responsible for managing regulatory compliance for groundwater recharge activities and recycled water projects, including the Groundwater Replenishment System, the largest potable reuse project of its kind in the world. He also coordinates and directs water quality monitoring programs and studies for surface water, groundwater, and recycled water. He has experience in the planning, development, and use of groundwater models and tracer tests for resource management and transport analysis. Dadakis received a B.A. in Earth Sciences from Dartmouth College and an M.S. in Hydrology from the University of Arizona. He is a licensed professional geologist and certified hydrogeologist in the State of California.

Michael Dourson, Ph.D., DABT, FATS, FSRA. Michael Dourson is Professor of Environmental Health in the Risk Science Center at University of Cincinnati College of Medicine. Before this position, he founded the Toxicology Excellence for Risk Assessment Center (TERA) in 1995 and served as director and/or

president for more than 20 years. He also held numerous leadership positions during 15 years of service with the U.S. Environmental Protection Agency. He has won several awards, including four bronze medals at EPA, the Arnold J. Lehman award from the Society of Toxicology, and the International Achievement Award by the International Society of Regulatory Toxicology and Pharmacology. He also has been elected as a Fellow of the Academy of Toxicological Sciences and as a Fellow for the Society for Risk Analysis. Dourson has co-published more than 150 papers on risk assessment methods or chemical-specific analyses, and co-authored well over 100 government risk assessment documents (including guidance texts), delivered more than 150 invited presentations, and chaired more than 150 sessions at scientific meetings and independent peer reviews. He was elected to multiple officer positions in the American Board of Toxicology (including its President), Society of Toxicology (SOT), and Society for Risk Analysis, and is the President of the Toxicology Education Foundation. In addition to numerous appointments on government panels, such as EPA's Science Advisory Board, he also serves as a media resource specialist in risk assessment for the SOT, and is a member on the editorial board of several journals. Dourson holds a B.A. from Wittenberg University and a Ph.D. in Toxicology from the University of Cincinnati.

Kara Nelson, Ph.D. Kara Nelson is a Professor in Civil and Environmental Engineering at the University of California, Berkeley. Her research program addresses critical issues at the intersection of public health and the environment, with a focus on reducing the threat posed by waterborne pathogens by improving our engineering infrastructure to make it more effective, affordable, and environmentally beneficial. Specific research areas include the mechanisms of pathogen inactivation, molecular techniques for pathogen detection, optimization of treatment processes, water reuse, and challenges with providing safe drinking water and sanitation in the developing world. Nelson has published over 50 articles in peer-reviewed journals, including two invited reviews, and one book chapter. She is the Director of Graduate Education at the National Science Foundation Engineering Research Center for Reinventing the Nation's Urban Water Infrastructure (ReNUWIt), and the faculty leader of the Research Thrust Area on Safe Water and Sanitation at Berkeley Water Center. Nelson was awarded the Presidential Early Career Award for Scientists and Engineers (PECASE) at a ceremony at the White House in 2004; this award is the nation's highest honor for scientists in the early stages of their career. She received a B.A. degree in Biophysics from University of California, Berkeley, an M.S.E. in Environmental Engineering from the University of Washington, and a Ph.D. in Environmental Engineering from University of California, Davis.

Gordon Thrupp, Ph.D., PG, CHG. Gordon Thrupp is a senior hydrogeologist at Geosyntec Consultants in San Francisco, California, and has more than 30 years of experience providing hydrogeological consulting services, including developing groundwater flow models, designing wells and hydraulic testing programs, and directing environmental investigations. Thrupp has developed, applied, and reviewed groundwater models for many water resources and engineering design applications, including: evaluating groundwater resource capacity; assessing hydraulic connection between surface water and groundwater; investigating the potential for contaminant migration and sea water intrusion; designing hydraulic containment alternatives; locating and designing municipal supply wells and coastal margin subsurface intakes; designing sewage and groundwater infiltration basins; assessing impact of open-pit mines on groundwater systems; and predicting groundwater seepage rates into excavations for dewatering feasibility studies. He received a B.S. in Geology from Stanford University and a Ph.D. in Earth Sciences from the University of California, Santa Cruz.

NATIONAL WATER RESEARCH INSTITUTE

Independent Advisory Panel for
Soquel Creek Water District's Groundwater Replenishment Project

AGENDA

Web-Enabled Conference Call (Meeting #1)

February 27, 2017

(1:00 pm to 3:00 pm PST)

Online Meeting:

GoToMeeting

Contact

Suzanne Faubl (NWRI)

(714) 378-3278 (office)

Meeting Objectives:

- Present an overview of the project
- Review the geochemical characterization report prepared by Brown and Caldwell
- Discuss the scope of work for the CEC Sampling Plan/Water Quality Study and solicit feedback from the Panel

Monday, February 27, 2017

1:00 pm	Welcome and Introductions	Jeff Mosher, NWRI and WE&RF, and Channah Rock, Panel Chair
1:05 pm	Overview of the Panel Process	Jeff Mosher
1:15 pm	Project Overview	Melanie Schumacher, Soquel Creek
1:35 pm	Groundwater Replenishment Feasibility Study	Lydia Holmes, Carollo Engineers
1:50 pm	Geochemical Characterization Study	Sunny Wang, Brown and Caldwell
2:00 pm	CEC Sampling Plan and Water Quality Study and proposed Bench-Scale Demonstration	Lydia Holmes
2:30 pm	Discussion and Q&A	Facilitated by Panel Chair
2:50 pm	Next Steps	Facilitated by Panel Chair
3:00 pm	ADJOURN	

APPENDIX D: PARTICIPANTS AT MEETING #1

Panel Members:

- Chair: Channah Rock, Ph.D., University of Arizona
- Joseph Cotruvo, Ph.D., BCES, Joseph Cotruvo & Associates
- Jason Dadakis, PG, CHG, Orange County Water District
- Michael Dourson, Ph.D., DABT, FATS, FSRA, University of Cincinnati
- Kara Nelson, Ph.D., University of California Berkeley
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