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OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

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WATER REUSE

Playing catchup—the slow and steady march of water reuse in New England

Membrane bioreactor for potable reuse—validation of a full-scale flat plate MBR for virus and protozoa removal

Potable reuse in Florida—how one small utility is making it happen

Sustainable Water Initiative for Tomorrow—groundwater replenishment in eastern Virginia

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Annual Conference
(pages 68–83)
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OUR ASSOCIATION WAS ORGANIZED NINETY-FOUR YEARS AGO in Hartford, Connecticut, on April 23, 1929, with the objectives of advancing the knowledge of design, construction, operation and management of waste treatment works and other water pollution control activities, and encouraging a friendly exchange of information and experience. From 40 charter members, the membership has steadily grown to more than 2,000 today. Membership is divided into the following classes:

Professional Member—shall be any individual involved or interested in water quality including any manager or other officer of a private waste treatment works; any person engaged in the design, construction, financing, operation or supervision of pollution control facilities, or in the sale or manufacture of waste treatment equipment.

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President's Message

My name is Bob Fischer. I am the water quality superintendent for the city of South Burlington, Vermont. I am honored to be the 93rd president of NEWEA—and only the second Vermonter in this office since 1929. NEWEA is one of the premier Member Associations in the Water Environment Federation (WEF), and our over 2,100 members include regulators, engineers, municipal operators and managers, contractors, manufacturer and supplier representatives, college faculty and students, and innovators of all skills in the Northeast, all dedicated to contributing their excellence to the water sector.

The theme of my presidency is One Water. The following supports this theme: NEWEA's Mission Statement notes "NEWEA's mission is to promote education and collaboration…"; article II of the original 1929 NEWEA Constitution states that one major object of the association should be "the encouragement of a friendly exchange of information and experience"; and in Vermont, the state flag carries the motto "Freedom and Unity," and the Green Mountain Water Environment Association (GMWEA) was chartered in 1994 as a joint association of clean water and drinking water professionals. One Water.

In my youth and early career, I had little knowledge of the water sector, but somehow life led me into it. After a boisterous high school career, with degrees in biology and history from the State University of New York College at Buffalo and some graduate work in fisheries at California's Humboldt State University, I worked as the assistant forest fishery biologist for the Eldorado National Forest. In the face of a federal funding reduction, I took an operator position at the Tahoe Truckee Sanitation Agency's advanced wastewater facility, where I soon learned the gritty details about water resource recovery facilities. Since then, I have done more for public health and the environment than my youthful self ever could have dreamed, and I have also come to realize that all water is One Water.

The theme of my NEWEA predecessor Fred McNeill focused on the successes of the first 50 years of the Clean Water Act in mitigating over 100 years of neglectful pollution. The massive federal funding of modern, advanced wastewater treatment allowed our waters to become fishable and swimmable again. Yet since the 1970s, federal investment in water has steadily declined, except for occasional influxes such as the recent American Rescue Plan Act (ARPA) and the Infrastructure Investment and Jobs Act (IIJA), but these are a "drop in the bucket" of what is needed to enable One Water.

As a professional freestyle skiing coach, I have trained athletes who have gone on to compete at World Cup and Olympic levels. The U.S. Ski Team motto is ONE TEAM, as cross-training among the various disciplines makes you stronger in your main discipline. Likewise, in many Vermont communities, the same operators are responsible for the drinking water, the stormwater, and the wastewater. One Water. Excellence in all things takes hard work and dedication, and mastering water sector skills is a prime example.

Wastewater and drinking water treatment were both developed to protect public health. We often focus on the environmental benefits of wastewater treatment, but we are also front-line protectors of public health. We are the defenders of One Water. Vermont is a small state, and many of us wear multiple "hats" including myself. I am licensed both as a Wastewater Operator and a Drinking Water Operator and have operated both clean water and drinking water facilities. One Water. We all know that failure is not an option for water quality operators, no matter what. For example, when a pipe breaks in a snowstorm, freezing crews work overtime to fix the pipe; when a pipe breaks in another location as service is restored, they work on. The public, seeing operator crews digging up a line, don't know if the problem is with clean water or drinking water. But we all know that failure is not an option; this is excellence—we protect One Water.

All sides of the water sector are facing increasing regulations with limited staff for regulators; increasingly complex engineering needs while capacity is strained; manufacturers and suppliers dealing with inflation and supply chain issues; aging infrastructure; limited contractor capacity; hiring and workforce development issues; climate resiliency challenges; asset management equity issues; and emerging contaminants—but because we protect the public health, failure is not an option. These issues are many and immense, but our best hope of addressing them is through collaboration. The famous Helen Keller, no stranger to adversity, stated, "Alone we can do so little, together we can do so much." One Water. Environmental advocacy groups, fishery and wildlife biologists, city and regional planners, regulators, operators, engineers—all share the same goal: drinkable, swimmable, fishable waters. One Water. NEWEA is setting an example for the Northeast and for the nation, tackling the difficulty in attracting new employees to the water sector by working to form a Work for Water New England Collaborative. It consists of NEWEA, New England Water Works Association (NEWWA), American Public Works Association New England Chapter (NE-APWA), and all the Northeast state water/wastewater associations, all of whom have provided substantial funding to start the collaborative, which is currently gearing up to start the training organization. One Water.

The New England Stormwater Collaborative of NEWEA, NEWWA, and NE-APWA has been advancing stormwater management in the Northeast for almost 10 years. One water. Water Week, the Washington, D.C. Fly-in, where each state meets with its delegation to discuss water

The congressional delegation broad view can become confused when two groups, clean water and drinking water, approach them separately over similar water infrastructure issues.

issues, has been attended by NEWEA for over 25 years. The congressional delegation broad view can become confused when two groups, clean water and drinking water, approach them separately over similar water infrastructure issues. In 2016, GMWEA clean water and drinking water representatives together met with the Vermont delegation in what may have been the first of such joint meetings in United States, and they were cooperatively encouraged and supported by both NEWEA and NEWWA. One Water. By contrast, although WEF, the National Association of Clean Water Agencies (NACWA), the WateReuse Association, and the Water Research Foundation are attending D.C. together during Water Week 2023, AWWA is scheduled nearly a month ahead, so this year there will be no opportunity for joint meetings.

Approximately 10 years ago, the National Ad Council, which produced such iconic commercials as the litter-stricken, tearful Indigenous American, approached WEF and AWWA offering to fund a multi-million-dollar advertisement campaign if the two organizations could produce one joint theme. They could not, and sadly the National Ad Council moved on. We should, and I hope and believe that we can, do better at coordinating as One Water sector. We in the Northeast must lead the way toward One Water or it may never happen. In this spirit, in recent years NEWEA, NEWWA, and NE-APWA have met regularly to further collaboration under the One Water theme.

NEWEA is an elite organization of this excellence across the six New England states, and as an operator I know that those pillars of excellence, the boots-on-the-ground operators, often cannot attend NEWEA conferences, because they must operate their systems. However, NEWEA conference participants—the regulators, engineers, vendors, operators, scientists, educators, and contractors—provide cutting-edge technical training and equipment exhibits that attendees can take back to their home systems to spread and share the excellence with those who stayed on guard, improving their systems and efficiencies. I may not reach excellence, but I know it when I see it.

I may not reach excellence, but I know it when I see it—and I see all of you working so hard, when you all have so much more to do than ever. And when I see many who take the time to volunteer, uncompensated, spending time away from families, working to further advance the One Water sector, I sense that nothing about that aim has changed since 1929. This is excellence. I know it when I see it.

I thank my family for abiding my volunteer efforts, the city of South Burlington for its continual support, the city of Montpelier for its support while they employed me, and all of you for all you do every day for the public health and the water environment. One Water.

From the Editor

Historically, our region has faced a drought once every 10 years.[1] But over the past decade, climate change has been causing things to change. Massachusetts recently experienced three droughts—during the summers of 2016, 2020, and 2022. And at the end of the summer of 2022, every New England state experienced drought as well.[2] These "flash droughts" may last only a few months, but they can have profound impacts on our water resources and public water supplies. At the same time, increased development is placing even more demand on these stressed water supplies.

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Enter water reuse. While the arid West soaks up (yes—pun intended!) all the attention on this, water reuse has a place in New England. Reclamation of water for non-potable sources—landscaping, flushing toilets—can reduce demand for water. And when we get too much rain (ahem, the summer of 2021), we can use rainwater as the source of reclaimed water.[3] Gillette Stadium and Patriot Place provide one great example of water reuse in New England.

Gillette Stadium and Patriot Place provide one great example of water reuse

In operation since 2003, their system includes a 250,000 gallon per day (950,000 L/d) capacity membrane bioreactor (MBR) that generates reuse water for flushing toilets and cooling facilities. Gillette Stadium and Patriot Place are saving millions of gallons of water annually and have reduced their discharge to the local wastewater treatment plant by 50 percent.[4]

During the next Patriots' halftime, you can rest easy knowing that when 68,000-plus fans visit the bathroom, they are no longer drawing on the water resources of Foxborough, a community with a significantly smaller population than the stadium's capacity. They're also reducing the strain on the wastewater treatment plant, which could not handle all those flushes during the intermission.

In this *Journal* edition, we have a great lineup of articles highlighting the multifaceted benefits of water reuse. In the first article, Carrie Del Boccio and Jay Sheehan lay out the main drivers for reuse projects and identify pathways for their expansion into New England. You will be happy to read that the University of Connecticut (UConn) is a leader in this space; reclaimed water is flushing toilets in all campus facilities constructed after their facility came online in 2013.[5]

The next article, by Larry Morris et al., highlights cutting-edge research regarding MBRs. In addition to total suspended solids and biological oxygen demand removal, research shows that they can remove pathogens as well. Could Patriot Place and UConn expand the use of their MBRs into direct potable reuse (DPR) once these technologies are validated? We hope so!

The next two articles highlight exciting projects on the eastern seaboard. Caryln Higgins and Andre Dieffenthaller detail how one city in Florida built support for DPR as an alternative water supply. As our agricultural sector feels the strain of drought, perhaps this will be a driver for our region. This edition's final article, by Andrew Newbold, describes a project in eastern Virginia that tackles not only water reuse, but nutrient loading, sanitary sewer overflows challenges, stormwater nutrient challenges, aquifer depletion, saltwater intrusion, and land subsidence. Sound familiar?

Also be sure to check out the Water Reuse Committee's spotlight. The committee has an excellent introduction to water reuse and nicely covers the applications here in New England.

Last, April is National Volunteer Month. Thank you to all who dedicate their time to NEWEA to help solve critical water problems in our communities. Whether you spend a few or more than a few hours, we always appreciate your work. And a special (read: shameless) thank you to all the volunteers who write articles for the *Journal*.

1. https://www.wbur.org/news/2022/08/26/climate-change-flash-drought-massachusetts. Accessed 3/5/2023.

2. https://droughtmonitor.unl.edu/Maps/MapArchive.aspx. Accessed 3/5/2023.

3. https://www.epa.gov/waterreuse/capturing-stormwater-source-water-reuse-resources. Accessed 3/5/2023.

4. https://nsuwater.com/portfolio-item/gillette-stadium-and-patriot-place/#tab-id-2. Accessed 3/5/2023.

5. https://www.tpomag.com/editorial/2016/10/uconn_reclaimed_water_facility_shows_campus_green_side. Accessed 3/5/2023.

Industry News

Under EPA's Clean School Bus Program competition, Fall River will get a rebate to offset the cost to purchase 11 clean school buses and charging infrastructure

Public Health Protection Investments Celebrated in Fall River

EPA Regional Administrator David Cash recently celebrated federal and state infrastructure investments in the city of Fall River that will improve public health for residents. Mr. Cash was joined by the Massachusetts Environmental Protection commissioner, Fall River's mayor, and members of Congress to highlight coordinated efforts to identify and replace lead service lines, make other needed water infrastructure upgrades, and celebrate the award of zero-emission electric school buses in the community.

"Thanks to unprecedented funding from Congress and the Biden Administration, EPA and our partners are making critical, investments to upgrade infrastructure and protect people's health in Fall River," said Mr. Cash. "These investments, from replacing diesel school buses with clean, zero-emission vehicles, to modernizing water infrastructure and removing lead from drinking water pipes, will provide tangible health benefits to this community for decades to come."

Clean Water and Lead Service Line Replacements

EPA highlighted several key clean water investments in Fall River. These projects will provide funding to identify and replace lead service lines for drinking water in the city. Under the Water Infrastructure Improvements for the Nation Act (WIIN Act), $10 million is being awarded to help the city replace public and private lead pipes, which connect to homes. This funding will also help the city comply with a settlement announced on November 29, 2022, with the Commonwealth of Massachusetts requiring the municipality to remove lead service lines following a lead-action-level exceedance. EPA is also awarding Fall River $100,000 to locate lead pipes and provide education about lead hazards in at risk neighborhoods.

EPA will provide Fall River technical assistance to help identify infrastructure needs, plan for capital improvements, build capacity, support community outreach, and apply for funding for the range of eligible projects.

Massachusetts Clean Water Projects

The Commonwealth of Massachusetts also announced that Fall River will receive around $4 million in State Revolving Fund (SRF) loans to advance important projects such as the planning study for the combined sewer overflow (CSO) treatment facility, the construction of a new booster pumping station at the Wilson Road Pump Station, the Geobase mapping of the water distribution system with a $150,000 asset management grant, and the development of the Lead Service Line Inventory and Revised Replacement Plan with a $750,000 loan that is expected to be fully forgiven once the project is completed. The Commonwealth has also allocated $9.4 million to fund electric school buses and charging stations in various communities across the state.

Zero-Emission Clean School Buses

Under EPA's Fiscal Year 2022 Clean School Bus Program competition, Fall River will get a rebate to offset the cost to purchase 11 clean school buses and charging infrastructure, worth up to $3,895,000, that will accelerate the transition to zero-emission vehicles and produce cleaner air in and around schools and communities. The Fall River award is among $29,570,000 being given to five school districts in Massachusetts this year. EPA's investment in zero-emission school buses highlights how they will reduce greenhouse gas emissions, save schools money, and better protect children's health. The investment will also drive demand for American-made batteries and vehicles, boost domestic manufacturing, and create good-paying jobs. This funding is part of a national total of nearly $1 billion, made available to aid 389 school districts, Tribes, and U.S. territories, and is resulting in the purchase of 2,400 clean buses nationally.

Note: All EPA industry news provided by EPA Press Office

EPA Proposes Adding Environmental Justice, Climate Change, and PFAS to National Enforcement and Compliance Initiatives

Earlier this year EPA announced it was seeking public comment (during a 60-day public comment period) on its proposal to address environmental justice, climate change, and PFAS contamination in its National Enforcement and Compliance Initiatives (NECIs). Every four years, EPA selects national initiatives to focus resources on serious and widespread environmental problems where federal enforcement can make a difference. These initiatives aim to protect human health and the environment by holding polluters accountable through enforcement and assisting regulated entities to return to compliance.

EPA proposes to continue four of the six current national initiatives during the fiscal year 2024–2027 cycle and return two of the current national initiatives to the core enforcement and compliance program. In addition, EPA proposes to address environmental justice concerns in all NECIs, and to add two new NECIs on mitigating climate change and addressing PFAS pollution, for the 2024–2027 cycle.

"We look forward to receiving public comment on our proposals, which include both familiar and emerging issues. Of particular importance, we have built environmental justice considerations firmly into every initiative to protect vulnerable and overburdened communities." said Larry Starfield, acting assistant administrator for EPA's Office of Enforcement and Compliance Assurance.

In selecting initiatives for the upcoming cycle, EPA will consider the three criteria to evaluate the existing and proposed new initiatives: 1) the need to address serious and widespread environmental issues and significant violations impacting human health and the environment, particularly in overburdened and vulnerable communities; 2) areas where federal enforcement can help ensure national consistency, promote a level playing field, and achieve compliance; and 3) alignment with EPA's Strategic Plan.

Proposed Initiatives

EPA proposes continuing the following four current NECIs in the 2024–2027 cycle:

1. Creating cleaner air for communities by reducing excess emissions of harmful pollutants
2. Reducing risks of accidental releases at industrial and chemical facilities
3. Reducing significant non-compliance in the National Pollutant Discharge Elimination System (NPDES) Program
4. Reducing non-compliance with drinking water standards at community water systems

EPA proposes returning these two current NECIs to the core enforcement and compliance programs:

1. Reducing toxic air emissions from hazardous waste facilities
2. Stopping aftermarket defeat devices for vehicles and engines

EPA proposes adding these two new NECIs:

1. Mitigating climate change
2. Addressing PFAS contamination

Comments on whether to add an NECI to address coal combustion residuals (CCR) pollution and/or lead contamination will also be received by EPA.

Name Change for Initiatives

While formal enforcement remains the key tool to address serious environmental problems and significant violations, as well as create general deterrence, EPA also uses various compliance assurance tools to achieve this objective. To reflect this comprehensive approach, EPA has changed the name of its priority initiatives from National Compliance Initiatives (NCIs) to NECIs.

Rule Finalized for Defining WOTUS and Restoring Fundamental Water Protections

EPA and the U.S. Department of the Army (the agencies) announced a final rule establishing a durable definition of "waters of the United States" (WOTUS) to reduce uncertainty from changing regulatory definitions, protect people's health, and support economic opportunity. The final rule restores essential water protections in place prior to 2015 under the Clean Water Act.

"When Congress passed the Clean Water Act 50 years ago, it recognized that protecting our waters is essential to ensuring healthy communities and a thriving economy," said EPA Administrator Michael Regan. "Following extensive stakeholder engagement, and building on what we've learned from previous rules, EPA is working to deliver a durable definition of WOTUS that safeguards our nation's waters, strengthens economic opportunity, and protects people's health while providing greater certainty for farmers, ranchers, and landowners."

The rule returns to a reasonable and familiar framework founded on the pre-2015 definition with updates to reflect existing Supreme Court decisions, the latest science, and the agencies' technical expertise. It establishes limits that appropriately draw the boundary of waters subject to federal protection.

More information, including a pre-publication version of the Federal Register notice and fact sheets, is available at EPA's WOTUS website.

Accompanying the issuance of the final rule, the agencies also released several resources to support implementation in communities across the United States. A summary of 10 regional roundtables was released that synthesizes key actions the agencies will take to enhance and improve implementation of WOTUS. These actions were recommendations provided during the 10 regional roundtables where the agencies heard directly from communities on what is working well and where there are opportunities for improvement. The roundtables focused on the geographic similarities and differences across regions and provided site-specific feedback about how the agencies were implementing WOTUS.

Playing catchup—the slow and steady march of water reuse in New England

CARRIE DEL BOCCIO, Woodard & Curran, Walnut Creek, California
JAY SHEEHAN, Woodard & Curran, Middletown, Connecticut

ABSTRACT | Expansion of water reuse has been slow in the Northeast, where the foremost driver, water scarcity, has been less broadly felt than in other regions. Areas with the most critical need have led the way in adopting both the infrastructure and regulatory structures to enable the growth of this increasingly valuable water conservation practice. As states in New England establish water reuse programs and guidelines, stakeholders can learn from established programs in other regions as well as from those in the Northeast. Examples from Florida, Connecticut, and California illustrate some of the obstacles and approaches to overcome them used across the country.

KEYWORDS | Water reuse, recycled water, water reuse permitting, New England water reuse, water reuse funding, Water Reuse Action Plan

Water reuse has been formally practiced in the United States since California passed the first regulations in 1918. However, expansion has been slow, especially in the Northeast where the foremost driver, water scarcity, has been less broadly felt than in other regions. It stands to reason that areas with the most critical need have led the way in adopting both the infrastructure and regulatory structures to enable the growth of this increasingly valuable water conservation practice.

There are no national regulations for water reuse, although EPA provided guidelines in 1992, so each state must develop its own regulatory structure and determine its own allowed uses (e.g., landscape irrigation, food crop irrigation, toilet flushing, groundwater recharge). As states in the Northeast establish programs and guidelines, water reuse project stakeholders can learn from other regions to guide implementation.

The number of water reuse projects has grown sporadically, with the strongest growth in recent years. According to the Bluefield Research April 2017 Market Insight report, *U.S. Municipal Wastewater Reuse: Project Pipeline Segmentation & Analysis, 2017–2030,* at the time nearly 600 water reuse projects were being developed; that did not include all the projects already online then.

Water reuse in the United States has been led by Arizona, California, Florida, and Texas. Several factors explain the differences between states, including water scarcity, state-level policy, funding availability, and historical experience.

A multi-agency federal group has taken on the task of advancing water reuse across the nation. The group's first action was to develop the National Water Reuse Action Plan (WRAP) published in February 2020, with a set of actions "to advance the consideration of reuse to improve the security, sustainability, and resilience of our nation's water resources, especially in the face of a changing climate" (EPA). Some actions are as simple as compiling state policies and approaches to water reuse (Action 2.1) and establishing a water reuse champion award program for private sector companies (Action 8.4). The latest information on the WRAP's progress can be found through quarterly updates by EPA or from the federal group's online portal: epa.gov/waterreuse/national-water-reuse-action-plan-online-platform.

DRIVERS OF REUSE PROJECTS

The necessary drivers for successful water reuse projects are intuitive, but it is worth stating them clearly. Perhaps the most obvious driver is water scarcity stemming from limited water resources, frequent droughts, or weather variability. Recycled water provides water purveyors with a reliable, drought-resistant, locally controlled supply.

A joint project between the city of Orlando and Orange County, Florida, Water Conserv II was the first water reuse project permitted by the Florida Department of Environmental Protection to irrigate crops produced for human consumption

The second driver is economic conditions that make water reuse attractive. A key factor is high or increasing costs for new water supplies, which often align with limited water resources, but can also arise where significant residential or industrial development is underway. Population growth creates more demand for water, places more pressure on water infrastructure, and increases the burden on the local water utility. Likewise, manufacturing or technology facilities require high-quality water to operate, driving up demand and putting upward pressure on water prices. Funding availability can also greatly influence the economic viability of water reuse. Often this takes the form of grants or low-interest loans to encourage reuse.

The third driver of successful reuse projects is a regulatory framework that encourages water recycling. This can include restrictions on water withdrawals, permitting limitations on effluent discharge, or a requirement to include reuse as part of water resource recovery plans. California is the leading example here, with strong policy drivers that make water reuse essential in municipal water resource planning and use.

When all three of these drivers align, the necessary and sufficient conditions for water reuse projects are in place. If only two are present, it is still possible to implement a project, but it requires a strong fourth driver: political will. With enough political support, the absence of one of the other three drivers can be overcome. Nationally, one outcome of the WRAP (Action 1.1) is a federal policy statement that supports and encourages water reuse in watershed-scale planning. With this policy statement, the federal agencies have signaled unified support for water reuse.

WATER REUSE ACROSS THE UNITED STATES

There is clearly an appetite for more water reuse, but because the regulatory, historical, and financial drivers vary so much from state to state and project to project, owners must be creative to move projects forward. Examples from Florida, California, and Connecticut illustrate some of the obstacles and approaches to overcome them used across the country.

Water Conserv II: Irrigation and Aquifer Recharge in Florida

Constructed in 1989, Water Conserv II is one of the largest water reuse projects in the world that combines irrigation and aquifer recharge via rapid infiltration basins. Launched as an innovative joint water reclamation project between the city of Orlando and Orange County, Florida, Water Conserv II pushed the state to become the first water reuse project permitted by the Florida Department of Environmental Protection to irrigate crops produced for human consumption.

Water Conserv II is a useful example for project stakeholders in areas like New England where most of the drivers for reuse are in place

The plant was designed to provide irrigation water to local orange groves. Water Conserv II was commissioned as an answer to the local water scarcity problem driven by agriculture, a growing population, and aquifer withdrawal limitations. The citrus groves provided an economic opportunity, with customers nearby willing to use reclaimed water for their crops. These drivers were bolstered by momentum at the city, county, and state level to explore reuse.

While Florida had not established water reuse permitting prior to Water Conserv II's construction, there were regulatory drivers that enabled water reuse policies to develop more broadly there. At the time, Florida required the elimination of discharges to surface waters at the water resource recovery facility serving the area—a mandate that water reuse helped satisfy.

Water Conserv II is a useful example for project stakeholders in areas like New England where most of the drivers for reuse are in place, but a state-level regulatory framework may not yet include these facilities. Water Conserv II paved the way for many other reuse projects in Florida and continues to provide a cost-effective, year-round supply of reclaimed water more than 30 years after it was built.

In partnership with the cities of Modesto and Turlock, Del Puerto Water District has delivered tertiary recycled water to California's agricultural lands since 2017

Del Puerto Water District Delivers Drought Resistance in California's Central Valley

While exciting advancements in potable reuse are happening in San Diego and Los Angeles, one of the largest recent non-potable recycled water projects in California came online in 2017 through a partnership of urban and agriculture needs in California's Central Valley. The cities of Modesto and Turlock partnered with an irrigation water district, Del Puerto Water District (WD), to bring 25,000 ac ft/year (3,084 ha m/year) of tertiary recycled water to agricultural lands through the North Valley Regional Recycled Water Program (NVRRWP).

The Delta-Mendota Canal is a constructed facility, but it is also listed as a Water of the United States and subject to Clean Water Act National Pollutant Discharge Elimination System permitting

The Del Puerto WD manages irrigation water for 45,000 acres (18,000 ha) of productive farmland parallel to a major federal canal, the Delta-Mendota Canal. Typical crops grown in the Del Puerto WD service area include tree crops such as almonds and apricots, feed crops such as oats and barley, and various others including tomatoes, broccoli, and wine grapes. Del Puerto WD has experienced major shortages and decreased reliability in the water it receives under its federal water service contract, so the need for reliable, drought-resistant, and locally controlled water was there. And with a federal nexus and a multi-year California drought, 1 percent loan interest financing and millions of dollars in grants were available as well.

The NVRRWP appeared to have elements of all three key drivers, but there was a regulatory twist waiting. While California has regulations covering recycled water use on food crops, the project fell outside the typical regulatory structure for recycled water. The Delta-Mendota Canal is a constructed facility, but it is also listed as a Water of the United States and subject to Clean Water Act National Pollutant Discharge Elimination System (NPDES) permitting. The project partners worked with the regional entity responsible for NPDES permitting and the U.S. Bureau of Reclamation to approve the new discharges to the Delta-Mendota Canal and the right to extract the recycled water from existing agricultural turnouts.

"The project has been an unqualified success," said Del Puerto WD General Manager Anthea Hansen. "We crafted an approach that allowed it to be permitted despite no real precedent for this kind of project. We are now delivering recycled water to our landowners, thanks to the creativity, organization, collaborative spirit, and hard work of the entire project team."

UConn Paves the Way for Water Reuse in Connecticut

The University of Connecticut (UConn) continues to expand approved uses of water reuse that reflect the challenges of implementing them in states where the regulatory framework has not been established. Similar to how Water Conserv II served as a regulatory pilot program for Florida, the UConn Reclaimed Water Facility (RWF) is driving regulatory progress with the State of Connecticut, as the university collaborates with the Connecticut Department of Energy & Environmental Protection (CTDEEP) to develop standards for water reuse in the state.

UConn has grown rapidly since the mid-1990s, thanks to substantial state investment to expand the campus. In turn, water demand has risen sharply, affecting not only UConn but several public schools, municipal buildings, businesses, and private residences that rely on a shared public water supply.

Two wells provide potable water for the campus. During drought conditions in 2005, the wells could not meet peak water demands. In response, the State of Connecticut and UConn collaborated to reduce water withdrawal rates.

In 2006, UConn began planning construction of the reclaimed water facility to reduce potable water demand and provide water for non-consumptive uses

To meet these new reduced withdrawal rates, UConn implemented additional conservation measures, including increased outreach to promote water conservation, sustainable design guidelines for any new on-campus construction, streamflow monitoring of the Fenton River, and withdrawal management protocols based on streamflow. However, the university recognized that conservation alone was not enough to meet the mandate and provide long-term protection of the community's water resources. In 2006, UConn began planning construction of the RWF to reduce potable water demand and provide water for non-consumptive uses.

Connecticut is one of the few states in the nation with no regulatory framework for water reuse, presenting a major obstacle. However, cooperation among university and state agency stakeholders has enabled the university to divert much of its wastewater for reuse.

Treated wastewater enters the RWF from the adjacent water pollution control facility (WPCF) and receives further treatment that includes auto-strainers, microfiltration, and UV disinfection. The recycled water then travels via a campus-wide distribution system to facilities engaging in approved uses.

Next door at the WPCF, recycled water is used for tank filling and cleaning. The campus central utility plant uses it for steam generation and cooling tower operations. Recycled water feeds the cooling system in UConn's Innovation Partnership Building, a campus hub for research and industry collaboration. To bring things full circle, this tertiary-treated effluent is used for toilet flushing in all campus facilities constructed since the RWF came online.

This system has enabled UConn to further its goals to reduce potable water use, relieve demand on its wellfields, and provide resources for future campus development, and it has underscored the university's sustainability mission. The RWF produces approximately 400,000 gpd (1.5 ML/d) of treated tertiary wastewater; the facility has the capacity to produce up to 1 mgd (3.8 ML/d).

Cooperation between UConn and CTDEEP has enabled the university to divert much of its wastewater to reuse

The existing recycled water distribution system on the campus can accommodate irrigation, and project stakeholders hope to use recycled water for lawns and landscaping soon. The university continues to work closely with CTDEEP to expand approved uses and establish permitting standards for recycled water in Connecticut, creating a path for other water reuse projects.

DISCUSSION

Programs like the WRAP signify strong momentum for reuse projects around the country. As more public and private organizations turn to water recycling to address water scarcity issues and improve operational sustainability, the regulatory landscape will continue to evolve to accommodate this shift. The preceding case studies outline several means of improving project outcomes and advancing water reuse that correlate with key drivers. As we look forward to additional reuse projects, we should:

Solve problems creatively. Given that reuse projects often involve multiple parties responsible for wastewater treatment and water resources management, there can be a lot of creative space to develop unique solutions. Employing water reuse to address discharge restrictions or to provide a new water supply when scarcity or mandates are limiting availability can provide a win-win solution for multiple parties.

Secure funding. With its ability to provide multi-party, multi-benefit solutions, water reuse is popular with funding agencies and politicians. The Infrastructure Investment and Jobs Act provided funds specifically for water reuse—$1 billion for programs in the western United States and $48 billion for nationwide water programs that can support water recycling projects (WateReuse 2022). California is combining its Drinking Water and Clean Water State Revolving Fund programs to finance recycled water projects targeted for potable reuse. Alternative water supply funding programs, like those offered in Florida, can fund recycled water projects. Drought-resiliency grants, green infrastructure grants and bonds, and community revitalization funds all have the potential to meet a state's primary goals with water reuse solutions. Look for unusual opportunities; if in doubt, ask the funding program administrator to clarify what is allowed.

Collaborate with regulators. Expanding into water reuse can be uncharted territory when your state has not developed its own regulations. When starting conversations with regulators, bringing a proposed solution instead of only asking questions can help get your proposed uses approved. Lean on the states that already have regulations to give your regulators vetted examples to build from. One great new tool out of the WRAP, the REUSExplorer, is an online resource for exploring reuse regulations by state and by proposed end use. Available on the internet, this tool can give you a place to start to understand your own state regulations and other examples you can use to initiate conversations with local regulators (see the water reuse section of epa.gov for more information).

CONCLUSION

While many states have not yet established clear roadmaps for water reuse projects, where there is a will, there is a way. Every water reuse facility that exists today began as a water scarcity or effluent management issue. As referenced in the WRAP, water utilities and private stakeholders across the United States can expect water scarcity to be an increasingly prevalent driver due to climate change—a factor that will likely introduce greater economic benefit to reusing water. Meanwhile, greater adoption of this technology and initiatives like the WRAP will help to fulfill the third driver—a supporting regulatory framework.

Just as non-potable reuse has grown over recent decades, many areas that have installed non-potable systems are now looking to potable reuse as a method to conserve water resources. California, Arizona, Florida, Colorado, and Texas are developing regulations for direct potable reuse to meet the ever-growing demand while many areas of the country are starting to experience water scarcity, leading to the creation or expansion of reuse projects in places like Georgia, Oklahoma, Nevada, and New Mexico.

Fortunately, water scarcity is still a distant threat for most of the Northeast. As potable and non-potable water reuse technology, funding, and regulations progress, New England will continue to benefit from the paths laid by those in drier climates.

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Membrane bioreactor for potable reuse—validation of a full-scale flat plate MBR for virus and protozoa removal

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ABSTRACT | Pathogen removal performance of membrane bioreactors (MBRs) is critical to assess the technology's potential in potable reuse treatment. MBRs present a technological advancement for these treatment trains compared to conventional activated sludge plants due to their ability to produce reuse quality effluent and their concise size. MBR effluent, devoid of total suspended solids and low in biochemical oxygen demand and turbidity, should be scrutinized for pathogen removal as well, as effluent with these qualifications will suit downstream potable reuse treatment technologies, such as reverse osmosis. To this end, a 10-year-old, microfiltration flat plate-style MBR wastewater treatment plant in Northern California, with no history of membrane replacement, was subjected to MBR validation testing for potable reuse. Human pathogens *Cryptosporidium, Giardia,* enterovirus, and adenovirus were examined over two years at the MBR facility and determined to be thoroughly removed from influent wastewater with average log_{10} reduction values of 4.2, 5.2, 4.1, and 4.1, respectively. In addition to human pathogens, surrogate microorganism removal performance was also examined to assess the validity of using surrogates to represent their corresponding human pathogens (based on similar size). the surrogate microorganisms investigated were *Clostridium perfringens* representing *Cryptosporidium* and *Giardia*, with male-specific and somatic coliphages and pepper mild mottle virus representing enteric viruses.

KEYWORDS | Membrane bioreactor, microfiltration, flat plate, pathogen, potable reuse

Water scarcity is a growing issue. Driving water scarcity is climate change and its related issues, meaning more reliable water sources must be established in many areas. The U.S. Drought Monitor indicates that large areas of the western and central United States are experiencing severe, extreme, and even exceptional drought conditions.[1] Parts of New England are also being reported as abnormally dry by the U.S. Drought Monitor; this follows a trend of waterbodies east of the American West and Great Plains, such as the Mississippi and Ohio rivers, experiencing dry and moderate drought conditions.[2, 3]

Water scarcity has governmental entities exploring alternative sources for drinking water, and regulating agencies, such as the California Division of Drinking Water (CA DDW), are pursuing non-traditional water sources.[4] One sustainable option would be to recycle wastewater and reuse it as drinking water—that is, potable reuse.

Potable reuse has suffered from negative public response to such slogans as "toilet to tap,"[5] but in more recent (and dire) times, potable reuse has had a resurgence in popularity due to its high-quality, sustainably produced water. Indeed, recycled wastewater for public consumption has been shown by some studies to be of higher quality than conventional surface drinking water.[6] The posited question becomes how we include technologies such as membrane bioreactors (MBRs) in potable reuse treatment trains.

The answer is multifaceted and centered around technology validation and water quality regulations. Beginning with the latter, potable water must meet the Safe Drinking Water Act's federal drinking water requirements; however, recycled water must also meet state-level requirements. In California, where the study in this paper was conducted, direct potable reuse (DPR) and indirect potable reuse (IPR) have quality requirements that are based on log_{10} removal values (LRVs) of the technologies used within the treatment trains. DPR must meet criteria of 20-log removal of enteric viruses, 14-log removal of *Giardia*, and 15-log removal of *Cryptosporidium*;[7] meanwhile, IPR criteria follow the 12-, 10-, 10-log removal (virus, *Giardia*, and *Cryptosporidium*, respectively) rule. To reach the DPR criteria, many technologies are required, such as MBRs, reverse osmosis (RO), biologically active carbon filtration, activated carbon, chlorine, ultra-filtration, ultraviolet/advanced oxidation process (UV/AOP), ozone, etc., whereas IPR would require only MBR, RO, UV/AOP, and a buffering zone prior to distribution, such as recharging an aquifer. In Massachusetts, only IPR has been approved for planned potable reuse, and each site must be reviewed case by case.[8]

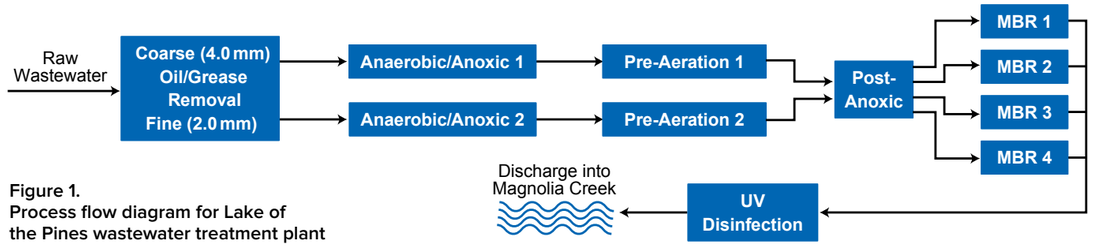

Figure 1.
Process flow diagram for Lake of the Pines wastewater treatment plant

Pathogen removal performance is normalized and represented on the log base-10 scale, as an LRV, due to the varying and high concentrations in the untreated wastewater, relative to the MBR filtrate, or treated water. This transformation is shown in the equation below:

$$LRV = \log_{10}\left[\frac{Concentration\ in\ Untreated\ Water}{Concentration\ in\ Treated\ Water}\right]$$

LRV is convenient and to the point in expressing pathogen removal performance for technology validation, although the performance of the MBR can be observed from the actual pathogen concentration in the MBR filtrate.

In a potable reuse treatment train, each technology must be validated according to its performance, which includes scrupulous testing and analytical criticism. The validation testing in this paper follows the *Membrane Bioreactor Validation Protocols for Water Reuse*, published by The Water Research Foundation.[9] Essentially, this publication presents a tiered validation method for MBRs:

- **Tier 1**: LRV credits granted to MBRs, 1.0 for virus and 2.5 for protozoa (*Giardia* cysts and *Cryptosporidium* oocysts), based on an exhaustive review of available literature
- **Tier 2**: Challenge testing of a specific technology to determine LRVs based on the most conservative, expected operating conditions
- **Tier 3**: Demonstration of LRV correlation of pathogens with surrogate parameters intended to be measured online during ongoing operation

For Tier 2 challenge testing in California, MBRs require validation before including the technology in potable reuse treatment trains, if credited LRVs higher than Tier 1 values are desired. For future DPR process schemes, this will likely be essential due to CA DDW's high removal requirements. Concerning public health, a conservative 5th percentile LRV will be the credited value to the technology for removal of a given pathogen.

Following the Tier 2 guidelines, validation testing was completed at Lake of the Pines wastewater treatment plant (WWTP) in Auburn, California, a full-scale MBR facility with microfiltration flat plate, submerged membrane units. The WWTP has a capacity of 1.2 mgd (4.54 ML/d) with a five-stage Bardenpho (double denitrification) process including MBRs (final aeration), followed by UV disinfection and membrane thickening for sludge handling. Figure 1 depicts the process flow at the Lake of the Pines WWTP. This study analyzed MBR permeate only. The pathogen LRVs for human viruses (adenovirus, enterovirus, and noroviruses) and protozoa (*Cryptosporidium* and *Giardia*) exceed the Tier 1 default values. Average LRVs are >4.2 for *Cryptosporidium*, 5.2 for *Giardia*, and 4.1 for enterovirus.[10]

In addition to Tier 2 validation testing, surrogate microorganism testing was conducted to establish any correlation(s) with pathogen removal. *Clostridium perfringens* spores (*C. perfringens*) were assessed against protozoa due to size similarity. Male-specific and somatic coliphages, and pepper mild mottle virus (PMMoV) removals were compared to enteric virus removal due to size similarity with enteric viruses (see Table 1, next page, for size comparison of pathogens and surrogate microorganisms). Coliphages are a typical surrogate for virus monitoring in wastewater treatment, while PMMoV is relatively new; it is a non-pathogenic virus to humans, infecting only peppers. Resulting from a

Table 1. Pathogen and surrogate microorganism sizes

Pathogen/Microorganism	Size (µm)
Cryptosporidium	0.5 – 5 (spore diameter)
Giardia	5 – 18 (spore diameter)
Enterovirus	0.090 – 0.100
Adenovirus	0.020 – 0.030
C. perfringens (surrogate for *Cryptosporidium* & *Giardia*)	0.9 (spore diameter)
Male-Specific Coliphages (surrogate for enteric virus)	0.022 – 0.026
Somatic Coliphages (surrogate for enteric virus)	0.022 – 0.200
PMMoV (surrogate for enteric virus)	0.318 x 0.018

high consumption of pepper-based products (e.g., hot sauces), the concentration of PMMoV is high in human fecal matter and therefore a potential candidate to monitor pathogens at WWTPs. PMMoV is rod-shaped with an approximate length of 318 nm and diameter of 18 nm.[11]

Surrogate correlations are arduous to confirm due to the several operative removal mechanisms in MBRs; absorption into and adsorption onto sludge flocs (pathogens and surrogates being removed by wasting), entrainment from the membrane, fouling onto the membrane (often called the biofilm or dynamic fouling layer), and finally bio-predation. The study's conclusions are based on the similarity of LRVs and/or final MBR filtrate concentrations.

MATERIALS AND METHODS

Below we discuss the sampling site, pathogen and indicator microorganism sampling, laboratory analysis, and data analysis.

Sampling Site

Sampling was performed at Lake of the Pines WWTP as part of the Tier 2 validation testing and surrogate microorganism testing. Figure 1 (previous page) illustrates the treatment process and sampling locations. Raw wastewater samples were taken after the fine screens (2 mm) and before the anaerobic zone. MBR filtrate samples were obtained directly from the MBR 1 permeate header via a spigot installed by the operations staff for this study; therefore, results are of one MBR train but can be considered to represent the combined MBR effluent. The submerged membrane units installed at Lake of the Pines WWTP are 14 ft high x 1.9 ft wide x 9.6 ft long (4.29m x 575 mm x 2.925 m) microfiltration style units with nozzle-outlet, flat plate, chlorinated polyethylene membranes with an average pore size of 0.2 µm, and 1.45 m^2 of filterable surface area.

Grab samples were acquired for influent wastewater characterization, while composite samples were required for the MBR filtrate due to the low and often undetectable concentrations in the filtrate. Although Lake of the Pines has four MBR basins, only MBR 1 filtrate was scrutinized for pathogen removal performance.

Pathogen and Indicator Microorganism Sampling

The sampling protocol followed the Tier 2 guidelines for MBR validation in WRF 4997.[9] The protocol includes 24 sampling events over a minimum of three months, capturing raw wastewater and MBR filtrate to be analyzed for *Cryptosporidium*, enterovirus and microorganism surrogates, *C perfringens,* male-specific and somatic coliphages.[6] *Giardia* can also be sampled in parallel with *Cryptosporidium* as it is captured by the same filter and is analyzed by the same EPA method (see Laboratory Analysis section below). PMMoV was chosen as an additional virus surrogate due to its prevalence in wastewaters across the country.

Cryptosporidium and *Giardia* samples were concentrated from the MBR filtrate in the field using a polyether sulfone-based membrane with a 1.0 µm pore size for capturing protozoa. Pathogenic virus samples were concentrated from the MBR filtrate in the field using a nanoceram filter (pore size < 30 nm). Grab samples of filtrate were taken for the indicator microorganisms *C. perfringens*, male-specific and somatic coliphages, and total coliform during pathogenic microorganism sampling. Pathogen and microorganism samples were shipped overnight on ice to a third-party laboratory for analysis.

Laboratory Analysis

Cryptosporidium and *Giardia* were analyzed according to EPA Methods 1693 and 1623 for raw and permeate samples, respectively. Quality assurance was performed using colorseed analysis, and recovery adjustment was applied to the final concentrations and LRV results. Enteric, norovirus, and total culturable viruses were analyzed by EPA Method 1615; analysis for adenovirus was performed similarly as applicable.

Male-specific and somatic coliphages were analyzed according to the Adams method.[12] PMMoV was analyzed by a university laboratory using conventional reverse transcription quantitative real-time polymerase chain reaction (RT-qPCR) analytical methods and recovery techniques.

Data Analysis

Data fitting was performed in Excel identically to that used in WRF 4997.[9] Probability plots were prepared from available data. Censored data were substituted to take the numerical value of the detection limit without censoring. If more than three values were certain data (i.e., not censored) then an additional fit was made to extrapolate through censored data.[10] Recoveries were incorporated into LRV transformation if the original measurement (raw wastewater or MBR filtrate) was above the detection limit.

RESULTS

General

MBR pathogen removal performance and surrogate correlation hinge on continuously detectable concentrations in the influent wastewater as well as the filtrate. In many instances it was found that the MBR filtrate concentrations of pathogens fell below the detection limit and were therefore reported as conservative estimates. As an example, *Cryptosporidium* was never detected in the MBR filtrate, and was detected only in the influent in 10 out of 24 sampling events. All other organisms were detected in the feed wastewater for each event.

RT-qPCR was to be the champion of virus data quantification in this study, but due to issues (e.g., inhibition, etc.) the results were scant as only 11 of 17 MBR filtrate samples were accurately analyzed. Conventional culturing, however, was reliable in determining 5th percentile LRVs for the microfiltration membranes. It was fortunate that EPA-approved methods were used, as they mandate both PCR- and culture-based methods.

Virus and Protozoa Removal Performance

The Monte Carlo analytical method was used to determine a wider breadth of probability as well as a more definitive 5th percentile. The 5th percentile LRVs for each of the human pathogens—*Cryptosporidium*, *Giardia*, and culturable enterovirus—well surpassed the Tier 1 LRVs, with values of > 3.0, 3.3, and 2.7–2.8, respectively.

While California is concerned with validating technology and granting LRVs based on conservative 5th percentile results, these do not necessarily indicate the MBR's full performance. Table 2 shows the mean, standard deviation, and 95th percentile same-day paired results. Average LRVs of the pathogens in question ranged 4.1 to 5.2, while 95th percentile results were upward of 5.9 for *Giardia*, 4.7 for *Cryptosporidium*, and 5.7 for culturable enterovirus. These results indicate the MBR performance is robust and suitable in potable reuse treatment trains.

Surrogate Microorganism Correlation with Pathogen Removal

Ideally, surrogate microorganisms are conservative estimates of actual pathogen removal, meaning that surrogate LRVs are actually lower than pathogen LRVs. The reason for this is to reliably estimate that the technology is performing better than indicated. Pathogen testing is costly, with Tier 2-type testing costing hundreds of thousands of dollars for analyses alone; surrogate testing meanwhile is affordable, but must provide results that represent pathogen removal.

Table 2. Pathogen and surrogate microorganism same-day paired results

Pathogen/Microorganism	Average LRV ± σ	95th Percentile LRVs
Cryptosporidium	4.2 ± 0.5	4.7
Giardia	5.2 ± 0.6	5.9
Enterovirus Culture	4.1 ± 0.9	5.7
Adenovirus Culture	4.1 ± 1.0	5.5
C. perfringens (surrogate for *Cryptosporidium* & *Giardia*)	5.0 ± 1.3	6.7
Male-Specific Coliphages (surrogate for enteric virus)	4.6 ± 0.6	5.4
Somatic Coliphages (surrogate for enteric virus)	4.6 ± 0.9	5.7
PMMoV (surrogate for enteric virus)	5.2 ± 0.9	6.8

Figure 2 (next page) displays the same-day paired, 5th percentile, average, and 95th percentile LRVs for pathogens and surrogate microorganisms. A clear conservative estimate from *C. perfringens* for *Giardia* and *Cryptosporidium* can be observed at 2.8-log for the 5th percentile LRV, although the average and 95th percentile LRV results for *C. perfringens* are much higher than those of *Cryptosporidium*. On average though, *C. perfringens* could be a slightly conservative estimate for *Giardia* removal.

Somatic and male-specific coliphages show a similar display of correlation to enteric virus; however, 5th percentile LRVs were slightly higher than enterovirus (3.1), at 3.2 and 3.3, respectively. Coliphages and adenovirus shared a similar story to enterovirus, albeit with a lower 5th percentile LRV of 2.7 for adenovirus.

Surrogate correlations hinge on monitoring as a reliable stand-in for the corresponding pathogen; while there can be agreement comparing results from an entire study, plant operators will be comparing results daily. Results from this study did not show a one-to-one relationship for any pathogen–surrogate pair. The closest relationship was between the LRV for the pathogen *Cryptosporidium* and the surrogate *C. perfringens*, with a Pearson's R^2-value of 0.66 (Figure 3, page 25).

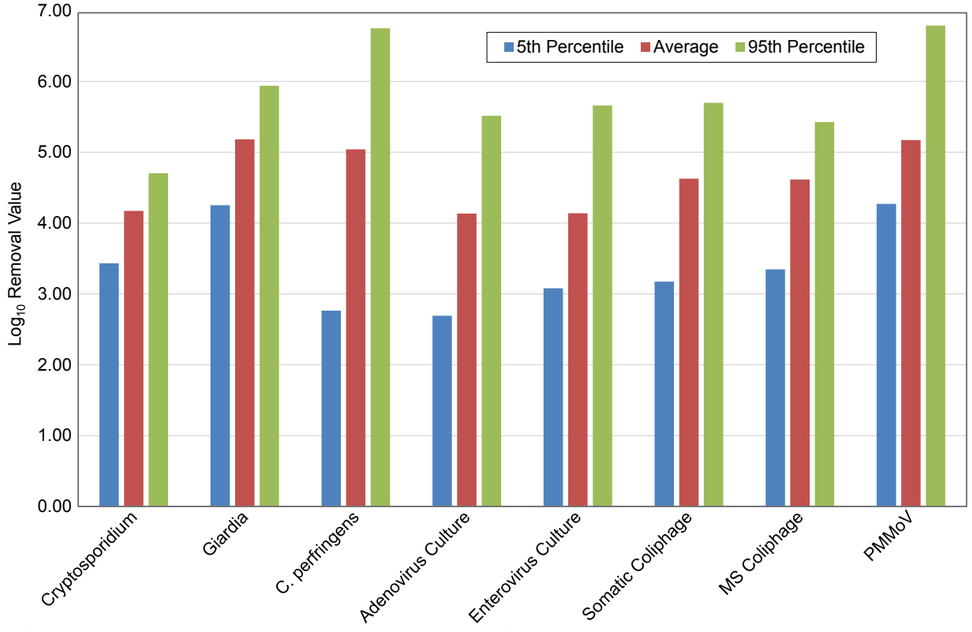

Figure 2. Same-day paired 5th percentile, average, and 95th percentile log_{10} removal values

Figure 4 illustrates PMMoV concentrations in the raw wastewater and MBR filtrate; results show an elevated 5th percentile LRV of 4.3 and average LRV of 5.2 (Figure 2). This cannot serve as a conservative estimate for enterovirus removal, but may indicate a higher echelon of the microfiltration membrane's pathogen removal performance. While the length of PMMoV is on the order of 300 nm, the rod-shaped virus is merely 18 nm in diameter, easily allowing it to fit through a bare membrane pore. As indicated earlier, the membrane is covered by a biofilm that aids in filtration and creates an effective pore size capable of excluding such sub-microscopic entities as viruses. Indeed, 95th percentile removal performance for PMMoV was 6.8-log, indicating high performance from the flat plate membrane.

CONCLUSIONS

When sampling began, Lake of the Pines WWTP membranes had been in continuous operation for nine years without reported damage or replacement. Pathogen removal results indicate robust removal from the microfiltration MBR over the two-year period of sampling, involving membranes near the end of their 10-year lifespan. Average LRVs exceeding 4.0-log_{10} demonstrate that this treatment technology is suitable for potable reuse treatment trains and will be vital to supplementing depleted water supplies around the country.

Great care and patience should be taken when considering implementing a protocol such as the one in this paper. The analyses are costly, as is the time required for sampling; composite sampling of the MBR filtrate can take an entire shift to filter an appreciable volume of water that will yield results above the detection limit.

Same-day paired LRVs indicate reliable pathogen removal over the lifespan of the microfiltration flat plate membranes studied. Monte Carlo 5th percentile LRVs for permitting in California exceeded the Tier 1 LRVs of 2.5 for protozoa and 1.0 for viruses with > 3.0-, 3.3-, and 2.7-2.8-log_{10} for *Cryptosporidium*, *Giardia*, and culturable enterovirus, respectively. Pathogen removal correlation with typical removal of microorganism surrogates (*C. perfringens* and coliphages) was limited at best. *C. perfringens* could hold as a conservative surrogate for *Giardia* using 5th percentile same-day paired results, but could not necessarily be a conservative surrogate for *Cryptosporidium*. Coliphages shared similar results with both enterovirus and adenovirus, with both 5th percentile and average same-day paired LRVs falling within standard deviations; however, a clear-cut conservative estimate could not be established.

MBRs show promise for potable reuse treatment trains due to their unparalleled, high-quality effluent, condensed footprint (higher solids concentrations relative to conventional activated sludge plants), compatability with biological nutrient removal treatment processes, and ability to remove pathogens efficiently.[13,14]

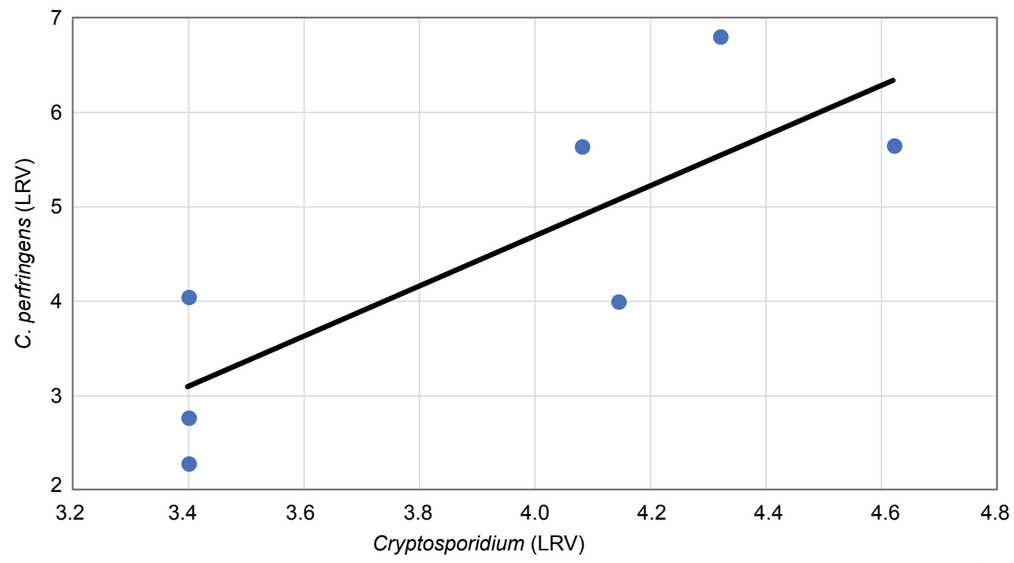

Figure 3. *C. Perfringens* and *Cryptosporidium* lack of correlation from same-day sampling events with a Pearson's R^2 coefficient of 0.666

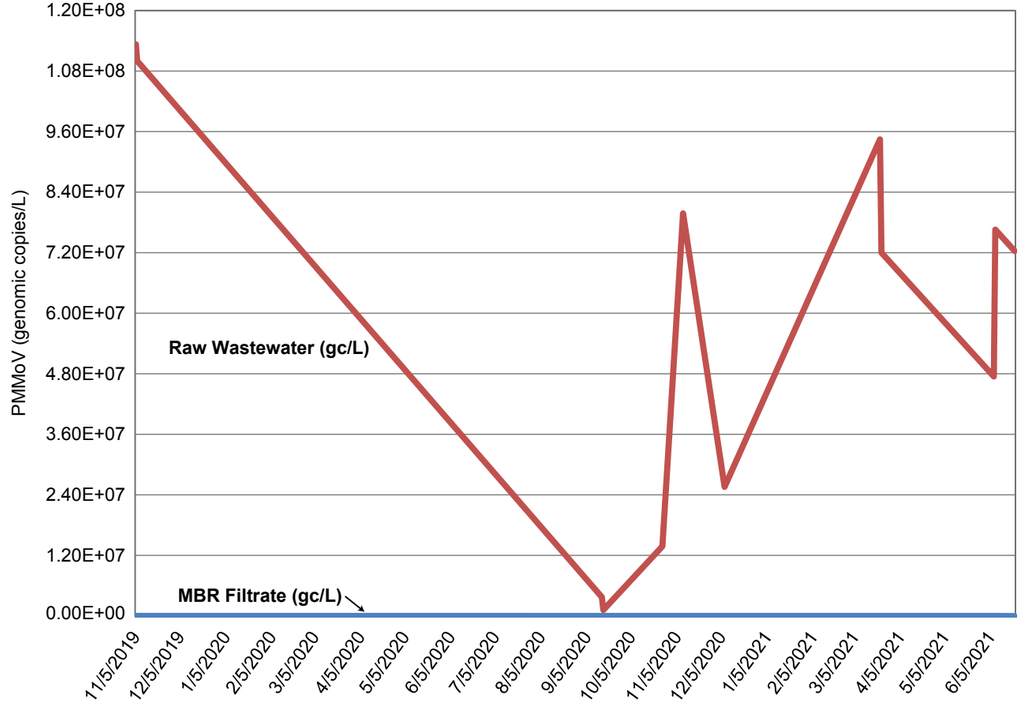

Figure 4. PMMoV concentrations in raw wastewater (red) and MBR filtrate (blue) displayed in units of genomic copies/L

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Potable reuse in Florida—how one small utility is making it happen

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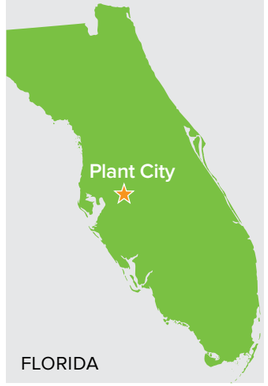
ANDRE DIEFFENTHALLER, PE, Hazen and Sawyer, Tampa, Florida

ABSTRACT | Plant City is a small, agricultural-based community in greater Tampa Bay faced with both water supply limitations and effluent management challenges. The city launched an integrated water management plan, which includes increased water supply through potable reuse. To evaluate the feasibility of using treated wastewater effluent as a potential alternative source for drinking water, Plant City conducted a potable reuse pilot study consisting of membrane filtration, reverse osmosis, and ultraviolet advanced oxidation. The year-long pilot study demonstrated that the purified water quality met current and anticipated pending regulations. The study also identified key design parameters for the full-scale potable reuse design. The city's comprehensive public outreach program succeeded in gaining support for potable reuse as an alternative drinking water supply.

KEYWORDS | Potable reuse, Florida, Plant City, pilot, public outreach, regulations



Plant City is known for abundant berry production and the annual Strawberry Festival, which brings thousands to the area to engage in rodeo-like activities, listen to music from national headliners, and enjoy strawberry shortcake. The city also owns and operates an integrated water, sewer, and reclaimed water utility. Located on the eastern outskirts of the Tampa Bay area in Florida, Plant City expects significant population growth over the next 20 years, prompting an increased water demand that will eventually surpass the existing water supply.

The city has limited expansion opportunities with its current groundwater potable supply due to its location within the Dover Plant City Water Use Caution Area, an established 259 mi² (671 km²) area with restrictions for new groundwater withdrawals to protect the limited local aquifer levels from excessive drawdown. Therefore, the city must identify alternative drinking water sources to satisfy increasing demand. It intends to remain independently water secure, while also acknowledging the potential for mutually shared resources. Using an integrated water management approach, the city developed a project that incorporates stormwater treatment, mitigation of localized flooding, rehabilitation of a natural habitat park, and increased water supply through potable reuse. The program's objectives are to increase water supply while restoring hydrologically impacted wetlands and enhancing the beneficial reuse of high-quality reclaimed water. As part of the feasibility phase, the city evaluated potable reuse by investigating the effectiveness of technologies to further treat reclaimed water with the goal of increasing the drinking water supply.

Florida's regulations require a pilot to demonstrate performance for intended potable reuse. The state has been a hot spot for testing potable reuse, with at least 12 Florida utilities having conducted pilots or demonstrations in the last decade (Florida Potable Reuse Commission, 2019). However, the city is unusual as one of few in Florida to pilot potable reuse while adhering to draft Florida Department of Environmental Protection (FDEP) statewide potable reuse regulations. Continued discussions with FDEP have confirmed that the city is collecting the appropriate data for future permitted full-scale implementation. These discussions with FDEP have helped shape and finalize the statewide potable reuse rules and regulations. Although a smaller utility (the water reclamation facility has a maximum capacity of only 10 mgd [38 ML/day]), the city is paving the way for implementing a full-scale potable reuse process in Florida and demonstrating a small community's holistic water management strategy for the future.

POTABLE REUSE CONSIDERATIONS

The pilot and subsequent full-scale potable reuse facility will treat reclaimed water to meet all regulated chemical and pathogen concentrations for drinking water, while also monitoring unregulated contaminants. The city considered both membrane- and non-membrane-based potable reuse treatment. The two treatment approaches have been studied and used at other pilot- and full-scale facilities across the United States and in Florida. Criteria for potable reuse treatment include efficacy, potential draft regulatory changes, waste stream disposal, operation and maintenance, and lifecycle cost of the facility.

An initial effort to evaluate potable reuse examined the city's wastewater effluent water quality over time to determine the appropriate treatment. The effluent's average conductivity was close to 900 µS/cm, with seasonal variations including concentrations as high as 1,200 µS/cm, shown in Figure 1. Elevated conductivity levels correspond to a total dissolved solids concentration of greater than 500 mg/L, which would constitute an exceedance of the secondary drinking water standard in Florida. Therefore, the higher salt content in the source water drove the need for salt removal using high-pressure membrane technology such as reverse osmosis (RO).

To permit a potable reuse treatment facility, the process train must reliably achieve a certain log inactivation of pathogens. Although the pathogenic log removal requirement for potable reuse treatment in Florida has not been finalized, the piloted unit process was chosen based on draft FDEP regulations and comparable regulations in California and Texas. Table 1 shows the log removal requirements for the membrane-based potable reuse treatment system consisting of membrane filtration (MF), RO, and the ultraviolet advanced oxidation process (UV/AOP). Using the credit given by other state regulations (e.g., California), the potable reuse process achieves log-removal of 12, 12, and 15 for virus, *Cryptosporidium*, and *Giardia*, respectively. The potable reuse treatment train provides barriers against both chemical constituents and pathogens to protect human health. This multi-barrier train is recognized as a validated treatment approach for potable reuse and has been piloted elsewhere in Florida. EPA recognizes the RO-based technology approach for potable reuse treatment, and it has been implemented and verified in potable reuse treatment facilities throughout the United States, Europe, Africa, and Australia.

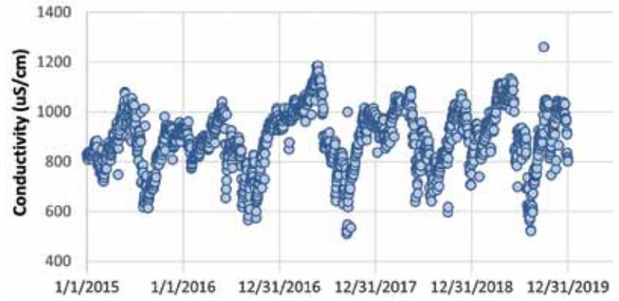


Figure 1. City wastewater effluent historical conductivity

Table 1. Assumed log removal values for potable reuse processes based on California regulation

Process	Virus	*Cryptosporidium*	*Giardia*	Trace Organics
MF	0	4	4	
RO	2	2	2	✓
UV/AOP	6	6	6	✓
Storage with Cl	4	0	3	
Total	12	12	15	

The pilot treatment was selected to treat water suitable for either indirect or direct potable reuse. Indirect potable reuse consists of advanced treatment followed by a natural buffer such as groundwater recharge or surface water augmentation. Direct potable reuse eliminates the natural buffer and sends treated water directly to the potable distribution system. Once Florida's regulations are finalized, additional treatment may be required for direct potable reuse. To better characterize the near- and long-term implications of indirect versus direct potable reuse, the city coupled the pilot study with groundwater modeling. It did so to optimize location and sizing for recharge and withdrawal wells should the aquifer be an environmental buffer. The potential of recharged water to supply not only the city but also other local authorities without interconnecting infrastructure may drive the project toward indirect potable reuse. However, the pilot aimed to validate the current treatment; the terminus of the alternative water supply will be decided after the pilot.

PILOT PLAN GOALS AND OBJECTIVES

The city's pilot testing program aimed to achieve the following goals:

- Meet the regulatory requirements of the FDEP Florida Administrative Code 62-610.564 in its existing form and proposed draft form in the potable reuse rulemaking process
- Establish preliminary design and operating criteria for the full-scale process
- Provide an educational demonstration for public officials, regulators, schools, community groups, and the public
- Provide operator training for operation and maintenance of the process

The city established a water quality sampling plan and treatment process operational guide for the procedure required to meet the piloting goals.

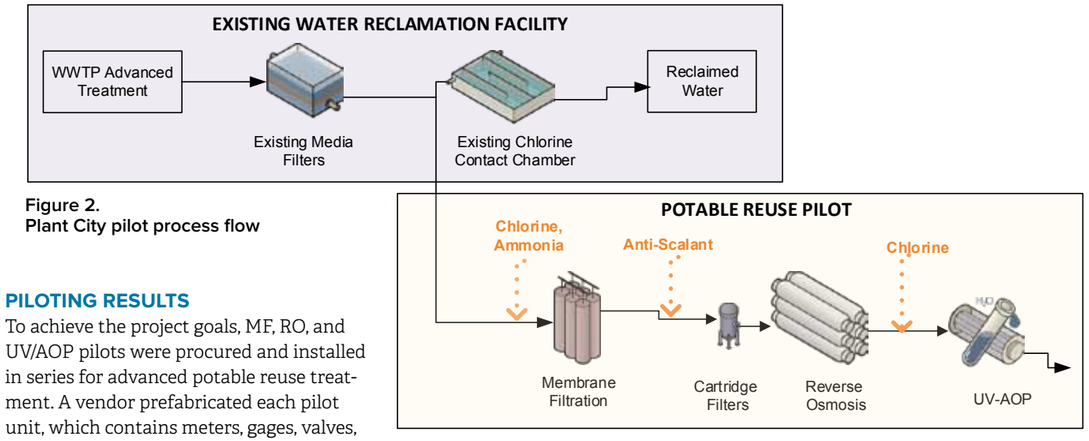


Figure 2.
Plant City pilot process flow

PILOTING RESULTS

To achieve the project goals, MF, RO, and UV/AOP pilots were procured and installed in series for advanced potable reuse treatment. A vendor prefabricated each pilot unit, which contains meters, gages, valves, and other instrumentation required to monitor and adjust performance. The pilots contain panels to collect water samples at each treatment stage. The pilot process received only a fraction of the flow of a potential full-scale purification facility. In this application, the water reclamation facility diverts approximately 40 gpm (150 L/m) of wastewater effluent from the city's sand filter effluent to the pilot process, which is 1/40th of the expected full-scale flows. Figure 2 displays the pilot's process flow diagram, and Figure 3 (next page) shows images of the installation.

During the study, water quality entering both the water reclamation facility and the pilot was monitored to identify seasonal trends and variability in character. The pilot influent conductivity and temperature differed seasonally throughout but did not affect pilot performance. However, as the wastewater treatment facility receives flow from industrial users, observing the quality and quantity of their discharges closely was important to confirm they were within permitted limits and the potential impacts on the pilot. Although the city monitors industrial waste flows, conductivity, and pH, additional parameters may better identify waste character changes. As result of the pilot, the city will examine the collection system to further characterize uncommon sewersheds to identify additional constituents for prioritized monitoring.

To meet FDEP requirements in existing and proposed draft form, water quality samples were taken consistently and analyzed for primary standards, secondary standards, and unregulated constituents such as pharmaceuticals, pesticides, personal care products, per- and polyfluoroalkyl substances (PFAS), and other constituents of emerging concern. Table 2 presents pilot influent and treated water parameter water quality concentration, comparing the concentration to respective maximum contaminant levels (MCLs). Each constituent was present in the finished water at concentrations less than

Table 2. Potable reuse train constituent average removals

Standard Class	Analyte	Units	Pilot Influent Concentration	UV/AOP Treated Concentration	Maximum Contaminant Level
Primary, Microorganisms	*Giardia*	cysts/L	0.231	**<0.09***	zero/TT
Primary, Inorganic Chemicals	Barium	mg/L	0.011	**<0.002***	2
Primary, Organic Chemicals	Benzene	µg/L	<0.5*	**<0.5***	5
Primary, Radionuclides	Beta Particles	pCi/L	18.6	**<0.99***	50
Secondary	Total Dissolved Solids	mg/L	675	**30.6**	500
Secondary	Sulfate	mg/L	120	**<5.0***	250
Unregulated, EPA HAL	PFOA	ng/L	15	**<1.9***	0.004
Unregulated, EPA HAL	PFOS	ng/L	4.0	**<1.9***	0.02
Unregulated, CEC	Hexazinone	µg/L	0.11	**<0.097***	N/A
Unregulated (DBP Indicator)	Total Organic Carbon	mg/L	4.06	**<0.500***	N/A
Unregulated	1,4-Dioxane	µg/L	3.61	**0.09**	0.35[1]
Unregulated	NDMA	ng/L	57.1	**<2***	10[2]

[1] EPA Health Advisory Level [2] CA Notification Level *not detected

Figure 3.
Plant City pilots
1. MF, 2. RO,
3. UV/AOP

the existing or potential MCLs, confirming that the UV/AOP treated water met the required water quality standards; in many cases, several of the constituents were undetected. The current water quality data demonstrate that MF, RO, and UV/AOP treatment yields water quality that complies with existing and anticipated future regulation.

Critical to a pilot program is the investigation, documentation, and demonstration of performance of the individual and combined processes. The city's potable reuse pilot identified set points that would yield the most sustainable operation for potential full-scale design. Real-time data from each pilot unit were incorporated into a data management dashboard that displayed trends in performance. Operators monitored performance daily to facilitate informed decisions about set point changes for optimal performance. In addition to performance, the data dashboard capability monitored the process's critical control points (CCPs), which directly affect the finished water quality related to public health. Performance data validated that each process was operating as intended and producing adequate water quality, and alerted an operator if the system was not operating as intended and needed corrective action.

For example, the RO process is a CCP and was validated through permeate water conductivity. The pilot's sensors constantly measured RO permeate conductivity and sent data to the human–machine interface (HMI) every 10 minutes. The RO permeate conductivity was consistently below 30 µS/cm throughout the study but exceeded the limit once in June, indicating a breach of performance. The breach was immediately investigated and determined to be due to a scaling event caused by a change in water quality from an industrial contribution to the wastewater treatment plant. As a result of this incident, the RO pilot experienced moderate scaling in the second stage of the process. The composition of the scale was primarily calcium phosphate and organics. The pilot unit was restored to previous performance following a clean-in-place procedure. The event further verifies the need to consistently monitor wastewater influent and effluent water quality as well as the performance in each pilot process. This and other events from the pilot will be used to create operational bounds and alarms at a full-scale facility.

Table 3 presents preliminary design parameters, optimized based on performance. For example, continuously injecting a low dose of chloramines prior to MF and RO treatment significantly reduces

Table 3. Design parameters for full-scale implementation

Process	Parameter	Value
Pretreatment	Pretreatment Chemical	Chloramines; 2.5 mg/L Total Chlorine Residual
MF	Flux	40 gal/ft^2/d, (68.6 L/m^2/h)
	Cleaning Chemicals	Citric acid, bleach, caustic, sulfuric acid
RO	Flux	11.4 gal/ft^2/d (19.3 L/m^2/h)
	Recovery	85%
	Scale Inhibitor	Yes
UV/AOP	Oxidant	Chlorine
	UV Dose	900 mJ/cm^2

biofouling and aligns with pretreatment strategies for potable reuse noted elsewhere. Furthermore, operating at a RO recovery of 85 percent and flux of 11.4 gal per ft^2/d (19.3 L/m^2/h) was sustainable, and thus will guide the membrane surface area requirements for the full-scale treatment facility in the design phase. Preliminary criteria developed for full-scale implementation will contribute to the overall size, layout, and cost of the facility. Such design-based activities are planned for after the piloting period.

PUBLIC OUTREACH PROGRAM

The city has engaged in a comprehensive public outreach program to educate the community about the future of Plant City water. This outreach aims to increase public acceptance of potable reuse by educating stakeholders on the quality and safety of alternative potable water supplies. The program includes branding, user-friendly graphics and educational materials, and public tours.

The branding effort created a name, logo, and tagline to communicate the city's availability of high-quality recycled water accurately and succinctly. A creative brief was conceived, documenting information about the city to produce a logo associated with the city's essence and community values. Aligning with the city logo of "Preserving the Past, Embracing the Future," the creative brief emphasized the city's historic and patriotic roots. Once a logo was narrowed down to a few finalists, the city surveyed staff for feedback on the logo options. Figure 4 shows the final logo to brand the larger One Water-based effort. The logo represents the following:

- Waterdrop shape representing the continuity of recycled water and its importance to the community
- Upper water wheel representing water's many uses in the community and ability to expand those uses ("hidden" star feature in center as nod to the city's patriotic character)
- Lower waves representing positive ripple effect Plant City water will have locally and in larger One Water
- "Our Water, Our Future" tagline representing city's commitment to water independence

The team developed a full campaign of support graphics and educational materials for public education and outreach. Easy-to-read and user-friendly signs were created and housed at the pilot to explain the motivation behind Plant City engaging in potable reuse, how water cycling works, and the piloted technology and individual process descriptions. Figure 5 presents an example of the sign created for the MF process. The signs included a simple color scheme, a basic process description, the treatment flow path, and fun facts to generate interest, arouse curiosity, and increase understanding of the process.

PLANT CITY WATER
OUR WATER • OUR FUTURE

Figure 4. The Plant City One Water logo

Tours included the branding materials, demonstration models, and signage to engage and educate the local community about potable reuse. The city's public outreach plan commenced with a ribbon-cutting ceremony to gather support and spread awareness for continuing to provide safe drinking water to the community. A survey was created to gather public feedback about the city's potable reuse efforts. Initial survey data from the tour groups have been encouraging, with all responders supporting the city using recycled water to sustain their water supply. Delivering effective communication is critical to change public perception about the safety of the city's water supply.

CONCLUSION

The MF, RO, and UV/AOP process as applied to potable reuse treatment paradigms has been investigated for decades (Mulford et al., 2018). The process consists of the most advanced and comprehensive water treatment technologies available for drinking water treatment. Plant City engaged in an integrated water management program, which investigated the feasibility of gaining alternative water supplies through potable reuse. The city piloted a MF, RO, and UV/AOP treatment train over a year-long study. To verify that pilot water quality performance would meet regulatory requirements for drinking water quality, the city monitored primary and secondary standards as well as unregulated constituents such as pharmaceuticals, pesticides, personal care products, and other contaminants of emerging concern. Current data suggest the piloted process meets current and anticipated future regulations. Frequent communication with regulators gave assurance that the proposed treatment and approach will protect public health and benefit the environment. Initial public outreach has been successful, with the community supporting additional potable supplies.

The city will pilot the potable reuse train through April 2023 to fully understand process performance over a year of seasonal variation. Once the pilot data have been analyzed and reported, preliminary design of the full-scale facility will occur. Post-treatment considerations, waste disposal, end use of the potable water, capacity, location, and cost will be evaluated and determined at this stage in the facility design.

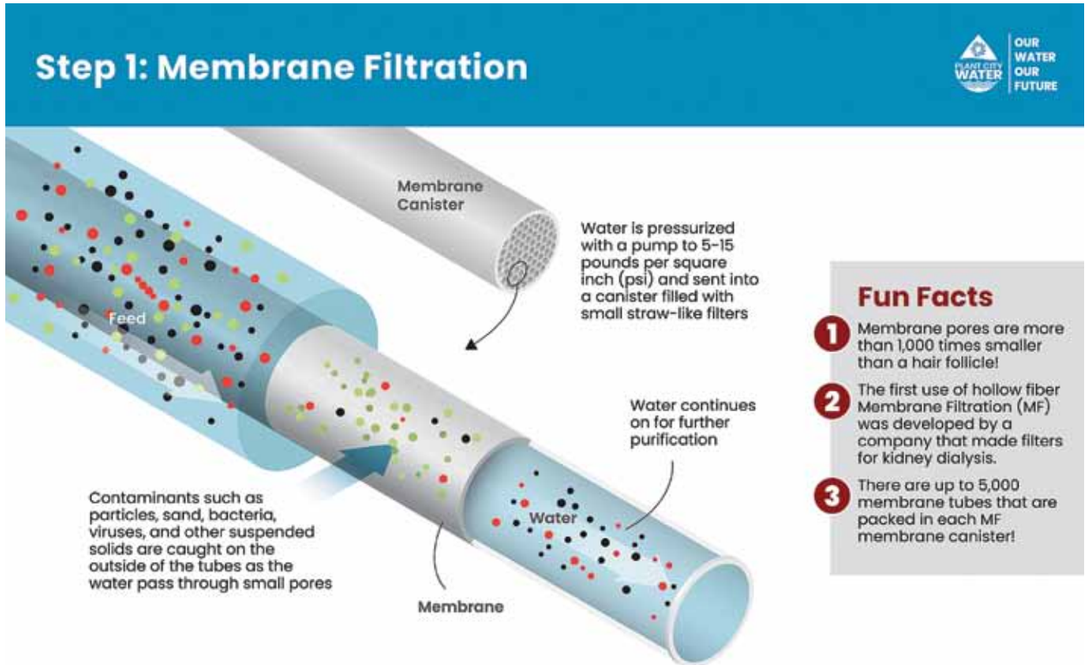


Figure 5. Educational sign created for the MF process

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Sustainable Water Initiative for Tomorrow (SWIFT)—groundwater replenishment in eastern Virginia

ANDREW NEWBOLD, Hazen and Sawyer, Virginia Beach, Virginia

ABSTRACT | At the southern end of the Chesapeake Bay where the bay empties into the Atlantic Ocean lies the Hampton Roads region. The region comprises 20 separate localities including Norfolk, Virginia Beach, Hampton, and Newport News, and is home to about 1.9 million residents and the world's largest naval base. An area notable for its history, the Hampton Roads region faces pressing environmental and economic challenges that threaten its future. Among those challenges is maintaining regulatory compliance with ever-tightening nutrient waste load allocations and complying with EPA's consent decree to reduce the frequency and severity of regional sanitary sewer overflows. These two issues, taken separately, would require years and millions of dollars to resolve. This article highlights Hampton Roads Sanitation District's managed aquifer recharge Sustainable Water Initiative for Tomorrow program, and how it addresses these challenges.

KEYWORDS | Indirect potable reuse, managed aquifer recharge, groundwater replenishment, nutrient management, Chesapeake Bay restoration, sea level rise, saltwater intrusion

HAMPTON ROADS REGION'S UNIQUE CHALLENGES

The Potomac aquifer is confined, stretching north–south along much of the mid-Atlantic region and halfway across the state from Richmond, Virginia, to the Atlantic Ocean. When first tapped, the aquifer was artesian with a static head of around 30 ft (9 m) above land surface. Over decades of aquifer use and because of its limited ability to recharge itself naturally, its static head has fallen to approximately 100 ft (30 m) below land surface and continues to fall. As the water pressure falls, it becomes more vulnerable to saltwater intrusion from the nearby Atlantic Ocean, and to the risk of dipping below the confining layer and permanently losing storage capacity, both of which would permanently compromise the present and future use of the aquifer.

The Hampton Roads region is one of the most vulnerable areas in the world to sea level rise. The developed land area is low-lying, and the region already struggles with drainage. Moreover, the land under the region is subsiding for two reasons thought to be contributing equally. The first is a geological artifact of the last ice age; a glacier was formerly perched on the interior of the state, where it raised the continental crust under the region like a tectonic seesaw. With this massive counterweight now removed, the crust is slowly but persistently descending. The second reason is consolidation and compression of soil particles within the aquifer's water-bearing layers as the pressure declines with overuse (Eggleston, et al).

Hampton Roads Sanitation District (HRSD), the region's wastewater utility, manages the interceptor conveyance and wastewater treatment infrastructure assets. The combined local treatment capacity is nearly 250 mgd (946 ML/d), with an average daily wastewater flow of over 100 mgd (380 ML/d). HRSD was created in 1940 as a political subdivision of the Commonwealth of Virginia; the governor appoints the commissioners who supervise the district.

HRSD has historically operated eight major treatment facilities that discharged into the James River basin. The total nitrogen (TN) waste load allocation (WLA) for the basin has been progressively restricted from 6 million lbs (2.7 million kg) of TN per year in 2011 to 4.5 million lbs (2 million kg) of TN in 2017 and 3.5 million lbs (1.6 million kg) of TN in 2022. During this time, HRSD performed major upgrades to four of its contributing treatment facilities and decommissioned one treatment facility, rerouting its influent flow to a treatment plant that discharges directly into the Atlantic Ocean. This was done to maintain compliance with the tightening nutrient discharge limit. Despite the significant upgrades required to meet the 2022 WLA, EPA—to maintain its Chesapeake Bay Act restoration targets—could reduce HRSD's WLA even further, which would require costly, limit-of-technology treatment techniques.

MULTIPLE BENEFITS OF MANAGED AQUIFER RECHARGE

At the same time, the region was under a consent decree from EPA to develop a Regional Wet Weather Management Plan to reduce SSO discharges from wet weather, a mandate that would have cost the region hundreds of millions of dollars. HRSD saw an opportunity both to address regional regulatory challenges and provide several other benefits to the region. It envisioned a managed aquifer recharge initiative under their Sustainable Water Initiative for Tomorrow (SWIFT) Program. Under the program, HRSD proposed adding advanced water treatment to several of its large treatment facilities and then taking the finished water—referred to as SWIFT Water™—and pumping it into the Potomac aquifer. The plan would redirect most of HRSD's treatment facility effluent flows, which originally discharged into surface waters, and send them to advanced treatment for beneficial reuse, reducing the amount of nutrients released into the bay and complying with foreseeable WLA scenarios. The managed aquifer recharge plan would further benefit the region: replenishing the Potomac aquifer and converting it into a sustainable groundwater supply; protecting the groundwater supply from saltwater intrusion; and slowing the rate of land subsidence and relative sea level rise. HRSD also entered into nutrient trading agreements with 11 local municipal separate storm sewer system (MS4) permit holders to help offset the cost of the SWIFT program by reducing the expense of the projected regional stormwater improvements.

Finally, HRSD collaborated with EPA to prepare a Regional Wet Weather Management Plan (RWWMP) that accounted for SWIFT's beneficial impacts. This integrated plan, which would remain in effect until 2030, included SWIFT implementation, a continuation of HRSD's effective Pathogen Tracking Program, and a limited selection of high-priority RWWMP projects that would deliver the best return on investment. After 2030, the integrated plan would transition into a Final Measures Plan that aimed to achieve the RWWMP's original goals.

HRSD studied the affordability of different scenarios to meet these upcoming regional regulatory challenges and determined that the SWIFT plan was the most affordable option for the region and provided several non-cost benefits. HRSD organized its approach into six phases: concept feasibility, concept development and pilot testing, concept demonstration, facility plan development, implementation plan, and full-scale facility implementation. The concept feasibility phase consisted of a desktop study to evaluate options for advanced water treatment alternatives, regulatory compliance approaches, groundwater scenario modeling, and cost estimating.

FULL ADVANCED TREATMENT VS. CARBON-BASED ADVANCED TREATMENT AND REGULATORY APPROACH

The advanced water treatment alternatives included two proven processes for water reuse. One was conventional full advanced treatment (FAT)—ultrafiltration, reverse osmosis, and advanced oxidation process. The other was carbon-based advanced treatment (CBAT)—flocculation/sedimentation, biofiltration, granular activated carbon adsorption, and ultraviolet (UV) disinfection. The study concluded that the FAT process would be impractical for several reasons. First, the reverse osmosis process used in FAT generates a brine solution that typically amounts to 15 to 25 percent of the process flow and that must be disposed of, and the associated risks and costs would be prohibitive. Second, the FAT reverse osmosis process demineralizes the product water, or permeate, produced. This demineralization would make downstream advanced oxidation more efficient but would render the product water unfit for aquifer recharge due to its low mineral content. Several project risks would thus result, including reducing the ability of the recharge wells to accept water and potentially mobilizing and transforming in situ compounds in the aquifer. The chemical costs to restabilize the product water proved this option would be impractical. The study found that CBAT would be a practical alternative to FAT for the SWIFT program. The CBAT process would generate little wastewater compared to the FAT process, since it did not include reverse osmosis. What is more, CBAT would metabolically transform and stabilize several contaminants, while FAT would mostly aim to separate the contaminants for disposal elsewhere. CBAT's product water chemistry would also be far more compatible with the native groundwater and require much less chemical addition for effective stabilization. Finally, the CBAT process would use far less energy compared to FAT and had a much smaller carbon footprint.

The program's regulatory approval would be managed under EPA's Underground Injection Control (UIC) Permit Program, and HRSD began coordinating with EPA along with the Virginia Department of Environmental Quality and the Virginia Department of Health. It was determined that the SWIFT water would meet all EPA drinking

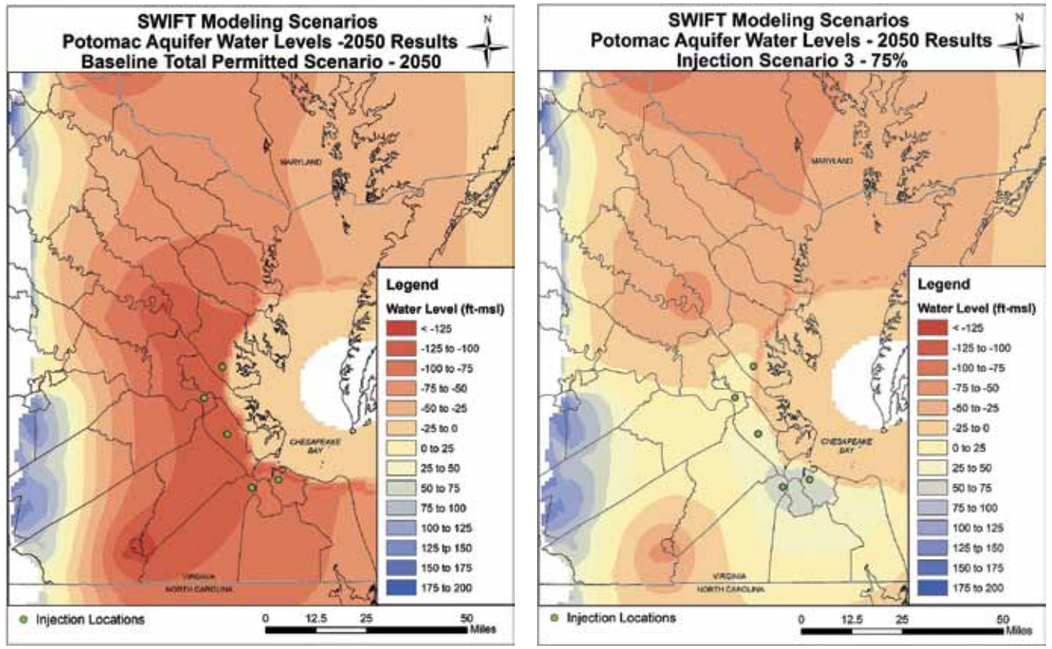

Figure 1. 50-year groundwater modeling projections without (left) and with SWIFT

water Maximum Contaminant Levels (MCLs) in addition to additional requirements for nitrogen, solids, organics, and barriers to pathogen removal. Total Nitrogen limits of 5 mg/L and 8 mg/L were adopted as the maximum monthly average and maximum daily limit, respectively. Total organic carbon (TOC) limits of 4 mg/L and 6 mg/L were adopted as the maximum monthly average and maximum daily limit, respectively. HRSD adopted the 12, 10, 10 California reuse standard for pathogen inactivation. This standard refers to a 12-log removal of viruses, 10-log removal of *Cryptosporidium*, and a 10-log removal of *Giardia* across the entire treatment process, including the removal of viruses granted under the California regulations for soil aquifer treatment (migration of recharge water through the native groundwater supply).

The study modeled the groundwater levels with and without SWIFT-managed aquifer recharge to determine the potential long-term impact on the regional groundwater supply. The groundwater model showed the condition of the aquifer after 50 years with and without SWIFT aquifer recharge, and the results showed a dramatic improvement in the "with SWIFT" condition of the aquifer (see Figure 1). The model also demonstrated that the managed aquifer recharge process could replenish the aquifer and maintain the current user withdrawals without long cross-country pipelines to deliver the water from point A to point B.

SWIFT ADVANCED WATER TREATMENT PILOT TESTING

With the study confirming that managed aquifer recharge would work and that the CBAT treatment option was feasible, HRSD began concept development and pilot testing. During pilot testing HRSD aimed both to show the CBAT treatment train would protect public health as well as FAT would and to better understand the treatment needs specific to HRSD's facilities and aquifer recharge goals. Pilot-scale parallel CBAT and FAT treatment trains were installed and commissioned at HRSD's York River Treatment Plant in 2016. HRSD operated both treatment trains in parallel for about two years, using the effluent of this plant. HRSD learned several lessons during the pilot testing.

Both treatment trains were comparable in their water treatment performance throughout the pilot. HRSD performed challenge testing using coliphages, viruses (adenovirus, norovirus, and enterovirus, pepper mild mottle virus, and MS2), and bacteria (total and fecal coliform) and found both trains performed equally well at meeting the pathogen removal targets. Chemical testing revealed both treatment trains effectively removed contaminants of emerging concern (CECs) such as endocrine disruptors, pharmaceuticals, and personal care products (PPCPs), and many indicator compounds such as sucralose and Iohexal.

SWIFT Research Center

Lobby – multimedia to tell the SWIFT story

Mezzanine—enabling the public to see the treatment facility and learn about how it works

SWIFT pilot at the York River Treatment Plant

Test well 1 at the SWIFT Research Center

SWIFT Research Center Interior—looking down the process

The pilot phase also gave HRSD insight into treatment challenges with the CBAT process. Bromate, a disinfection byproduct formed from bromide in the presence of ozone, was identified as a challenge early in the pilot, and HRSD experimented with several strategies to manage the formation of bromate during testing. HRSD also experimented with various treatment alternatives to remove TOC upstream of the granular activated carbon (GAC) contactors to reduce the operating costs of GAC replacement.

Room-scale piloting answered key questions for HRSD, most importantly that CBAT would protect public health as well as FAT and meet SWIFT water quality goals at a much lower cost. It also helped HRSD understand the nuances and complexities of operating such a sophisticated treatment process. However, with a capacity of about 5 gal/m (19 L/m), the room-scale pilot could do little to answer how compatible the SWIFT water would be with the Potomac aquifer. It also provided limited opportunity for HRSD to communicate the robustness and

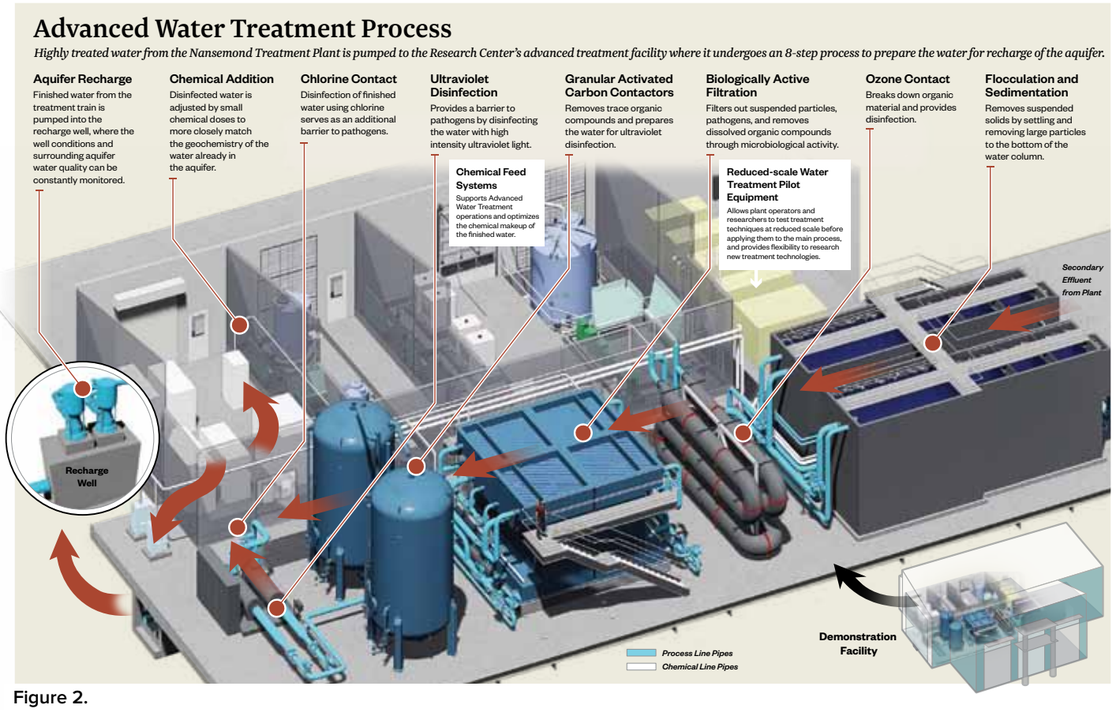

Figure 2. Infographic of the SWIFT facility

reliability of large-scale, automated, reuse facilities to the public. To do this, HRSD embarked on the next phase of implementation: concept demonstration.

SCALING UP SWIFT ADVANCED WATER TREATMENT TO DEMONSTRATION SCALE

The project charter for the 1 mgd (3.8 ML/d) SWIFT Research Center project most completely summarizes the demonstration phase's objectives, paraphrased below:

> To demonstrate, at a meaningful scale, that advanced treatment will produce finished water that meets primary drinking water standards and is compatible with the receiving aquifer. Collect operational data and aquifer hydraulic response data to optimize the design and construction of full-scale SWIFT facilities and define permitting requirements with regulators for future full-scale SWIFT facilities.

The Research Center project's secondary goals included providing a facility for staff and operator training, public education and outreach, and monitoring of constituent migration throughout the aquifer.

The SWIFT Research Center started aquifer recharge in May 2018 and operated around the clock under operator supervision in the same way that a full-scale SWIFT facility would operate. The larger scale of the SWIFT Research Center allowed HRSD to study and understand the dynamics of aquifer recharge at a similar scale as full-scale recharge using a single test well before building more than 50 wells throughout the region. The Research Center also enabled HRSD to road test the program for several years before committing to a full-scale facility process (see Figure 2). One advancement of the SWIFT Research Center was incorporating critical control points (CCPs) throughout the treatment process to monitor the critical barriers to pathogens. CCPs are online monitoring points located along the treatment process designed to be sensitive to the treatment process they monitor. For example, the flocculation, sedimentation, and filtration processes use the log removal values granted through the Surface Water Treatment Rule. Filter effluent turbidity is monitored as the CCP associated with the pathogen-inactivated credits granted through these processes (2-log removal for virus, 3-log removal for *Cryptosporidium*, and 2.5-log removal for *Giardia*). Other CCP online monitors include conductivity (a surrogate for bromide), ozone feed status, and UV reactor dose. If the CCP barrier is compromised, the plant control system automatically diverts the SWIFT water away from the aquifer until the barrier is restored. HRSD gained experience with the operation of the CCPs in working with the Research Center, important since the CCP methodology is part of HRSD's regulatory compliance with its UIC permit.

The SWIFT Research Center has also been important to HRSD's public outreach to keep key program stakeholders informed and confident about the steps and precautions to keep the public safe. The Research Center has welcomed interested local engineers, curious students, and government leaders to see the treatment process for themselves and better understand the benefits, challenges, and opportunities.

In 2019, the Virginia Legislature passed a bill to create the Potomac Aquifer Recharge Oversight Committee (PAROC), a 10-member expert advisory board to independently monitor the SWIFT program. The bill also established the Potomac Aquifer Recharge Monitoring Laboratory (PARML) to monitor the impact of the SWIFT-managed aquifer recharge, to manage test data, and to conduct water sampling and analysis. The PAROC holds quarterly public meetings to review SWIFT operational data and aquifer impact and will continue to do so during full-scale implementation.

FULL-SCALE IMPLEMENTATION OF THE SWIFT PROGRAM

Construction has begun on the HRSD James River Treatment Plant (JRTP) to establish the first SWIFT facility and the wastewater process improvements that will support SWIFT operation. The JRTP will have a capacity of 16 mgd (61 ML/d), enough to capture the average daily flow through the facility. The SWIFT facility is scheduled to be commissioned in 2026. The next facility, planned for HRSD's Nansemond Treatment Plant, will have a capacity of 33 mgd (125 ML/d) and is expected to be operational by 2028, to be followed by full-scale SWIFT implementation at other HRSD facilities.

The SWIFT program started as a more future-proof approach to meeting HRSD's imminent nutrient waste load allocation limits. With the introduction of additional challenges such as the regional SSO consent decree, locality stormwater nutrient challenges, aquifer depletion, saltwater intrusion, and land subsidence, SWIFT promises to relieve these broader challenges and improve the region's quality of life. A recent *New York Times* article on SWIFT brought national attention to HRSD's efforts, and the water treatment research that HRSD has done during the program has added critical knowledge to advanced water treatment and water reuse. Meanwhile, the public outreach and trust HRSD has worked toward has lent credibility to similar programs run by smaller utilities throughout the country, enabling them to take on water reuse projects to solve their own challenges.

ACKNOWLEDGMENTS

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ABOUT THE AUTHOR

Andrew Newbold is a senior associate with Hazen and Sawyer in Virginia Beach, Virginia. Mr. Newbold has 18 years of experience in water reuse and advanced water treatment.

Committee Focus Water Reuse

The Water Reuse Committee seeks to expand knowledge of the water reuse field to provide sound information to both present and future NEWEA members, as well as regulators and other interested parties. To learn more about the committee, the *Journal* reached out to its current leaders, Anastasia Rudenko and Bruce Douglas.

Journal *Water reuse is emerging as a key tool to manage one of our most critical resources—water—more sustainably. Can you tell us more about it?*

Water reuse includes the collection, treatment, and distribution of reclaimed water for direct and indirect potable and non-potable uses. Source water for reuse may come from one or more of the following sources: rainwater, stormwater, greywater, blackwater, industrial process water, or wastewater treatment facility effluent.

Anastasia Rudenko

Direct water reuse uses a system that pipes black or greywater into a water reclamation facility and then pipes fit-for-purpose water out of the facility. Water can also be reused indirectly, by discharging treated or untreated wastewater into a soil absorption system that conveys wastewater to the groundwater where, after adequate time of travel, wells extract it for reuse.

Direct, non-potable water reuse can reduce water consumption by approximately 40 percent to 70 percent.[1] Typical uses of reclaimed non-potable water include the following:

- Toilet flushing
- Landscape irrigation
- Cooling water
- Industrial process water

Water reuse can be feasible in both sewered and unsewered areas. As a regional example, New York City has approximately 10 single building or multi-building water reclamation systems in operation, and the New York City Department of Environmental Protection has water and wastewater rate discount programs to incentivize in-building direct non-potable water reuse.[2]

■ *New England does not typically come to mind when our industry references water reuse. Is this something that is practiced here?*

Of the four types of water reuse (Table 1), three are used in New England: direct and indirect non-potable water reuse, and indirect potable water reuse. The fourth type of direct reuse system is used in Singapore. The Water Reuse Committee is not aware of any direct potable water reuse systems in New England.

Table 1. Water reuse—centralized or distributed (sewered or unsewered)

Non-potable	Potable
Direct	Direct*
Indirect	Indirect

*Direct reuse does not appear to be practiced in New England at either the centralized or distributed scale.

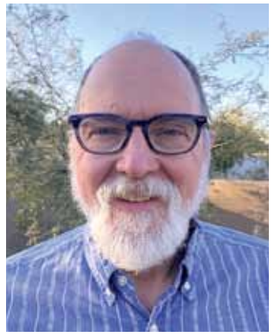
New England has about 15 direct non-potable water reuse systems in operation in five of the six states—Connecticut, Rhode Island, Massachusetts, Vermont, and New Hampshire.[3] Massachusetts is the only state with explicit water reuse regulations.[4] These include both centralized and distributed (also referred to as decentralized or onsite) water reuse systems. Centralized systems use effluent from wastewater treatment plants as the feedstock for water reuse systems and typically convey the reclaimed water to large-scale non-potable water users. Distributed systems typically use individual building- or site-generated blackwater as the feedstock for water reuse, and the non-potable water is then used near the reclaimed water source. Most of the reuse systems in New England are distributed systems.

The Massachusetts Water Resources Authority (MWRA) recently amended its regulations to allow distributed water reclamation facilities to operate efficiently in communities connected to the MWRA sewer service collection system that amend their local sewer ordinances similarly.[5]

■ *So, it sounds like we need water reuse in New England!*

Yes! Water reuse is an essential water management tool that is currently practiced in New England. Water reuse should be expanded in New England for both drought mitigation and resiliency, and as a tool to address combined sewer overflows.

Several New England communities that rely on either groundwater wells or service water reservoirs were severely affected by the 2016/2017 drought conditions. Having distributed or centralized water reclamation systems could have greatly lessened the drought impact in these communities.



Bruce Douglas

New England is part of a national movement toward water reuse that is being led by the National Blue Ribbon Commission for Onsite Non-potable Water Systems.[6,7] The Blue Ribbon Commission was convened by the U.S. Water Alliance, the Water Environment & Reuse Foundation, and the Water Research Foundation, and comprises technical experts and reuse program managers from around the United States. The commission has developed a risk-based approach to onsite water reuse system design, operation, maintenance, and management.[6] It also has produced guidance documents and model regulations and ordinances and facilitated state- and municipal-level implementation.[6,7]

■ *What are some of the projects that the Water Reuse Committee is working on?*

The committee is reviewing regulations pertinent to water reuse, particularly the Massachusetts Plumbing Board's practice of requiring that non-potable reuse water be dyed before distribution. It has been communicating with the Water Innovation Committee, which in turn has reached out to the Government Affairs Committee on this issue.

In addition, the Water Reuse Committee highlights water reuse applications by hosting conferences at operating facilities in New England. The committee has discussed with other NEWEA committees about a possible joint specialty conference. The last Water Reuse specialty conference in August 2018 included a tour of the University of Connecticut 1 mgd (3.8 ML/d) water reuse facility in Storrs. The two specialty conferences being considered are joint conferences at the 0.25 mgd (0.95 ML/d) reuse facility at Gillette Stadium in Foxborough, Massachusetts, and a pilot reuse project on the Isles of Shoals off Portsmouth, New Hampshire, with the Small Community and Sustainability committees, respectively.

■ *What's your favorite part of being a member of the Water Reuse Committee?*

Water reuse is a relevant and important water management tool for New England communities to sustainably manage our impact on the water cycle. The scientific foundation and technical practices are well-established. We can use this strong foundation to find financially and technically innovative solutions that incorporate water reuse. It is also great to be on the cutting edge of helping to provide a sustainable water supply for current and future generations.

■ *Are you looking for new members?*

Yes! NEWEA members interested in joining the Water Reuse Committee are encouraged to reach out to the current committee chair Anastasia Rudenko (Anastasia.Rudenko@ghd.com) or submit a committee application through the NEWEA.org website. In closing, this is an exciting time for water reuse in New England due to the ability to increase the resilience of water infrastructure by implementing water reuse in its many forms.

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NEBRA Highlights

NEWEA Annual Conference—Lots of PFAS, Something for Everyone

NEWEA's Annual Conference in Boston in January was "Celebrating the 50th Anniversary of the Clean Water Act. . . A Job Well Done," but there was also focus on what still needs to get done. The numbers of attendees and exhibitors approached pre-Covid numbers—over 2,000 people and 190 exhibitors—and there was a lot of energy and excitement throughout the conference. Once again, North East Biosolids & Residuals Association (NEBRA) members came out in force, making presentations, moderating sessions, exhibiting equipment and services, and helping to make the conference a success.

There was much educational content for biosolids and residuals managers at the conference, including two technical sessions dedicated to residuals, two dedicated to contaminants of emerging concern (CECs)—with per- and polyfluoroalkyl substances (PFAS) top of the list, two Government Affairs Committee sessions on regulatory efforts throughout New England, and the Innovation Pavilion featuring biosolids-related technologies. Also, many graduate and undergraduate student papers discussed the PFAS problem.

The first Residuals Management technical session on Monday, about the impact of PFAS on biosolids, was packed. The first two presentations were specific to Maine facilities where the state legislature's ban on recycling biosolids recently took effect. The last two presentations discussed innovations in biosolids processing: one on developing biosolids processing technologies and one specific to gasification and pyrolysis.

The second Residuals Management technical session, on Tuesday, focused on residuals operations. Presentations included EPA's annual biosolids reports, phosphorus removal from sludge using struvite and brushite recovery processes, the Greater Lawrence Sanitary District's organics-to-energy project, and basics about using polymers and flocculants for thickening and dewatering wastewater solids.

The two sessions sponsored by the Contaminants of Emerging Concern (CEC) Committee were also well attended, as anything about PFAS was of interest to many conference attendees. NEBRA members from CDM Smith and the town of Nantucket, Massachusetts, presented their PFAS source control efforts that developed a Nantucket-specific "PFAS cycle" to better understand and communicate PFAS transport around the island and plans to reduce exposure risks most effectively and efficiently.

The NEWEA Residuals Committee meeting at the conference was the last in the term of the outgoing chair, Eric Spargimino, a NEBRA member from CDM Smith. PFAS was of course the big topic of discussion. Justin Motta, NEBRA member from Stantec, will chair the committee for the next three years. NEBRA was also well-represented on the NEWEA PFAS task force, which also met during the conference.

NEBRA Members Recognized

As part of the conference, NEWEA's awards ceremony recognizes the best of the business of clean water in New England. NEBRA Executive Director and former NEWEA President Janine Burke-Wells emceed this year's event, on January 25. She read off the names of many NEBRA members!

Karla Sangrey, long-time director of the Upper Blackstone Clean Water (UBCW) facility in Millbury, Massachusetts, took home the NEWEA Biosolids Management Award for her commitment to sustainably and cost-effectively managing the large UBCW regional biosolids processing facility. Ms. Sangrey, a professional engineer and certified wastewater operator, is engaged on biosolids management issues in Massachusetts and regionally, advocating for science-based policy and regulations, "Stewardship Through Science," as it says on the UBCW website, ubcleanwater.org.

NEWEA Biosolids Management Award recipient, Karla Sangrey

Other NEBRA members recognized by NEWEA include board member Aaron Fox from the Lowell Regional Wastewater Facility, who won the Alfred E. Peloquin Award for Massachusetts for his contributions to excellence in plant operations. Philip and Theresa Tucker from York, Maine, were recognized for public relations with NEWEA's Youth Educator awards. Clayton "Mac" Richardson, who helped NEBRA restart in 1997, achieved Water Environment Federation (WEF)'s Life Membership. Raymond Vermette with the Dover, New Hampshire clean water facility joined the Quarter Century Operators Club.

Chelsey Little, superintendent of the Montague, Massachusetts Clean Water Facility received the William D. Hatfield Award. Dr. Hatfield was a long-time wastewater operator known for his communications and public relations acumen. If you check out the Montague Clean Water Facility website (https://montague-ma.gov/index.cfm?p=p.33) or read the local paper, you will understand why Ms. Little so deserved the award. Other noteworthy NEWEA awardees include long-time NEBRA collaborator Mickey Nowak, retired from the Massachusetts Water Environment Association, who received the Elizabeth A. Cutone Executive Leadership Award.

EPA New England also recognized several NEBRA members and associates, including the city of Manchester, New Hampshire's Industrial Pretreatment Program and Anthony Drouin, administrator of the Residuals Management Section for the New Hampshire Department of Environmental Services, who was selected as the EPA Educator of the Year.

Year of Poo—We Barely Knew You!

Last year was memorable thanks to the Year of Poo (yearofpoo.org). If you did not keep up with the flush of activities, you can catch up on the website or follow it on social media (twitter.com/pooandu). WEF plans to continue to post about The Year of Poo into 2023. You can also follow WEF biosolids on LinkedIn: Biosolids Resource Recovery: Overview | LinkedIn. NEBRA loved the Fun Fecal Facts and especially the Friday Flushes! The Friday Flush #11 interview with *BioCycle* editor Nora Goldstein is priceless. To hear more about WEF's biosolids communications—including the Year of Poo—listen to this 14-minute interview with Maile Lono-Batura, WEF's director of Sustainable Biosolids Programs: youtube.com/watch?v=-Juwvdh3E50.

Biosolids Viewpoint Story for PBS

In late 2022, WEF announced the completion of a "Viewpoint with Dennis Quaid" (PTV Segments | Biosolids - Viewpoint Project) segment about biosolids that is available on public television. The short video, about what happens after you flush the toilet, airs in-between shows. WEF created the URL of biosolids.org, which appears at the end of the video. You can watch the full episode on the WEF website: wef.org/pbs. WEF encourages members and others to use the video and corresponding website for community engagement. Messaging for the main script for PBS was crafted using WEF's Biosolids Communication Toolkit.

PFAS Pandemonium Hits Canada

Two news stories aired in Canada at the end of 2022, giving biosolids a black eye. The publicly funded Radio-Canada organization produced two stories

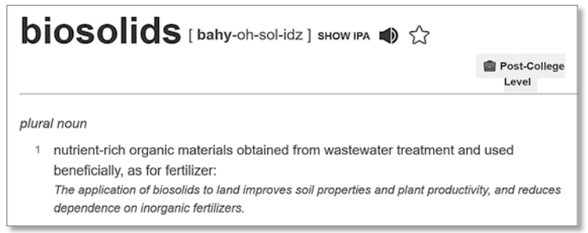
focused on PFAS in biosolids. The stories aired less than a week apart and focused on Maine's ban of land application of biosolids and the importation of Maine biosolids into Quebec for recycling to the soil. The stories asked many questions that Northeast states such as Maine have been asking but it did convey a negative slant toward biosolids.

Radio-Canada's *La Semaine Verte* (the "Green Week") show on November 26 included a 24-minute story about land application of biosolids in Quebec. This story included the perspective of the provincial regulator in Quebec, *Ministère de l'Environnement Lutte Contre Les Changement Climatiques, de la Faune et des Parcs (MELCCFP),* and planted the seed, so to speak, for the story that would follow on the December 1 edition of "Enquête," another Radio-Canada program. The "Enquête" piece, "Une histoire qui ne sent pas bon...," translated in English to mean "A Story That Does Not Smell Good."

NEBRA spoke with and helped connect reporters for both stories to NEBRA members, including the Sanford, Maine, water resource recovery facility (WRRF) and biosolids management company Resource Management, Inc. NEBRA member Englobe also spoke with reporters. The subsequent reports covered the need for these substances, produced all day every day by everyone, to be better managed, but did not discuss much the benefits of recycling them to the soils and reducing climate impacts. Source reduction and individual contributions to the PFAS problem also were not emphasized.

The "Enquête" story resulted in calls to ban biosolids imports from the United States. One of the unintended consequences from Maine's law (Public Law Chapter 641) banning beneficial uses is that more Maine biosolids are being exported to Quebec and other adjacent provinces and states. However, landfill disposal in Maine had previously been around 25 percent of biosolids end uses. It is now approaching 75 percent (see New Report Informs Next Steps on Regional Sludge Management • NEIWPCC), so most of it is not going to Canada, where organic materials like biosolids are generally prohibited from landfills. The National Biosolids Data Project (biosolidsdata.org) did not track where U.S. biosolids ultimately end up—an improvement suggested for the next national survey—but the Northeast biosolids community is aware of major imports from Canada into the United States.

The "Enquête" story did question Maine's new approach to biosolids management: putting biosolids into lined landfills may serve to contain some PFAS, but in most cases PFAS returns to the treatment facility in the form of leachate. Landfilling also generates more greenhouse gases (GHGs) than other biosolids management methods such as incineration, pyrolysis, and recycling to soils (see Biosolids Emissions Assessment Model website for examples: biosolidsghgs.org/sharing).



MELCCFP is working on a risk assessment for PFAS in biosolids used for land application. It recognized that the situation in Maine was related to industrially contaminated biosolids spread on land decades ago and that today Maine's biosolids are unlikely to cause contamination. However, *MELCCFP* is concerned that background concentrations could be higher in Maine, so Quebec wants to be cautious about the spreading of biosolids from outside the country on agricultural land and plans to tighten the conditions for use for the 2023 spreading season. Whether Canada bans imports of U.S. biosolids, these stories could cause setbacks for Quebec, long a leader in organic materials recycling and beneficial uses of ash from sewage sludge incinerators.

The Word "Biosolids" Turns 25 in 2023

According to NEBRA's website, the word "biosolids" came into being in the early 1990s after WEF held a contest for a more precise term for treated and tested sewage sludge that can be beneficially used. The result of the contest was the term "biosolids." The word came from a University of Arizona professor researching trickling filters: "You have solids coming into a treatment plant and you put them through a biological treatment process—therefore, you have a 'biosolid.'" In 1998, the Merriam-Webster dictionary defined biosolid. That same year, the New Oxford Dictionary of English included the term "biosolids." Because of the difficulty of revising federal law and regulatory language, EPA has never officially adopted the term "biosolids," but it is, nevertheless, widely used in agency documents and on the EPA website. Many states have since adopted the term. To read more about the word biosolids, see nebiosolids.org/terminology.

Read more on these topics and stay abreast of the latest biosolids/residuals news and events at nebiosolids.org/news.

Committee Meeting Schedule

- Carbon & Nutrient Trading: 4th Tuesday of the month at 1 PM
- Reg-Leg: 3rd Tuesday of the month at 2 PM
- Research: 4th Wednesday of the month at Noon
- Residuals: 3rd Tuesday of the month at 10 AM
- nebiosolids.org/join-a-committee
  Go to nebiosolids.org/events for the latest.

Janine Burke-Wells, Executive Director
603-323-7654 / info@nebiosolids.org

For additional news or to subscribe to NEBRAMail, NEBRA's email newsletter, visit nebiosolids.org

Innovation Highlights

Innovation Council Survey Data—Implementing New Technologies

The Innovation Council has conducted a survey to plan for future events and to identify opportunities to better support members. The survey was sent out to NEWEA membership in 2020, and again in 2022. In 2020, 123 people responded; in 2022, 43 responded. The responses for both years produced virtually the same results. To avoid potential individual response replicates, only the most recent results are presented here. Over 50 percent of the respondents were in the municipal sector, and around 20 percent were from the private sector/industrial entities. The rest were from academic, manufacturing, supply, regulation, and other related fields.

When asked "What drivers encourage your decision to implement innovations?" the most frequent responses were as follows:

1. Financial justification
2. Reliability/acceptance
3. Efficacy
4. Regulation

When asked "What obstacles hinder your implementation of innovations?" the most frequent responses were as follows:

1. Lack of time/resources
2. Potential risk
3. Regulation
4. Lack of exposure to innovations

The survey then asked respondents to identify their issues of greatest concern. Most respondents cited more than one issue, including the following:

1. Emerging contaminants
2. Climate change
3. Funding
4. Water reuse
5. Workforce development

The final question asked respondents "What are your interest areas of innovation?" The answers to this question varied, but "treatment processes" and "Internet of Things (IoT)" showed up the most frequently.

These results, despite being from a small group, can still help water quality innovators identify a potential customer's drivers and obstacles regarding the adoption of new technology. Financial justification is the number one reason to implement innovations. A lack of time and/or resources is the number one obstacle that hinders implementation. Interestingly, "regulation" was both an encouragement factor and an obstacle for implementing innovations. The issues of greatest concern may differ for each facility, and innovators may have to identify customer concerns by establishing trust through direct communication and collaboration.

Pilot Projects: Challenges and Insights in the Clean Water Industry

Pilot projects frequently coincide with new technologies in the water innovation ecosystem. Many companies seek to test and apply new technologies or approaches in a controlled and confined field setting to learn more about the interaction between the proposed innovation and its real-world operation. Finding a pilot site is essential to identify trends of success or failure. For innovators, finding a location for a pilot project can be challenging. First, they must identify the ideal customer, or who would most likely benefit from their innovation. This requires not only a deep dive into knowing not only the solution(s) their own technology will bring but also which type of facility, company, or organization within their customer base is open to a pilot project. If an innovative company has identified its ideal customer base, what is the best approach to find and reach out to customers with a problem that must be solved, and that are willing and ready to take on a pilot?

To address this issue, knowing both what *encourages* and what *hinders* decisions to implement innovations is important. So too is knowing the greatest *concerns* and *needs* in the water quality industry, to tailor and calibrate innovations that maximize the value for all parties involved. Drinking water and wastewater treatment plants are not always vocal about their problems and so, unfortunately, no "problem portal" exists for innovators to browse. Finding a way to pinpoint the problems and issues facing the water sector is a step in the right direction.

Identifying and Securing Locations for Pilot Projects

Concerning pilot projects, knowing the drivers, obstacles, and interests are just the first steps. Innovators must then attempt to identify facilities interested in such a project. Many utilities have a strict budget and cannot spend extra money on pilot projects, making it reasonable to assume why financial justification is the main driver to implement innovations. It also makes sense that the lack of time and/or resources is the number one obstacle that hinders implementation. It can be helpful to view different perspectives when attempting to understand the how best to implement a pilot project. In the following sections we explore perspectives from the utility, startup, and academic sectors. Understanding the utility operator perspective is important, as these individuals and their associated facilities could provide the testing location. The startup perspective is important because most of the water technology pilot project implementers are startups. This article would not be complete without the academic perspective, since universities are often large generators of new technology, can become partners for early-stage technology development, and are often pilot locations for water technology.

An Operator Perspective—Chelsea Mandigo, City of Essex Junction, Vermont

One way to discover how innovators can identify a facility that needs a pilot project is to gather insight from someone who works in a target operation. In this case, the Innovation Council has asked Chelsea Mandigo, water quality superintendent for the city of Essex Junction in Vermont. This water resource recovery facility treats 3.3 mgd (12.5 ML/d) and serves the towns of Williston, Essex Junction, and Essex. The plant recently partnered with scientists from the Water Treatment and Environmental Nanotechnology Lab at the University of Vermont (UVM). The pilot is testing a portable device meant to extract high-strength phosphorus from wastewater. Ms. Mandigo, who has worked at the plant for 11 years, is heavily involved with the project.

"Testing new innovations can be a way to discover solutions to problems where the industry may be lacking in common solutions. It could also lead to a more affordable solution," Ms. Mandigo says. "It's also really neat to be a part of such a discovery, which is what science is all about. Unfortunately, the main hindrances to testing are the time to invest in supporting innovators and sometimes the cost."

Ms. Mandigo stresses that innovators have a formulated idea and the ability to share as much information as possible when describing their technology to potential pilot-testing customers.

"A summary format or some sort of visual design is extremely helpful," she says. "The potential costs, expected time investment, and the problem you're trying to solve should also be included. Express your vision on how this partnership could benefit the utility."

Forming a mutually beneficial relationship is essential. Innovators want to solve a problem and provide proof of concept, and a facility is often looking for a solution to a problem. It helps for innovators to know this industry's common problems and issues, so that they can prioritize and focus their efforts on real market needs.

The pilot is testing a portable device meant to extract high-strength phosphorus from wastewater

Drinking water and wastewater treatment plants are not always vocal about their problems and so, unfortunately, no "problem portal" exists for innovators to browse

When asked about the issues water quality innovators should focus on, Ms. Mandigo says PFAS destruction, biosolids management, and reduction of wastewater treatment chemical use (given the impact of inflation on cost) are at the top of the list.

The test device installed at the Essex Junction facility has produced phosphorus-free water ready to be discharged into the nearby Winooski River. The extracted phosphorus will be bagged and sent to nearby farms for fertilizer application. In this case, the relationship between the innovators and the facility has been positive, and it came to fruition because of the mindset from treatment plant leadership coupled with a cost-effective market solution that the innovators at UVM were willing to provide.

"Our facility has always been one to work with innovators, and through these partnerships, simpler ways of tackling issues in wastewater treatment have been discovered," Ms. Mandigo says.

She also feels that working with innovators helps grow interest in the field and trades, something desperately needed in Vermont and New England.

"Sometimes pilot projects lead nowhere," she cautions. "However, when they do lead to a solution, it is often extremely beneficial to the utility. Remember that pilot projects are a two-way street, where both the utility and the innovator benefit from the partnership."

A Startup Perspective—Young Lee, AdvanceH2O

Startups often have novel technology requiring piloting, and they often consider getting that first pilot project implemented a company success that will open doors to additional pilot projects. Young Lee, CEO and founder of AdvanceH2O, a recent National Science Foundation (NSF) awardee and startup that develops next-generation monitoring and data informatics for water treatment, has agreed to share his experience and advice on pilot projects. Mr. Lee speaks of the obstacles he has encountered with piloting new technology.

For Young Lee (right), tech innovation and adoption begins with listening to and learning from the experiences of plant personnel. At the South Windsor, Connecticut water pollution control facility, Robert Butler (left), lead operator process control, provides his expertise and critical partnership throughout the entire pilot test.

"We've found that the water treatment ecosystem is often resistant to and/or slow to change," he says. "Bureaucracy is another challenge. Most end-user wastewater treatment plant collaborators/customers fall under the authority of municipalities that include many bureaucratic organizational layers. Thus, often, initiating pilot tests can take time as multiple parties must 'sign off' on a collaboration."

Despite the challenges AdvanceH2O has faced (including speaking with over 250 potential customers before identifying a successful pilot test collaborator), Mr. Lee has discovered what works for him and his team.

"The goal, especially with respect to that first pilot test, is to identify a collaborator facility that is well run (i.e., achieves regulatory compliance), where the obstacles described above are mitigated (i.e., fewer bureaucratic layers), with progressive wastewater treatment plant operators, managers, and supervisors," he explains. "The key is to look for someone who wants to be an innovator and is open to trying new things."

For Mr. Lee and his team to succeed, most important is patience, including taking the time to build relationships and establish rapport with potential partners.

"You have to exercise extreme patience with the entire process," he says. "Building long-term relationships with treatment plant personnel is paramount. It's natural for us, the tech developers, to be excited about our work. However, it's not automatically equivalent for the pilot-test collaborator/future customer to share our enthusiasm even if our mission is to save them significant energy and other operational costs. It may take a while to identify that first pilot-test collaborator, but when that happens, it will most likely pave the way to the next one, as it did for AdvanceH2O."

Relationship building is important in many aspects of society, and the water industry is no different. Having rapport with an individual can reduce the initial feelings of distrust or skepticism toward a new technology. Being patient while finding the best way to form a positive relationship with someone will go a long way. Mr. Lee made frequent visits to the pilot test collaborator wastewater treatment plant to build familiarity, rapport, and subsequent trust with the personnel. One of the pleasantly surprising upshots was that plant personnel have contributed their expertise to the Columbia University MBA program. Mr. Lee also expressed transparency with what he did not know about operations, and he always asked a lot of related questions.

"Chances are, any one of the personnel at a well-run wastewater treatment plant will know a lot more than we do about their operations."

An Academic Perspective—Dr. Jeffrey McCutcheon, University of Connecticut

The academic point of view on pilot projects may differ from private companies simply because the incentives and capabilities differ. Dr. Jeffrey McCutcheon is the centennial professor in the Chemical and Biomolecular Engineering Program at the University of Connecticut (UConn) and the director of the Connecticut Center for Applied Separations Technology (CCAST). CCAST identifies opportunities to implement membrane and other advanced separation technologies into various industrial and manufacturing processes to lower energy use, reduce carbon footprint, limit waste, and prevent adverse environmental and health impacts.

Dr. McCutcheon defines a pilot project as a pre-commercial scale but "element-based" test with real waters. By "element," he refers to a device of a similar geometry to that used in a commercial setting.

"Academics do not usually have the facilities or expertise to host full-scale pilot projects," he says. "We're

Dr. McCutcheon's benchtop system (left) and pilot system (right)

lucky enough at CCAST to operate a facility that can test both at the device level and the system level."

He mentions the greatest challenge he has come across in pilot projects is the risk-averse approach that personnel at municipalities tend to take.

"Operators typically don't want people setting up unproven equipment at their facilities and asking for slipstreams of their water. Such efforts risk their operations and their primary mission, which is to deliver a utility or service to the public. You've got to find a partner that is open to driving technology innovation and open to being an early adopter. One of our partners, the Greater Lawrence Sanitary District (GLSD) in Massachusetts, is a good example. We are working with them on a Department of Energy-funded project that involves instrumenting their anaerobic digesters with sensors. However, GLSD is an anomaly. It is my hope that more utilities will become more open to using their facilities as test beds to pilot new technologies."

Dr. McCutcheon stresses the importance of ensuring that incentives align for the individual who is building the pilot and the municipalities hosting the pilot.

"There needs to be something in it for them. There should be an alignment of incentives between the pilot test site and the innovator. For example, finding a municipality that is interested in lowering their carbon footprint, perhaps through a state mandate, would be ideal if that's what your technology promises to do."

Dr. McCutcheon notes that several facilities in the western United States are set up for pilot testing. These include the Brackish Groundwater National Desalination Research Facility in New Mexico and the Port Hueneme (U.S. Navy) plant in California. These facilities can host pilot systems in brackish and seawater desalination, respectively. Also, municipal facilities, such as the Yuma Desalting Plant (Bureau of Reclamation) in Arizona and the Kay Bailey Hutchison Desalination plant (El Paso Water) in Texas, will host pilots. Innovators can test their technologies, many times at no cost, at select locations. These facilities are largely focused on western United States water needs, however, and geared toward desalination.

"To my knowledge, there is no pilot facility in the New England region that does piloting of new wastewater technologies. To test a new technology, one is most likely connecting to a wastewater treatment plant or municipality."

DR. JEFFREY MCCUTCHEON

"To my knowledge, there is no pilot facility in the New England region that does piloting of new wastewater technologies," he says. "To test a new technology, one is most likely connecting to a wastewater treatment plant or municipality. We are lucky at UConn that the university owns and operates its own wastewater treatment plant and water reclamation facility. I would love to see more capabilities added to the facility and to offer piloting and test-bed facilities at this site. One of my ideas is to add a biosolids management research and test bed facility with anaerobic digestion, gasification, and biogas upgrading capabilities. With such a facility, there would be an opportunity for people to bring their technology here and run pilot tests on anything from sensors to water reuse technologies."

Assuming such a facility would connect to a wastewater treatment plant, it would have access to in-house expertise and operators to monitor systems that run continuously. Facility designs would also

have to consider research, educational, and operational goals that would not affect operations at the plant. This is one reason to consider locating the facility near a university.

"Fulfilling an education and research mission would strengthen the ties of such a facility to the innovation community in the wastewater space," Dr. McCutcheon remarks. "I would anticipate that such a facility would also retain environmental consulting firms who specialize in designing, building, and operating wastewater treatment plants and could help provide insight on how to tie new technology into working systems without compromising operations. In addition, membership organizations like NEWEA and NEBRA (North East Biosolids & Residuals Association) are great connectors to people and companies that would use such a facility. They can help find individuals who are actively looking for a way to demonstrate new technology."

Dr. McCutcheon hopes that recent investments in climate-related infrastructure will support facilities like this.

"The key to decarbonizing the water and wastewater treatment sectors is through improvements at the wastewater treatment plants themselves," he says. "We should be able to test new technologies on real water at real plants. If the western U.S. can do this with desalination, why shouldn't New England be able to do it with wastewater treatment?"

Conclusion

Pilot projects are often essential for new technology. Securing a pilot project can lead to an in-depth analysis of the technology in a field setting. Piloting will often determine whether the product will succeed in the market. Securing that first pilot project can be a challenge, so knowing the main drivers and hesitations of implementing an innovation is the first step. The next step is to understand the customer or whoever will test the product. This requires much work: establishing a strong relationship; finding out their specific needs, desires, and hesitations; exercising patience throughout the process; and asking relevant questions. Patience, perseverance, and a well-formulated idea will most likely lead to a successful collaboration where all parties benefit. With water reuse a growing concern for many water quality professionals, investing in new technologies that will improve a facility's water reuse capabilities will help build more modern and sustainable communities. Most important, the water environment will benefit, resulting in a healthier and safer world.

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About the Author

Since May 2021, Megan Goldsmith has been working for the NEWEA Innovation Council to identify the key players in the water innovation ecosystem, with close to 4,000 entities cataloged to date. Ms. Goldsmith is assisting NEWEA with finding productive ways to break down the siloed water ecosystem and form partnerships among stakeholders in drinking water, stormwater, wastewater, water reuse, and other water-centric sectors.

YP Spotlight—*Tess Laffer*

Tess Laffer, a water/wastewater project engineer at AECOM, has participated in the Young Professional (YP) Committee, so much so that she won the Young Professional award at this year's Annual Conference. Tess is one to always raise her hand to volunteer and help out. She helped plan the last three YP summits, and also co-leads the YP mentoring program. We talked with Tess to learn more about what motivates her to dedicate several lunch breaks a month for YP meetings.

Journal *How did you choose the clean water profession?*

Tess: : In my high school Advanced Placement Environmental Science (APES) class, I was drawn to various topics but especially to water use, water pollution, and pollution impacts on ecosystems. I researched more on my own about worldwide water scarcity, failing infrastructure, innovative treatment systems, etc. The more I learned, the more passionate I became. I would discuss these topics at great length with my APES teacher, so much that she informed me of an up-and-coming major, Environmental Engineering (EVE), that focuses primarily on water and wastewater treatment, and recommended I look into it. In my college search, I came across Worcester Polytechnic Institute (WPI) and was impressed with the curriculum and feedback on their EVE program; I applied and was lucky enough to be accepted.


Tess Laffer

In my tenure at WPI, I participated in an internship with Saha Global for a multi-week program in Ghana, Africa. Saha Global develops drinking water treatment systems for communities in need, using exclusively local resources. My team installed a treatment system that served over 100 people with clean water, and we simultaneously taught the system users the importance of keeping their water clean, including what chemicals to use and associated volumes/exposure durations, and how to fix pieces and parts of their system when something breaks. On our last day there, the chief of the village profusely thanked us, and in that moment, I knew that I had made the best career choice. After four years at WPI, I graduated with a B.S. (Bachelor of Science) in EVE, knowing I wanted to specialize in drinking water and wastewater treatment for my full-time profession.

■ *Can you tell us a bit about your involvement with the YP Committee? What motivates you to give up your lunch breaks to help plan the YP summits and run the YP mentoring program?*

Tess: I first became involved with NEWEA as a junior at WPI when I attended the 2017 Annual Conference. I was fortunate to meet the president at the time, WPI alum Jim Barsanti, who almost immediately became my personal mentor. Meeting Jim sparked my enthusiasm even more for the industry, and NEWEA itself, so I collaborated with my peers to found a NEWEA student chapter at WPI via the American Academy of Environmental Engineers and Scientists (AAEES). I am indebted to Jim for offering endless career advice, introducing me to countless colleagues in the industry, and overall being a great and supportive friend over the years.

The combination of meeting incredible peers, having so much fun at the conferences, and experiencing an enriching mentorship relationship, led me to become a very active member of the YP committee, the YP Summit Planning committee, and co-chair of the NEWEA mentorship program. I firmly believe that without NEWEA, I wouldn't have had nearly the number of opportunities I've been fortunate enough to be given (internships, job offers, presentations, technical papers). So, my goal is to inspire others in the same way that NEWEA and its members and events have inspired me over the years.

■ *I hear you also presented at WEFTEC! Can you tell us a bit about that experience as a young professional?*

Tess: In the spirit of mentorship, one of my project managers at AECOM, Tom Parece, believes firmly in giving young engineers various career-building opportunities, even if those opportunities are a bit out of their comfort zone. Tom mentioned to me that he had presented at numerous conferences throughout his career, so why not let me take the reins moving forward. At WEFTEC 2022, I presented on creative funding sources for new wastewater infrastructure for AECOM's Orleans, Massachusetts project alongside my coworker and friend, Amy Hunter. Similar to my first presentation at NEWEA, I wasn't incredibly confident of the material at the time when we found out our abstracts were accepted. However, in Tom's mentorship approach, he thought it would make for a perfect opportunity to learn the ins and outs of the subject matter, improve my presentation techniques, and develop stronger technical paper writing skills, all of which have made me a stronger and more well-rounded young professional (although I made sure Tom wasn't far during the Q&A portion of the presentations).

■ *Anything else fun you'd like to share with NEWEA?*

Tess: A final shoutout to our fearless YP leader, Daryl Coppola, for his amazing guidance and friendship, and for nominating me for the 2022 YP award. He constantly inspires me, and my NEWEA participation and enthusiasm were a direct product of that—I couldn't have done it without him!

The speed networking session challenged attendees to connect efficiently

The seventh annual NEWEA/ NEWWA Young Professional (YP) Summit brought together young professionals in the water and wastewater industry to learn from industry leaders and network with peers from across New England. This year's program focused on 50 years of the Clean Water Act.

The YP committee hosted an engaging program of panels, presentations, and networking sessions designed to help young professionals strengthen their leadership and technical skills and advance their water industry careers. The program was kicked off by NEWEA's YP Committee chair, Daryl Coppola, followed by a session on "How to Network," which included a speed networking session. Then Newton Tedder, EPA, gave the keynote presentation on "50 Years of the Clean Water Act" that included an overview of the act, where it stands today, and Newton's predictions of its future. After lunch, two panel discussions were offered, the first highlighting water and wastewater treatment plant professionals, and the second featuring advice from experienced water professionals on navigating a rewarding career path. The Meme Contest, a repeat attendee favorite from the 2021 program, involved attendee-submitted water and wastewater related memes that were displayed to allow the crowd to vote on their favorites. Finally, the mentoring program graduation was presented, recognizing successful mentor pairings from the 2022 program.

Following the completion of the program, attendees were invited to enjoy a networking reception that was also attended by experienced water industry professionals and members of the NEWEA and NEWWA Executive Committees.

Some of the young professionals also also got together on Tuesday night of the conference for a social outing. We are proud to say that the group won two rounds of trivia before moving on to some Karaoke... where it was determined that it's a good thing everyone is good at their day jobs, because singing careers may not be in their futures. But fun was had by all!
Photo: James Plummer, Daryl Coppola and Victoria Helle

YP SUMMIT PROCEEDINGS
Sunday, January 22, 2023
Hosted at NEWEA's Annual Conference, Boston Marriott Copley Place Hotel

Welcome/Opening Remarks
- Daryl Coppola, NEWEA YP Chair, F.R. Mahony & Associates
- Christopher Astephen, NEWWA YP Chair, Tighe & Bond

Intro to Networking
- Daryl Coppola, F.R. Mahony & Associates
- Victoria Helle, NEIWPCC
- Sruthi Kakuturu, Dewberry
- Tess Laffer, AECOM
- James Plummer, NEIWPCC

Keynote: 50 Years of Clean Water Act
Moderator: James Plummer, NEIWPCC
- Newton Tedder, EPA

Water and Wastewater Treatment Plant Panel & Discussion
Moderator: Victoria Helle, NEIWPCC
- Peter Conroy, Peirce Island Treatment Facility, Portsmouth, NH
- David Milano, Cheshire, CT, Water Pollution Control Facility
- Daniel Sullivan-Xenos, Orleans, MA, Wastewater Treatment Facility

Meme Contest
Moderator: James Plummer, NEIWPCC

Mentor Program Graduation
CoChairs: Emily Korot, Hazen and Sawyer; Tess Laffer, AECOM; Victoria Helle, NEIWPCC

Career Panel Discussion
Moderators: Tess Laffer, AECOM; Erica Lotz, Stantec Consulting; Colin O'Brien, Brown and Caldwell

Closing Remarks
- Fred McNeill, NEWEA President
- Jim DeCelles, NEWWA President

2023 Student Poster Board Competition

The NEWEA Student Activities Committee hosted the annual Student Poster Competition on Monday during the 2023 Annual Conference in Boston. The competition drew a record attendance this year, with 15 posters in the Undergraduate category and 24 posters in the Graduate category.

Students from 10 universities participated:

- Massachusetts College of Pharmacy and Health Sciences
- Northeastern University
- Roger Williams University
- Stevens Institute of Technology
- University of Hartford
- University of Maine
- University of Massachusetts Amherst
- University of New Hampshire
- University of Rhode Island
- University of Vermont

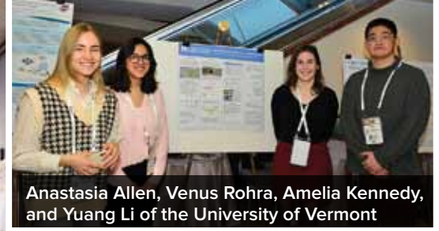
The posters were reviewed and scored by a panel of industry professionals and were displayed all day throughout the third- and fourth-floor halls, allowing students to network with and receive feedback from conference attendees.

The winning posters (included here) were presented by the University of Massachusetts Amherst undergraduate student team of Cullen Calhoun and Marie Rausch on "Engineers Without Borders: Responsible Closeout of International Project Work" and by University of Vermont graduate student Amy DeCola on "Metagenomic Insights into the Full-Scale Anaerobic Digestion of Cow Manure and Pre-Treated Food Waste."

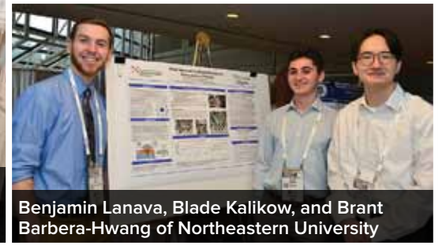
The Student Activities Committee thanks the participating students, whose dedication to and enthusiasm for the field was evident in the incredible display of posters! We also thank the volunteer judges. We are excited to have brought so many students and professionals together in person at this year's event. If you missed this year's event, stop by next year on Monday during the 2024 Annual Conference.

If your organization is interested in supporting future student poster sessions and the student engineers and scientists who present their work, please reach out to the NEWEA Student Activities Committee chair for more information.

Event judge Paul Hogan interviews poster presenter Linnea Wilson of Northeastern University



Anastasia Allen, Venus Rohra, Amelia Kennedy, and Yuang Li of the University of Vermont



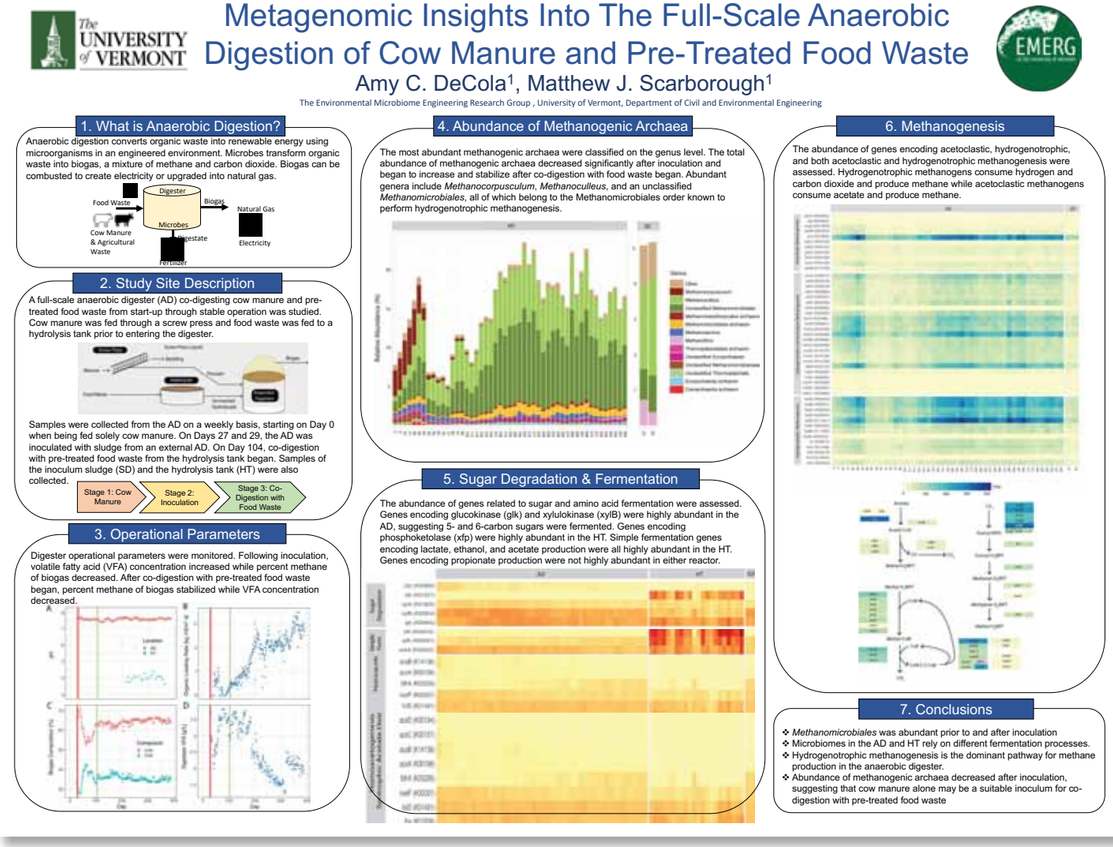
Benjamin Lanava, Blade Kalikow, and Brant Barbera-Hwang of Northeastern University

This year's competition drew a record 39 posters

Ryan Douglas explains his poster to Dennis Hallahan

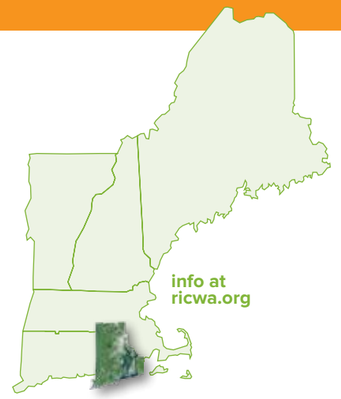
Karlen Alenó Hernández of Mass College of Pharmacy explains her poster

Deborah Sebagisha of the University of Maine presents her work



Rhode Island State Director Report

by Eddie Davies
edavies@quonset.com



Established in 1952, the Rhode Island Clean Water Association (RICWA) is a nonprofit organization created to promote the advancement of knowledge concerning the nature, collection, treatment, and disposal of domestic and industrial wastewaters.

RIDEM Salary Survey of Pay in the Wastewater Sector

Information provided to the Rhode Island Department of Environmental Management (RIDEM) indicates many facilities are struggling to recruit and/or retain qualified employees; addressing this challenge is important to the proper operation and maintenance of wastewater treatment facilities. In response, RIDEM is developing a survey focused on wastewater staff recruitment and associated difficulties with hiring new employees—whether entry level or management.

Competition with other sectors related to pay and benefits may be a cause for such front-line recruitment and retention issues. If so, we must better understand that information. The first step to improve our understanding of how salaries and wages may affect recruitment and retention is to gather current salary/wages and benefits data. After that, the data will be compared to information about the pay of similar occupations in industries outside the wastewater sector. To make such a comparison, RIDEM has partnered with the Rhode Island Department of Labor and Training (RIDLT) and will use nationally standardized occupational categories. The salary survey will also help us understand pay variability within the wastewater sector.

RIDLT has partial—and thus incomplete—information from the wastewater sector from that agency's previous survey requests. RIDEM's targeted survey is meant to better round out statewide data from the 19 major wastewater treatment facilities (WWTFs), as well as to hear from managers and others about related issues.

New Board Members

RICWA held its first monthly meeting of 2023 on January 10 to develop committees, discuss the events calendar, and welcome its newest board members.

The 2023 board members are as follows: president, Peter Connell (Rhode Island Resource Recovery Corporation); past president, Scott Goodinson (town of Narragansett); vice president, Jeff Chapdelaine (West Warwick WPCF); treasurer, Nora Lough (Narragansett Bay Commission); secretary, Kim Sandbach (Narragansett Bay Commission); executive board, Dave Perrotta (East Greenwich WWTF), Ryan Desrosiers (Veolia Cranston), Kevin Regan (Veolia Smithfield), and Janine Burke-Wells (Northeast Biosolids & Residuals Association); directors of vendor/consultant coordination, Eli Hannon (EJH Professional Services), Tracy Santoro (Xylem); Rhode Island Board of Certifications, Paul Desrosiers (Narragansett Bay Commission); and NEWEA state director, Eddie Davies (Quonset Development Corporation).

Operator Training and Development

In 2022, RICWA continued to provide high-level continuing education for operators:

- *Design, Theory, Application and Maintenance of Double Disc Pump Technology*—Instructors: Preston Campbell and Bob Mack (Penn Valley Pump)
- *The Microbial World: Introduction to the Biological Reactor in a Wastewater Treatment Facility*—Instructor: Nora Lough (Narragansett Bay Commission)
- *Wastewater Facility Flow Meter Technologies and On-site Operation*—Instructors: Tim Larsen (Pond Technical) and Vinnie Russo (West Warwick Regional Wastewater Treatment Plant)
- *Wastewater Operator Grade 1 Exam Prep Review*—Instructor: Eddie Davies (Quonset Development Corporation)
- *Wastewater Operator Grade 3 Exam Prep Review*—Instructor: Eddie Davies (Quonset Development Corporation)

Visit ricwa.org for upcoming training opportunities.

WEFTEC Operations Challenge

Congratulations to the **RI**SING SLUDGE Operations Challenge team for displaying its skills at WEFTEC in process control (4th place), laboratory analysis (11th place), safety (10th place), pump maintenance (14th place), and collections (12th place). In only his second year competing, Captain Riley Greene led a team of first-year competitors (Dave Bruno, Rob Norton, Max Maher) in a strong performance and an eighth-place finish overall for Division 2. Forty-five teams representing 28 states and four international teams competed in three divisions. Competing at the national Operations Challenge competition is common for many leaders in our industry, and none of it would be possible without the support of families, employers, associations, and vendors.

Award Winners

The board would like to congratulate the following RICWA members on receiving awards: Dylan Chase (New Shoreham Water Pollution Control Facility) for the NEWEA Operator Award; Peter Hassel (Veolia Water, town of Smithfield) for the NEWEA Alfred E. Peloquin Award; Kevin Wunschel (Veolia Water, city of Cranston) for the RICWA Robert J. Markelewicz Award; Norman Blank (Suez, town of Warren) for the RICWA Collection Systems Operator Award; Paul Desrosiers (Narragansett Bay Commission) for the RICWA Carmine J. Goneconte Operator of the Year Award; and Joyce Smith-Corrente (Jacobs, Woonsocket) for the RICWA Facility Support Excellence Award.

Scholarship Winners

RICWA provides scholarships annually to college students sponsored by our members. Scholarships range from $500 to $1,000 depending on the number and quality of applications. Congratulations to our 2022 Scholarship recipients: Benjamin Liebermensch, Erin Healy, Jackson Arcand, Molly Juenger, Samuel Gerhard, and Steven Parrillo.

NEWEA Annual Conference

Rhode Island's clean water professionals were well represented at this year's NEWEA Annual Conference as vendors, committee chair, state director, state legislators, and attendees. Several RICWA members participated in the Executive Committee Meeting, Ops Challenge Committee Meeting, Workforce Development Committee Meeting, Government Affairs, and New England State Regulatory Roundtable, as well a variety of amazing technical sessions and important discussion forums.

Upcoming 2022 RICWA Event Highlights

- Awards Banquet May 12, Cranston Country Club
- Golf Classic, June 19, Potowomut Golf Club
- Clambake and Exhibition September 8
  Crowne Plaza, Warwick
- Holiday Party, December 1, location TBD

Please check ricwa.org or our Facebook page for all association news and full event listings.

Peter Hassel, NEWEA Alfred E. Peloquin Award

Dylan Chase, NEWEA Operator Award

RISING SLUDGE Operations Challenge team: (L-R) Max Maher, Rob Norton, Dave Bruno, Coach Eddie Davies, and Riley Greene

RICWA Clean Water Summit

Connecticut State Director Report

by Vanessa McPherson
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In case you were not sure if I was enjoying serving as the Connecticut state director for NEWEA for the third year of the term started by Bill Norton, the proof is in having raised my hand to serve my own full term. It is a privilege to continue in this role for the next three years, and I look forward to developing the relationships I've formed with so many, as well as making new acquaintances in the NEWEA community. We are keeping up the great momentum in Connecticut. Please read on about our events and activities.

Connecticut Water Environment Association (CTWEA) Manager's Forum

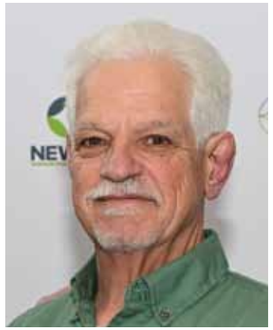
The Manager's Forum was held on January 20 at the Aqua Turf in Plantsville. This event focused on Connecticut operators, and the last forum happened before the pandemic. Our Operations Committee chair, Ted Donoghue (Litchfield Water Pollution Control Authority [WPCA]), poured his passion into its planning and execution. The event started with a slideshow of hard-working operators at various facilities around the state set to the instantly recognizable anthem "Rock and Roll" by Led Zeppelin (appropriate, since it had been a long time). A packed agenda followed, including Jason Nenninger's overview of the Operations Challenge, an update from Connecticut Department of Energy and Environmental Protection (CTDEEP) staff including the right-to-know reporting requirements, information about aquatic toxicity testing, a summary by Rob Butler from South Windsor Water Pollution Control Facility (WPCF) of his experience in the Operator Exchange with Massachusetts, and a presentation about preparing for plant upgrades highlighting the Torrington WPCF. The event also featured the graduation ceremony for the Manager's Class, led by Megan Ambrose (University of Connecticut WPCF), Jeff Lemay (South Windsor WPCF), and Jamie Kreller from Suffield WPCA. Graduates could say a few words—the highlight of the day for many, including myself.

Operations Challenge

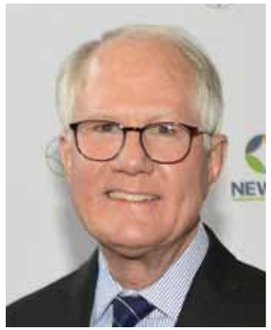
The 2022 Connecticut Operations Challenge team (photo next page) made us proud at WEFTEC. The team placed 3rd in the Process Control Event and came in 14th overall for Division II.

Our Connecticut team is looking for participants this year. Please visit our website (ctwea.org) to learn more. There are many ways to participate in Ops Challenge beyond being on the team itself,

Manager's Class Graduates



John Torre, NEWEA Operator Award



William Brink, NEWEA Alfred E. Peloquin Award

2022 Connecticut Operations Challenge team: Paul Burns, Brad Vasseur, Jason Nenninger, Ryan Harrold, and Nicole LaBoy

including donating equipment and supplies, judging events, and fundraising. The next event includes a NEWEA training day on March 31 and a New York/New England Water Environment Association combined competition event at the Spring Meeting in Saratoga Springs, New York, in early June.

NEWEA and WEF Award Recipients

This year's NEWEA Annual Conference was well attended and an excellent event, as always.

Connecticut representation in the Regulatory Roundtable session was by Ivonne Hall of the Municipal Wastewater section of CTDEEP. Thank you, Ivonne, for your time and participation.

We are proud of the Connecticut wastewater professionals recognized by NEWEA, WEF, and EPA at the NEWEA Awards luncheon for their work in 2022:

- US EPA Region 1 Wastewater Treatment Plant Operator of the Year Excellence Award—Jamie Kreller (Suffield)
- NEWEA Alfred E. Peloquin Award—William Brink (Stamford)
- Operator Award—John Torre (Greater New Haven WPCA)
- Past President's Plaque and Pin—Virgil Lloyd (Manchester)
- WEF Operations Challenge Competition, Division II, 3rd Place Process Control—CT Storm Surge; (Jason Nenninger and Ryan Harrold of Greater New Haven WPCA; and Paul Burns and Nicole LaBoy, of the Metropolitan District, Hartford)
- Quarter Century Operators' Club—Carl Veilleux (Enfield)
- WEF Life Membership Award—Ray Bahr (Durham) and Mike Bisi (Wethersfield)
- Stockholm Junior Water Prize—Adam Kleshchelski (Greenwich)

Government Affairs and Legislative Outreach

The Government Affairs Committee is gearing up for a busy legislative session. We have been working with our government relations advisor, Melissa Biggs, to maintain awareness and strategize for advocacy on legislation pertaining to our industry. Like other New England states, we anticipate per- and polyfluoroalkyl substances (PFAS) to be a hot topic in this session and are seeking ways to support legislation that we can stand behind such as source reduction.

CTWEA members have already testified on Raised Bill No. 916, which is an Act Concerning Foreclosure, Assignment, and Other Enforcement Actions for Unpaid Sewer Assessments and other Fees and Charges. A similar bill was raised during the prior legislative session. As proposed in this session, the raised bill prohibits foreclosure on owner-occupied residences for sewer assessment arrearages (based on principal) of less than $4,000. Talking points for our opposition are similar to prior advocacy and includes that financing publicly owned wastewater collection and treatment systems relies on sewer use billing and that the foreclosure process is rarely used. When it is employed, it is as a last resort.

Planning is underway for the DC Fly-in (April 25–26), and we will be scheduling meetings with the Connecticut delegation to raise awareness about hot topics and express our appreciation for the funding directed toward critical infrastructure needs and water quality in the state.

Events and Happenings

- Spring Workshop – Monday May 8, 2023, at the Aqua Turf in Plantsville
- Sewer Open – Friday June 16, 2023, at Skungamaug golf course in Coventry

Other Highlights

CTWEA has formed a Nominating Committee to prepare a slate of officers to be elected in July 2023. We appreciate the dedication and commitment of the CTWEA Board of Directors and the incredible energy our merged organization has demonstrated.

Become a member or supporter today! We are always looking for volunteers to work with our committees, so please express interest through our website to participate. Special opportunities:

- Young Professional participation as we work to develop engagement of this group (networking event being planned for this spring or summer)
- Small Community participation so we can be sure we represent all of the Connecticut wastewater sector

Maine State Director Report

by Paula Drouin
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Happy spring 2023. We've made it through another unpredictable winter in New England where many of us saw the coldest temperatures and most extreme wind chills in decades. On Mount Washington, the U.S. wind chill record was broken by over 6°F (3.4°C) when wind chills dropped to -108.4°F (-78°C) on February 3 and 4. A huge thank you to the clean water workers who endure these harsh conditions to keep our processes running and our communities served. Now, hopefully some warmth is in store.

Maine Water Environment Association (MEWEA) continues to be active, and I am proud to be part of and represent this organization. The 14th Annual Legislative Breakfast, called Waffles and Water, was held on January 18 in Augusta where we were thrilled to have the event in person once again after a couple of years of virtual only. Along with leaders in our association, speakers from the Maine Department of Environmental Protection and the Maine Drinking Water Program presented on clean water, biosolids management, and funding. Around 20 legislators attended and several asked questions. While the stress involving PFAS-related legislation was heard (and felt), we all left knowing there is no going back, and the only path is to move forward and foster partnerships that allow us to make the best possible regulatory decisions in the future.

In collaboration with the New Hampshire Water Pollution Control Association and Green Mountain Water Environment Association, we held our annual Ski Day on March 17 at Loon Mountain in Lincoln, New Hampshire. This event is always a great opportunity to network, socialize, and have fun. It was wonderful to have Vermont join us this year so we could connect with its membership.

The North Country Convention (NCC) occurs biennially (this year, April 5–6) in Presque Isle. This two-day event features technical sessions, exhibitor interactions, luncheon speakers, and networking opportunities. Our Joint Environmental Training Coordinating Committee (JETCC) and NEIWPCC host this event, with support from MEWEA. The conference takes place in "the county" to complement similar annual events that take place in the southern region of the state. The NCC brings the benefits of those events to the people of northern Maine. For perspective, it takes about two hours to drive from Portland to Bangor, but another two-and-a-half hours to get to Presque Isle. Maine sure is vast!

In Celebration of the Clean Water Week, MEWEA is again sponsoring a poster competition for Maine students in grades 1–12 where they create artwork illustrating "Why Water's Worth It to Me." In recent years the contest has been a huge success, and we routinely receive over 500 posters which are judged for demonstrating creativity, delivering a strong message, and connecting with MEWEA's mission. The top 12 posters are made into a calendar for the following year, and the top four student submissions (one from each age group) receive $100 and attend a celebratory event. Pre-Covid we often went with the winners to Augusta to visit the governor, and we would like to start doing this again.

Another upcoming social event is the Urban Runoff 5k on April 22 in South Portland. Organized and hosted by the Cumberland County Soil and Water Conservation District, this event supports clean water education in Maine. MEWEA has received the award for largest nonprofit team for years, and we will be back to defend our title! Anyone is welcome to join our team. Come walk or run for this great cause. There is a virtual option as well, so don't let distance deter you.

MEWEA is gearing up for the National Water Policy Fly-in, scheduled for April 25–26 in Washington, D.C. At this event, each state meets with its elected senators and representatives to talk with them about the critical work we do, including the challenges we face. Our story is not new, but showing up and providing a clear and concise update on current issues has value. We must also continuously extend ourselves as a resource if they ever have clean water questions.

Later this year, on September 21–22, MEWEA will host our annual Fall Convention at Sunday River in Newry. As usual, the annual golf tournament will be on the Wednesday before, September 20. This convention is our highest attended event due to the number of technical sessions, the vendor floor, and possibly the after-hours cornhole tournament hosted by our Collection Systems Committee. We also present our annual awards on Thursday. Over the years we have tried to make the awards program more special. A few years ago, we took NEWEA's practice of developing award brochures to be displayed on the tables. Last year, we held a separate awards event in a session room rather than during lunch. We found that the lunch area was not always suitable because of the visual obstructions and noise. The separate event gives awardees and attendees a much better experience. The response was overwhelmingly positive, so we will continue to hold a separate presentation.

I'll take this opportunity to promote the awards program: Whether you are in Maine or one of the other states, please look at the awards offered and make nominations (state and regional/national levels). I also challenge you to stretch your mind and nominate folks whom we may not see often at events but know are doing the work. Let's get them the recognition they deserve.

One other event worth mentioning is the Celebration of the 50th Anniversary of the Clean Water Act that we held in September along the Androscoggin River in Lewiston. It was a collaborative celebration of the act and Maine's success in transforming our rivers, lakes, and beaches, from Maine's own Senator Edmund Muskie's role in the development and passage of it, to the many dedicated citizens, advocates, and professionals protecting our water today. The Natural Resources Council of Maine recognized 100 clean water champions, including some who are longstanding MEWEA members. It was a lovely event where we reminisced on the progress made as well as the future improvements and challenges we look forward to.

Maine's 2022 NEWEA Award Winners

Michael Courtenay, Operator Award

Mark Holt, Alfred E. Peloquin Award

Theresa Tucker, Youth Educator Award

Philip Tucker, Youth Educator Award

Vermont State Director Report

by Michael A. Smith
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The Green Mountain Water Environment Association (GMWEA) is off to a good start in 2023. The following summarizes major activities and programs that we have advanced most recently, as well as personnel highlights from our association membership.

Collaboration with the Vermont Agency of Natural Resources

The GMWEA Government Affairs Committee met with members of the legislature on January 19 at the Vermont State House. Priority issues for 2023 that were discussed were a long-term approach for managing wastewater sludge, a long-term plan for management of septage, a long-term plan for management of landfill leachate, and support of drinking water, wastewater, and stormwater projects with upcoming federal infrastructure funding.

Vermont Department of Environmental Conservation has implemented a trial program for eligible pre-treatment wastewater projects that can be completed by September 2025. These projects will be funded partly through the available state fiscal year 2022 or subsequent American Rescue Plan Act pre-treatment appropriations. Pre-treatment grant awards are expected to have been made by the time this *Journal* issue goes to press. If this program succeeds, another round of applications is expected to be accepted for state fiscal year 2023.

Infrastructure Funding

The federal Bipartisan Infrastructure Law, or the Infrastructure Investment and Jobs Act, made needed fiscal year 2023 funding resources available in the following areas, with applications due by March 1, 2023:

- **General Water Quality Infrastructure**: $10.2 million for clean water and $21 million for drinking water project planning, design, and construction costs, through state matching funds and 49 percent principal forgiveness on Vermont State Revolving Fund (SRF) loans.
- **Emerging Contaminants**: $1 million for clean water and $7.5 million for drinking water for planning, design, and construction of projects addressing per- and polyfluoroalkyl substances (PFAS), including 100 percent principal forgiveness on Vermont SRF loans.
- **Lead Abatement**: $2.35 million for lead abatement in water systems, with 49 percent principal forgiveness on Vermont SRF loans
- **Source Protection**: $500,000 in partial grants for community water systems needing to buy land to secure their source protection areas.

The Vermont State Laboratory in Randolph has received $1.5 million for analytical equipment to measure PFAS in drinking water samples, allowing analyses to be performed in state and thus reducing cost and turnaround time.

Continuing Education Program

GMWEA is supporting continuing education for licensed membership through its Lunch and Learn Program. The GMWEA Continuing Education Committee has recently secured assistance from the University of Vermont to help with education on stormwater topics. This online program continues to be popular.

Workforce Development

Vermont is strongly involved with NEWEA, New England Water Works Association, and numerous other organizations in attracting and retaining talented engineering, operating, regulatory, and other employees to the water quality field to address lack of staff across all disciplines. GMWEA continues to support this new water works recruitment and training program.

Forever Chemicals

As a result of challenges created by the four EPA-released drinking water health advisories for PFAS in 2022, the Vermont Agency of Natural Resources has notified 61 public water systems with PFAS concentrations between non-detect and the Vermont Maximum Contaminant Level of 20 ppt that they will need to send documentation regarding PFAS and health and safety concerns to their connected users. Many of these systems are Transient Non-community and Non-transient Non-community systems, the largest of these the Stowe municipal water system, which generates 465,000 gpd (1.76 ML/d) of potable water. Vermont has indicated these systems may have to begin planning to remove PFAS from their water sources. GMWEA and other state water quality associations are collaborating on a position paper to EPA as well as to state primacy agencies to voice their concerns, thoughts, and recommendations on behalf of the membership regarding these new advisories.

Bernard (Bernie) Fleury retired from Essex Junction WWTF

Megan Moir, NEWEA Asset Management Excellence Award

Victor Chaput, Jr., NEWEA Operator Award

Personnel Announcements

Bernard (Bernie) Fleury, senior operator at the Essex Junction Wastewater Treatment Facility (WWTF), retired on December 16, 2022, as the longest continually serving employee at the WWTF. Serving for 44 years, Mr. Fleury participated in several process upgrades, including addition of secondary treatment, sludge management, and anaerobic digestion systems. He also worked on innovative pilot programs at the facility, including a phosphorus reduction and recovery project with the University of Vermont and the Vermont Phosphorus Innovation Challenge. Mr. Fleury has been active within NEWEA and GMWEA, and a well-known member of the Vermont Sewer Marines who were successful in Operations Challenge competitions of the late 1990s at NEWEA and nationally at WEFTEC. He received the GMWEA Wastewater Operator Excellence Award in 2021, and he is a 13-year member of the WEF Quarter Century Operators Club. Thanks to Mr. Fleury for his years of dedication to GMWEA, NEWEA, and the protection of Vermont's water quality.

GMWEA recognizes Megan Moir and Victor Chaput, Jr., as recipients of NEWEA awards at the 2023 Annual Conference in Boston.

Megan Moir, division director of water resources for the city of Burlington, received the NEWEA Asset Management Excellence Award, recognizing an organization that demonstrates initiative and leadership in asset management. Ms. Moir began with the city in 2009 as its stormwater program manager, and for the past seven years has led the development and implementation of asset management at all levels. She has been instrumental in the city's asset management plans and implementation of its computerized maintenance management system.

Victor "Rick" Chaput, Jr., chief operator at the city of Vergennes's WWTF, received this year's NEWEA Operator Award for Vermont, given annually to an individual who has shown interest and performance in wastewater operations and has contributed significantly to the wastewater field. Mr. Chaput's vigilance and ingenuity has kept Vergennes's aging wastewater infrastructure in compliance since 2014, which has been no small feat. He has successfully communicated infrastructure investment needs to the public at public meetings, helping to persuade voters to pass, with 87 percent support, a $25.5 million bond to overhaul the collection system and WWTF. Mr. Chaput has served as a board member and president of GMWEA, and (with Mr. Fleury above) competed locally and nationally in the Operations Challenge event for seven years in the late 1990s as a member of the Vermont Sewer Marines.

Upcoming Events

Our recent 2022 Fall Conference, the major GMWEA event each year, was successful and well attended, with full participation by vendors. Upcoming events include the following:

- GMWEA's Spring Conference and Annual Business Meeting at the Killington Grand Hotel in Killington on May 25
- George Dow Golf Tournament in August at the Cedar Knoll Country Club in Hinesburg
- GMWEA's 2023 Fall Conference in November at the Doubletree Hotel in South Burlington
- Operator training course and Lunch and Learns (schedule noted earlier)

Final dates for the above will be posted on our calendar at gmwea.org.

I hope everyone is having a great start to the spring season. As ever, I am most grateful to the GMWEA members who have directly (and indirectly) contributed to this report.

New Hampshire State Director Report

by Michael Trainque
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Greetings from the Granite State. I have been following the water crisis unfolding out west encompassing the Colorado River, Lake Mead, and Lake Powell. Not only are the water levels in these lakes becoming dangerously low, they also are not likely to refill in our lifetimes, if ever. In "water-rich" New England we tend to take our supply of potable for granted, but out west difficult decisions will be needed for both reducing demand and rationing supply since the current path is not sustainable. It should give pause to those of us directly involved in the water industry daily as to how fragile our water supply can be. It certainly makes us appreciate the value of this life-sustaining resource.

During the past year or so, the New Hampshire Water Pollution Control Association (NHWPCA) has transitioned to NEWEA for its administrative functions. This partnership between the NHWPCA and NEWEA is strong and has been a successful and beneficial change for the NHWPCA; it has also strengthened the bond between the two associations. We look forward to many more years working together!

Congratulations to Christopher Perkins of Weston and Sampson Engineers, Inc., on receiving the Alfred E. Peloquin Award and to Mark Corliss of the Winnipesaukee River Basin Program (WRBP) wastewater facility in Franklin on receiving the New Hampshire Operator Award at the NEWEA Annual Conference in Boston. Mr. Perkins has worked in the wastewater industry for 29 years. He is an active member of WEF, NEWEA, NHWPCA, and the Maine Water Environment Association. He was nominated for this award for his years of dedication and commitment to the wastewater industry and his willingness to contribute his time and talent to guide and help others progress. Mr. Corliss has been an operator with the WRBP in Franklin for 32 years. He not only invested in his own training and development but also assisted other operators in their professional development. Mr. Corliss is a dedicated public servant committed to the protection of the environment and the advancement of his fellow operators in the wastewater industry.

Planning for the 2023 operator exchange between New Hampshire and Vermont has been well under way as we prepare and hope to avoid pitfalls encountered last year. The Vermont exchange operator will visit New Hampshire from September 20–22, to coincide with the NHWPCA Fall Meeting scheduled for September 22.

The NHWPCA has a new Youth Outreach Committee. As there are several youth-focused association events, the goal for 2023 is to coordinate these under the new committee. Nate Brown (Peterborough) and Casey Maranto (Wright-Pierce) are the co-chairs. Its description and charge, now being developed, will be reviewed by the NHWPCA Board of Directors.

Four member associations of the New Hampshire Water Coalition—New Hampshire Waterworks Association (NHWWA), Granite State Rural Water Association (GSRWA), New Hampshire Municipal Association (NHMA), and NHWPCA—along with the New Hampshire Department of Environmental Services (NHDES) meet periodically to promote common messaging with state and national leaders as well as to inform the public. Most recently, this group has focused on legislative outreach, pending Legislative Service Requests, PFAS impacts on water and wastewater facilities, rapidly rising energy costs, and workforce recruiting challenges. The NHMA developed a nice legislative update that includes new state senate committee assignments. View it at nhmunicipal.org/legislative-bulletin.

NHWPCA partners with the NHDES and others on operator training. One such effort is the New Hampshire Water and Wastewater Managers School, a collaboration among NHWPCA, NHWWA, and NHDES. Classes in the current session occur on the third Tuesday of the month from March through November. Twenty-two operators are in the current Management School session. Tuition is $675 per student, and graduates receive 70 contact hours of training.

The NHWPCA Winter Meeting was on December 9, 2022, in Somersworth. Tours of the Somersworth Wastewater Treatment Facility in the morning showed the recent plant improvements. Lunch, technical presentations, a business meeting, and the always popular (and always raucous) raffle started at 11:00 AM at The Oaks Grandview Venue in Somersworth. One hundred fourteen people registered for the meeting, and the holiday spirit was evident in all.

New Hampshire held its annual water-focused Legislative Breakfast on March 8 at the Holiday Inn in Concord. This was a combined event sponsored by the NHWPCA, NHWWA, and GSRWA. The guest speaker was Scott Spradling, a former television anchor who is politically active in New Hampshire. Fred McNeill, from the city of Manchester Environmental Protection Division (EPD), moderated the breakfast. The event was well attended and much appreciated by the legislators.

The 14th annual Ski Day was planned for March 17 as a collaboration among NHWPCA, GMWEA, MEWEA, and the Maine Water utilities Association at Loon Mountain in Lincoln.

The NHWPCA Annual Trade Fair is on April 14 at the Sheraton Hotel in Nashua. The trade fair includes vendor exhibits, technical sessions for continuing education units (CEUs), a formal luncheon, an awards ceremony, and a raffle.

Discover Wild New Hampshire Day is on April 15 at New Hampshire Fish & Game Department in Concord. Discover Wild New Hampshire Day is a fun way for the family to explore New Hampshire's wildlife resources and legacy of outdoor traditions, browse educational exhibits by environmental and conservation organizations, see live animals, fish, and trained falcons, try archery, casting, fly-tying, and B-B gun shooting, watch retriever dogs in action, enjoy hands-on craft activities, and check out the latest hunting and fishing gear and gadgets. Last year, in what has become a tradition, NHWPCA gave away 20 fishing poles (two poles every half-hour) and provided pizza.

The spring 2023 edition of the NHWPCA newsletter, "The Collector," has been distributed and is available on the NHWPCA website: nhwpca.org/content.php?page=news.

We express our sincere thanks and appreciation to Rob Robinson, city of Manchester EPD, for his efforts as last year's NHWPCA president. His term ended in December. Great work, Rob! We also want to wish Ryan Peebles, NHWPCA's new president, success this year. Keep your head up with a smile on your face, work hard, and be true to yourself; success is sure to follow.

Chris Perkins, NEWEA Alfred E. Peloquin Award

Mark Corliss, NEWEA Operator Award

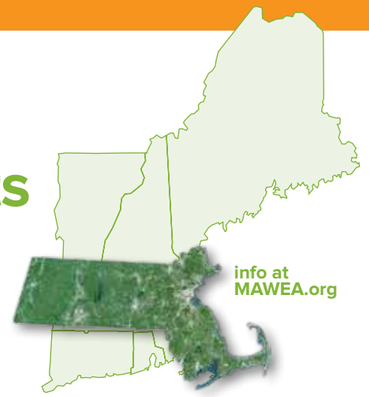
Sharon Nall, NEWEA Energy Management Achievement Award

Anthony Drouin, EPA Regional Wastewater Trainer of the Year

David Lovely, EPA Regional Wastewater Treatment Plant Operator of the Year Award

Christopher Crowley, Manchester, Pretreatment Supervisor, EPA Regional Industrial Pretreatment Program of the Year

Massachusetts State Director Report



by John Digiacomo
jdigiacomo@natickma.org

I am honored to be the incoming NEWEA state director for Massachusetts. For those who do not know me, I am a lifelong Massachusetts resident where I attended Worcester Polytechnic Institute, earning a bachelor's degree in civil and environmental engineering. I am the assistant town engineer for the town of Natick, where I have been for 18 years. Prior to that, I worked as a consultant for eight years for two companies. I am presently on the Massachusetts Water Environment Association (MAWEA) Board of Directors and have held many roles within NEWEA during the last 20 years, including Collection Systems Committee chair, Collection Systems/Water Resources Council director, and most recently the Assessment and Development Committee chair. I am also a member of more committees than I have room here to list. Thank you to the outgoing Massachusetts state director, Adam Yanulis, for his work over the last three years. I know I have big shoes to fill, but I am up for the challenge and excited for the opportunity.

MAWEA Events—Past and Future

Last year marked a transition for MAWEA, dealing with the lingering effects of Covid-19, the retirement of Mickey Nowak as executive director, and the subsequent decision to partner with NEWEA on operational and administration support for the organization. All of this has helped MAWEA grow stronger, and 2023 is shaping up to be an exciting and busy year. In February, MAWEA members participated in a Ski Day with members from the state associations of Connecticut (CTWEA) and Vermont (GMWEA) at Stratton Mountain in Vermont. Despite it occurring on the coldest day of the year, everyone had a great time, and no injuries were reported! Our quarterly meeting took place on March 15 at the Devens Common Center. While we have held effective events and meetings virtually over the last few years, it is exciting to get back to more in-person events like this. For the first time in a few years, our legislative breakfast (held jointly with Massachusetts Water Works Association and ACEC/MA) will be held in person at the State House in Boston on May 11. This is an amazing opportunity to partner with our other utility partners in meeting with our local state representatives and senators. These meetings are important in making our governmental representatives aware of the great work we do and the vital need of their support for funding of clean water infrastructure and other legislation affecting our utilities.

The 2023 National Water Policy Fly-in (that NEWEA attends with WEF and member associations from across the country) will be taking place on April 25–26 in Washington, D.C. This is the largest annual grassroots advocacy event for water policy issues and, like the Massachusetts legislative event, is crucial to helping engage and educate our representatives in the government on the remarkable work we do and the need for renewed funding for current initiatives as well as additional funding for future legislation. Please reach out to me, any member of the MAWEA Board of Directors, or the NEWEA Government Affairs Committee if you are interested in participating in either of these events.

The MAWEA Spring Operators Trade Show and Barbeque will be at Mount Wachusett on May 18. This will be a great event, and we hope for perfect weather for everyone! Please check the MAWEA website for information on this event (as well as all other upcoming events). And for all the golfers reading this (or people who, like me, enjoy having a beer and occasionally hitting a round ball with a metal stick into the woods or water hazards), please mark your calendars for the MAWEA Annual Golf Outing, scheduled for June 15 at the Heritage County Club in Charlton. Planning is well under way, and we are hoping to have another fun event this year, including new events and prizes.

NEWEA Annual Conference/Awards

NEWEA held its Annual Conference in Boston at the Marriott Copley Place from January 22–25. Attendance (and the excitement surrounding the event) appeared to be back at pre-Covid levels and many Massachusetts operators, municipalities, vendors, and consultants attended and had a great time. At the annual NEWEA Awards Luncheon, Massachusetts was well represented. Award recipients from Massachusetts included the following:

- Stockholm Junior Water Prize—Akhila Ram, Worcester
- Kate Biedron Memorial Scholarship Recipient—Ella Quinn, University of Massachusetts
- WEF Student Design Competition—Evan Anderson, Matthew Biega, Daniel Diament, Lauren Howe, Dillon McCormick, and Jacob Wasserman—Northeastern University
- NEWEA Operator Award—Jason Swain, Holyoke
- Alfred E. Peloquin Award—Aaron Fox, Lowell
- Operator Safety Award—William Smith, Chatham
- Elizabeth Cutone Executive Leadership Award—Mickey Nowak, Springfield
- Young Professional Award—Tess Laffer, Chelmsford
- James J. Courchaine Collection Systems Award—Joe Boccadoro, Ashland
- Founders Award—Paul Dombrowski, Holyoke
- E. Sherman Chase Award—Sharon Lawson, Millbury
- Clair N. Sawyer Award—Robert Rak, Bristol Community College
- Biosolids Management Award—Karla Sangrey, Millbury
- Committee Service Award—Alexandra Greenfield, Salem
- Energy Management Achievement Award—South Essex Sewerage District, Salem
- Diversity Equity & Inclusion Leadership Award—Isabella Cobble, Westwood
- George W. Burke, Jr. Award—Billerica Water Resource Recovery Facility
- William D. Hatfield Award—Chelsey Little, Montague
- Arthur Sidney Bedell Award—Lauren Hertel, Andover
- WEF Life Membership—Frank Cavaleri, Boston
- WEF Quarter Century Operator Award—Kathy Perez, Lowell
- WEF Delegate Award—James Barsanti, Boston
- WEF Fellow—Susan Sullivan, Lowell
- WEF Operator Scholarship—William Branton, Scituate

Congratulations to all the award recipients on these well-deserved honors.

Mass Chaos makes Massachusetts Proud

After finishing third in the Operations Challenge competition at the NEWEA Spring Meeting last May, the Massachusetts Operations Challenge team (Mass Chaos) qualified to compete in the national competition at WEFTEC in New Orleans this past October. The team competed well against 12 other teams in its division and placed second in the Division III competition. The team's scores included a first place in the Lab Event and second place in both the Safety and Collections events. The team includes Roel Figueroa, Kelly Olanyk, Scott Urban, Paul Russell, and Coach (flexing) Mike Williams.
While still riding the high from its winning performance, the team is already preparing for 2023 by participating in the Operations Challenge Training Day event on March 31 in Holyoke to get ready to compete at the Joint NYWEA/NEWEA Spring Meeting in Saratoga Springs, New York, in early June. Good luck!

Jason Swain, NEWEA Operator Award

Aaron Fox, NEWEA Alfred E. Peloquin Award

2023 Annual Conference & Exhibit Proceedings

Boston Marriott Copley Place, Boston, MA • January 22–25

NEWEA's 2023 Annual Conference convened with a meeting of the Executive Committee with all chairs on Sunday, January 22, 2023. More than 2,100 individuals attended the three-day event, which featured over 200 exhibitors and 34 technical sessions.

The Annual Business Meeting was held on Monday, January 23. Incoming Nominating Committee Chair Jennifer Kelly Lachmayr presented the slate of officers for 2023 as follows:

- Vice President – Deborah Mahoney
- WEF Delegate (through WEFTEC 2026) – Virgil Lloyd
- Council Director: Collection Systems and Water Resources – Scott Lander
- Council Director: Innovation – Michael Murphy
- Connecticut Director – Vanessa McPherson
- Massachusetts Director – John Digiacomo

In accordance with the provisions of Article 9.3.2 of the NEWEA Constitution & Bylaws, these officers advanced to the following positions:

- President – Robert Fischer
- President-Elect – Scott Goodinson
- Past President – Frederick McNeill
- Treasurer – David VanHoven

The remaining incumbents are fulfilling unexpired terms:

- WEF Delegate – Peter Garvey (through WEFTEC 2023)
- WEF Delegate – Raymond Vermette (through WEFTEC 2024)
- WEF Delegate – Janine Burke-Wells (through WEFTEC 2025)
- Council Director: Communications – Philip Tucker fulfilling Deborah Mahoney's term (3rd year)
- Council Director: Meeting Management – Amy Anderson George (2nd year)
- Council Director: Outreach – Colin O'Brien (3rd year)
- Council Director: Treatment System Operations & Management – Marina Fernandes (2nd year)
- Rhode Island Director – Edward Davies (3rd year)
- Maine Director – Paula Drouin (2nd year)
- Vermont Director – Michael Smith (3rd year)
- New Hampshire Director – Michael Trainque (2nd Year)

Opposite page: Program Chair Lauren Hertel, President Fred McNeill, and Exhibits Chair Paul Russell at the exhibit hall opening ribbon cutting **1.** EPA Region 1 Administrator David Cash delivers the Opening Session keynote address **2.** William Carter and Kevin Dalton, both of MWRA, arrive at the conference **3.** Bill Dimmick and Peter Bartlett of NewTech Environmental discuss program options for their day **4.** Registration Volunteer Sarah White, center, helps Faye Kuszewski of UMass Amherst and Natalie Sierra of Brown and Caldwell with the electronic self-registration process

34 Technical Sessions

SESSION 1
Young Professionals—The Future of the Industry
Moderators:
- Jaimie Payne, BETA Group
- Victoria Helle, NEIWPCC

Harmonization of Water Industry Trends to Drive Innovation of Analytics
- Ryan Flood, Water Analytics

Planting the Seeds for Young Professional Development through the Roots of Arcadis Program
- Baxter Miatke, Arcadis

The Next Generation of Operators—Recruitment and Retainage
- Robert Roland, Weston & Sampson

ESG 101: Why and How Water Utilities are Shifting from Sustainability Reports to ESG Reporting
- Karri Ving, Brown and Caldwell
- Matthew Ries, DC Water
- Rosaleen Nogle, Buffalo Sewer Authority
- Mary Tchamkina, Raftelis

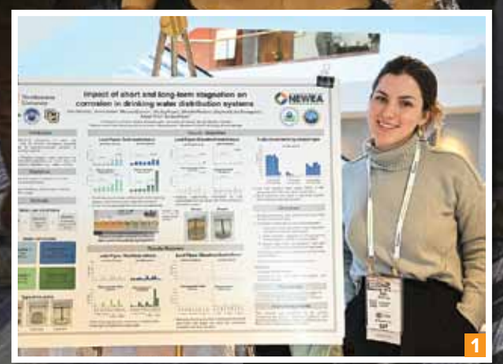
SESSION 2
Stormwater 1: Preparing for the Future—Stormwater Quality and Quantity
Moderators:
- Eric Kelley, Environmental Partners
- Maria Rose, town of Brookline, MA

Assessing Extreme Storm Event Inundation in Boston Using Spatial Rainfall—2-dimensional Dynamic Flood Modeling and Innovative Visualization Tools
- Ben Agrawal, Hazen and Sawyer
- Charles Wilson, Hazen and Sawyer
- Charlie Jewell, BWSC
- John Sullivan, BWSC

Mitigating High-Flows and Improving Water Quality in a Stormwater Impaired Brook
- James Sherrard Jr., city of Burlington, VT
- Dayton Marchese, Opti RTC

Stormwater Phosphorus Load and BMP Tracking in Brookline
- Sam Downes, town of Brookline, MA
- Matthew Davis, Brown and Caldwell
- Stephanie Alimena, Brown and Caldwell

The Port Flooding Resiliency Project—Safeguarding At-Risk Populations from the Effects of Climate Change
- Kate Goyette, Kleinfelder
- David VanHoven, Stantec
- Jerry Friedman, city of Cambridge, MA



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Monday morning crowds enjoy the busy poster contest aisle **Insert 1**. Kate Moloney of Northeastern University with her poster on effects of stagnation on corrosion in water distribution systems **Insert 2.** Timothy Onuh of UMass Amherst discusses his poster regarding pollutant effects of polystyrene nanoparticles

1. Tim Loftus, Denise Descheneau, and Ethan Cox, all of Upper Blackstone Clean Water **2.** Young professionals gather at Monday's YP Committee meeting **3.** Dennis Hallahan and Evan Dalton of Infiltrator Water Technologies select a pertinent session **4.** Alexander Lewis, Kaitlyn Schwalje, and Steven Jackson take a break from filming their special wastewater documentary

Session 3
Asset Management 1: Let's Get [Pro] Active with Asset Management!

Moderators:
- Matt Manchisi, Kimley Horn
- Eliza Styczynski, NHDES

New York State Department of Environmental Conservation's Asset Management Pilot Program
- Timothy Taber, Barton & Loguidice

Validating the Long-Term Cost-Effectiveness of Proactive Asset Renewal
- Brian Brown, CDM Smith
- Jason Waterbury, The MDC

What Everyone Should Know About Asset Management—an Expert Panel Discussion

Panelists:
- John Fortin, Salem and Beverly Water Supply Board
- Kevin Campanella, Burgess & Niple
- John Jackman, Hoyle, Tanner & Associates

How Long Will That Force Main Last? A Planning Approach for Evaluating, Assessing, and Rehabilitating Ductile Iron Force Mains
- Andrew Grota, Environmental Partners
- Ziad Kary, Environmental Partners

Session 4
Water Reuse— Today and Tomorrow

Moderators:
- Nick Ellis, Hazen and Sawyer
- Meredith Zona, Stantec

MBR for Potable Reuse—Validation of a Full-Scale Flat Plate Membrane Bioreactor for Virus and Protozoa Removal
- Larry Morris, Kubota
- Mike Sullivan, Carlsen Systems

Our wAAter Program—Implementing Indirect Potable Reuse in Maryland
- Ramola Vaidya, HDR

Using Electricity to Disinfect—Sparks Fly with O3 & UV—Is Reuse in your Future?
- Bruce Stevens, SUEZ
- William Nezgod, SUEZ

Achieving Enhanced Nutrient Removal with AquaNereda® Aerobic Granular Sludge
- Joe Tardio, Aqua-Aerobic

Session 5
Residuals Management 1: PFAS Impacts on Biosolids

Moderators:
- Janine Burke-Wells, NEBRA
- Eric Spargimino, CDM Smith

Maine—the First State to Ban Sludge Beneficial Reuse and its Immediate Impacts on WWTFs
- Chris Dwinal, Wright-Pierce
- Robert Pontau, town of Brunswick, ME

Land to Landfill—How Presque Isle Utilities District Changed its Handling of PFAS-Containing Biosolids
- Julianne Page, Woodard & Curran
- Krista Forti, Woodard & Curran

Innovations with Biosolids Process Technologies
- Charles Goss, AECOM

Gasification and Pyrolysis of Sewage Sludge Biomass
- Philip Pedros, Mott MacDonald

Session 6
Utility Management: Fresh Ideas in Utility Management

Moderators:
- Art Simonian, The Mattabassett District
- Karla Sangrey, Upper Blackstone

Who Wants to Buy a Sewer System?
- Adam Simonsen, Aquarion

Developing the Workforce Through Your Local School System
- Phil Tucker, York Sewer District
- Theresa Tucker, York Sewer District

Optimizing a Capital Improvement Program—How to Measure and Improve Effectiveness
- Stephen King, Hazen and Sawyer

New England NPDES Permits are Out-of-step with the Rest of the Country
- Paul Calamita, AquaLaw

Session 7
Government Affairs 1: Regulatory Roundtable

Moderators:
- Scott Firmin, Portland Water District
- Jeff McBurnie, Casella Resource Solutions

New England faces many challenges. The Regulatory Roundtable Session allowed for a discussion of common issues and solutions and to facilitate the exchange of information.

Panelists from all six states:
- Ivonne Hall, CTDEEP
- James Crowley, MEDEP
- Joseph Haberek, RIDEM
- Amy Polaczyk, VTDEC
- Kathleen Baskin, MassDEP
- Tracy Wood, NHDES

Session 8
Collection Systems 1: Pump Up the Volute

Moderators:
- Jim Barsanti, Hazen and Sawyer
- Kara Johnston, CDM Smith

Rebuild or Replace? It Depends
- Erik Meserve, AECOM
- Zachary Cronin, city of Portsmouth, NH
- Peter Rice, city of Portsmouth, NH
- Jon Pearson, AECOM

Understanding Sewer Slope Transitions—Reduces Odor/Corrosion Impacts!
- Richard Pope, Hazen and Sawyer

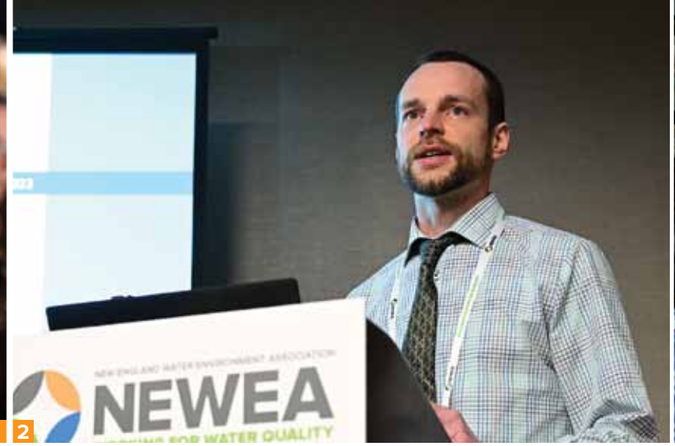
The Adventures of Large Diameter Force Main Pigging
- Jonnas Jacques, Kleinfelder
- Dave Peterson, Kleinfelder
- Rob Schultz, city of Newport, RI

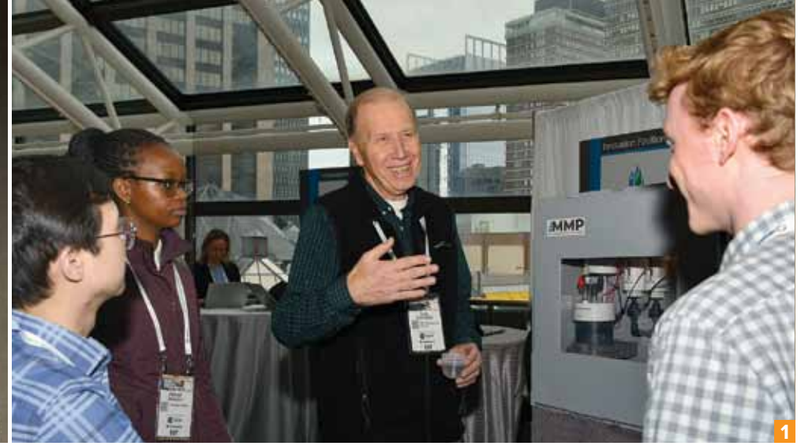
I Wonder What's Down Under? Condition Assessment and Rehabilitation of Critical Sewer Siphons
- David Polcari, CDM Smith

Session 9
Plant Operations 1: Troubleshooting, Issues, and Creative Solutions in Facility Upgrades

Moderators:
- Adam Higgins, Wright-Pierce
- Patty Chesebrough, NEIWPCC

A Tale of Two Processes—How the Metropolitan District's Wet Weather Process Expansion Program Led to Overall Plant Improvements
- Brian McGuire, Arcadis
- Jeff Bowers, The MDC






1. More than 2,100 individuals attended this years conference 2. Jeff Mercer of Wright-Pierce presents on sustainably dealing with street sand 3. The audience concentrates on green infrastructure at the Tuesday stormwater session 4. Emily Cole-Prescott of Saco, Maine, moderates the Tuesday Keynote Panel Presentation on the Clean Water Act—the Next 50 years

Teaching an Old Dog New Tricks—Troubleshooting & Optimizing Chlorine Disinfection Systems
- Brian Hilts, CDM Smith

Keeping the Aeration Train Rolling Through Turbulent Times—Hampton, NH WWTP Phase 1 Upgrade
- Philip McHenry, Wright-Pierce
- Michael Carle, town of Hampton, NH

Force Main Break During Construction Adds to Complexity of Difficult Project
- Doug Hankins, Wright-Pierce
- Matthew Hross, Hazen and Sawyer

Session 10
CSO/WWI 1: CSO Program Update—From Implementation to Water Quality Benefits

Moderators:
- Jason Kreil, Woodard & Curran
- Steve Perdios, Dewberry

Narragansett Bay Commission CSO Abatement: Water Quality Improvements Following Completion of Phase II
- Eliza Moore, Narragansett Bay Commission

Massachusetts Water Resources Authority's Journey from Long-term Control Plan to Post-Construction Compliance Monitoring Program
- Erika Casarano, AECOM
- Don Walker, AECOM
- Greg Heath, AECOM
- Jeremy Hall, MWRA

Incorporating Community Based GSI Solutions into a Large Scale CSO Program
- Brandon Blanchard, Pare Corporation
- Brian Kuchar, Horsley Witten
- Christopher Feeney, Stantec
- Kathryn Kelly, Narragansett Bay Commission
- Peter Georgetti, Pare Corporation

CSO Mitigation, Wet Weather Flows, and Regulatory Compliance—a Look into Fitchburg's Collection System Rehabilitation Plan
- Frank Occhipinti, Weston & Sampson
- Nicholas Erickson, city of Fitchburg, MA

Session 11
Diversity, Equity, & Inclusion: Engagement of DE&I Sustainable Strategies for Workforce Talent Acquisitions and Retention

Moderators:
- Stephen King, town of Danvers, MA
- Marina Fernandes, town of Milton, MA

Developing a Racial Equity Lens at Woodard & Curran—a Panel Discussion Q&A

Panelists:
- Rachel Gilbert, Woodard & Curran
- Julia Wahl, Woodard & Curran
- Sue Guswa, Woodard & Curran
- Jay Sheehan, Woodard & Curran

Application of DE&I Initiatives to Drive Successful Community Outreach
- Udayarka Karra, Arcadis
- Allison Zeoli, Arcadis

Bridging Differences to Inclusion
- Jasmine Strout, Green International
- Ko Ishikura, Green International

1. Craig Cunningham of Maine Manufacturing Partners pitches the DiriGo Stream product 2. Hugh Sinclair of Arcadis discusses optimizing asset management decision-making 3. Innovation Council intern Megan Goldsmith and Director Michael Murphy lead a discussion about Innovation program status 4. Rachel Gilbert speaks of racial equity development at Woodard & Curran

Session 12
Industrial Wastewater: What's in your Industrial Wastewater

Moderators:
- Matt Dickson, Haley Ward
- Sarah White, UniFirst

Implementing a Smart Industrial Pretreatment Monitoring Network
- Scott Simpson, Brown and Caldwell

Can You Accept That Industrial Discharge? Let's Test It!
- Leigh-Ann Dudley, Dewberry
- Katie Jones, Dewberry

Boston Groundwater Trust (BGwT): Wood Piles & Groundwater the Important Relationship
- Christian Simonelli, Boston Groundwater

Breaking the Chain—PFAS Intervention in the One Water Cycle
- Rosa Gwinn, AECOM

Session 13
Government Affairs 2

Moderators:
- Scott Firmin, Portland Water District
- Jeff McBurnie, Casella Resource Solutions

State Revolving Funds and the Bipartisan Infrastructure Law

EPA's State Revolving Fund team presented on the Bipartisan Infrastructure Law and its opportunities and implementation. Topics included financing, eligibility, and the similarities and differences among the domestic preference requirements, specifically the American Iron and Steel requirement and the Build America, Buy America Act. The presentation also included a Q&A period.

Presenters:
- Leslie Corcelli, EPA Office of Wastewater Management
- Kelly Tucker, EPA

Session 14
Collection Systems 2: Digging on the Dock of the Bay

Moderators:
- Peter Garvey, Dewberry
- John Digiacomo, town of Natick, MA

Provincetown's Wastewater System Implementation Using Design-Build-Operate—20 Years Later
- Paul Millett, Environmental Partners
- Robert Adams, AECOM

A Tite Fit—Novel Sliplining of Nahant's Force Main
- Stephanie Salerno, Wright-Pierce

Route 28 East Sewer Expansion Project in Barnstable, MA—the Cornerstone of the Future for a Cape Cod Community
- Michael Paulin, Weston & Sampson
- William Chandler, Weston & Sampson

Adapting Wastewater Infrastructure to Changing Flood Vulnerabilities—Southeastern Massachusetts Case Studies
- Sara Greenberg, GHD
- Anastasia Rudenko, GHD

1. Alexandra Greenfield and Marianne Langridge enjoy their initiation into the Select Society of Sanitary Sludge Shovelers (5S)
2. Douglas Reed removes the dust cover from the Meridian mapping drone 3. Claudio Ternieden (WEF), Deb Mahoney (Brown and Caldwell), NEWWA Executive Director Kirsten King, and NEWWA President James DeCelles share a laugh during Leadership Summit

Session 15
Plant Operations 2: Optimizing Energy Use in Biological Nutrient Removal

Moderators:
- Claudia Buchard, Woodard & Curran
- Nick Tooker, University of Massachusetts

More than Just Energy Savings—Understanding the Benefits of Low DO Operation
- Varun Srinivasan, Brown and Caldwell

How's Brockton Doing? Two Years of Process Optimization to Achieve 3 mg/L TN
- William McConnell, CDM Smith

Combating Costly Nitrogen Credits and Kilowatt Hours in Connecticut—the Story of Greenwich's Full-Scale, "Smart" Ammonia-Based Aeration Control Pilot
- Alyssa Beck, town of Greenwich, CT
- Isabella Silverman, CDM Smith
- Matthew Lick, CDM Smith

Utilization and Practical Optimization Strategies of Full-Scale Ammonia-based Aeration Control at Bonnybrook Wastewater Treatment Plant
- Mehran Andalib, Stantec

Session 16
CSO/WWI 2: Tunneling Challenges for Wet Weather Programs

Moderators:
- Mike Armes, IDEX
- Keith Gardner, Stantec

NBC Pawtucket CSO Tunnel—by Diameter North America's Largest CSO Storage Tunnel
- Kate Mignone, AECOM
- Kathryn Kelly, Narragansett Bay Commission

Balanced Treatment and Storage Efficiently Control Combined Sewer Overflows
- Kevin Trainor, Woodard & Curran
- Erik Osborn, Woodard & Curran

Crossing the Connecticut River—Big Pipes and Endangered Prehistoric Fish
- Gus O'Leary, Kleinfelder
- Jason Lavoie, Kleinfelder

Case History—Design and Construction of 5,100 LF of Soft Ground Microtunneling in Hartford, CT
- Thomas Loto, AECOM
- James Sullivan, AECOM
- Andrew Perham, The MDC

Session 17
Residuals Management 2: Residuals Operations

Moderators:
- Justin Motta, Stantec
- Mike Theriault, Wright-Pierce

Annual 503 Biosolids Reports—What Are They Good For?
- Mickey Nowak, MAWEA (retired)

Comparison of P Recovery with Struvite and Brushite Recovery
- Sara Arabi, Stantec
- Parnian Izadi, Stantec

Putting the Principles of Sustainability and Resiliency into Practice—the GLSD Organics to Energy Project
- Ben Mosher, CDM Smith
- Mike Walsh, CDM Smith

Polymer/Flocculant 101: Fundamentals of Thickening and Dewatering
- Yong Kim, UGSI

1. Garrett Bergey of SDE proudly displays his Golden Raindrop award for excellence in stormwater management
2. UNH Stormwater Center Director James Houle makes a point during the Stormwater Committee meeting
3. Richard Merson (NE-APWA), Incoming NEWEA President Bob Fischer, and NEWEA's Fred McNeill at Leadership Summit

Session 18
Sustainability: Closing in on a Circular Economy

Moderators:
- Wayne Bates, Tighe & Bond
- Miles Moffatt, Tighe & Bond

New Technologies Open Doors for Chitosan Applications
- Jenn Wood, Tidal Vision

Sustainable Solution to Street Sand
- Jeff Mercer, Wright-Pierce
- Tim Vadney, Wright-Pierce

Data Analytics Tools for Tracking Sustainability Goals and Improving Energy Performance
- Elizabeth Watson Keddy, Hazen and Sawyer

Full-scale MABR Experience—Case Studies of Process Intensification
- Jean Gagnon, Veolia

Session 19
Government Affairs 3: Infrastructure Planning Workshop

Moderators:
- Scott Firmin, Portland Water District
- Jeff McBurnie, Casella Resource Solutions

Making the Right Choices for Your Utility—Using Community Priorities and Sustainability Criteria for Water Infrastructure Decision-Making

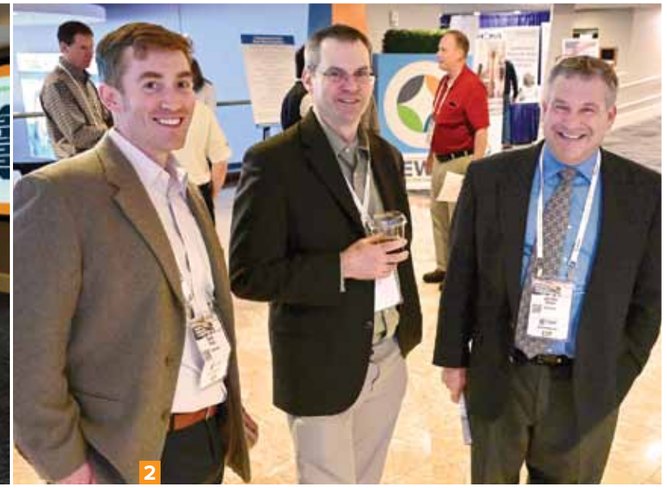
EPA hosted a pilot workshop to walk participants through the 10 steps in the Augmented Alternative Analysis (AAA) EPA planning process. This process incorporates social, economic, and environmental (triple bottom line) criteria and community involvement into traditional alternative analyses for infrastructure planning. The workshop included a presentation by Saco Water Resource Recovery Department (WRRD), which participated in the AAA process. The workshop introduced new fillable worksheets that enable every stake-holder group, community, and/or utility to use this planning method.

Presenters:
- Leslie Corcelli, EPA Office of Wastewater Management
- Howard Carter, city of Saco WWRD
- Dan Bisson, Tighe & Bond
- Emily Cole-Prescott, city of Saco, ME
- Emily Roy, city of Saco, ME
- Ed McCormick, McCormick Strategic Water
- Sarah Shadid, Ross Strategic

Session 20
Stormwater 2: Innovations in Green Infrastructure

Moderators:
- Natalie Pommersheim, Environmental Partners
- Joe Keitner, city of Westfield, MA

From Water Quality to Climate Resilience—Leveraging the Benefits of Widespread Green Infrastructure in Boston
- Nicole Holmes, Nitsch
- Emma Page, BWSC



1. One of several table discussions at the EPA Augmented Alternative Analysis Infrastructure Planning Workshop
2. Alexie Rudman of MassTC adds to the Innovation panel discussion
3. Joseph Fillion of Schneider Electric enjoys a point during a speech at the Opening Session
4. Lisa Wong, Timothy Beaulieu, and Caitlin Hunt of the MWRA Deer Island Process team

A Creative Solution for Green Infrastructure Implementation in an Urban Area
- Emma Page, BWSC
- Kelsey Kern, Nitsch

Innovative Application of Green Infrastructure in Public Spaces in the Northeast
- Emily Carlson, Arcadis

Green Stormwater Infrastructure Candidate Location Siting Application
- Michael Hanley, Dewberry
- Lucica Hiller, city of Somerville, MA

Session 21
Plant Operations 3: Data Driven Treatment Optimization

Moderators:
- Emily Korot, Hazen and Sawyer
- John Adie, NHDES

Machine Learning: How It Can Support Innovation In WWT/WWR and Can It Be Trusted?
- Amy Mueller, Northeastern University

What Have We Learned from AI? Lessons from Applying Machine Learning at Water Reclamation Facilities
- Sue Guswa, Woodard & Curran
- Jay Sheehan, Woodard & Curran
- Jeanna Long, Woodard & Curran

Clarifying Insight: Using Machine Learning to Evaluate Secondary Clarifier Performance
- Erik Osborn, Woodard & Curran
- Julia Beni, Woodard & Curran

Predictive Iron Dosing for Phosphorus Removal— a Data-Driven Strategy
- Varun Srinivasan, Brown and Caldwell

Session 22
Contaminants of Emerging Concern 1: CEC Measurement and Quantification

Moderators:
- Rachel Schnabel, Barton & Loguidice
- Lohita Rajesh, University of Massachusetts

PFAS Data from over 200 California Wastewater Treatment Plants
- Josh Soper, CDM Smith

PFAS in Wastewater—Advancing Source Control by Understanding the PFAS Cycle on Nantucket
- Eric Spargimino, CDM Smith
- Andrew Miller, CDM Smith
- Charles Larson, town of Nantucket, MA
- Roberto Santamaria, town of Nantucket, MA

Detection and Quantifying Microplastic Pollutants in Beach Sand and River Sediment
- Cole Radke, University of Massachusetts

Statewide PFAS Assessment of WWTPs in Michigan and Implications to the Beneficial Use of Biosolids for Land Application
- Chris Curran, AECOM

1. Brian Baumgaertel, Scott Horsley, and Bruce Walton lead the discussion about innovative/alternative onsite wastewater treatment systems (I/A OWTS)
2. CDM Smith's Nick Rossi, Joseph Laliberte, and James Drake converse during a session break
3. NEWEA 2022 President Fred McNeill passes the gavel to 2023 NEWEA President Bob Fischer

Session 23
Asset Management 2: Tools, Tips, and Technology in Asset Management

Moderators:
- Dan Capano, Gannett Fleming
- Georgine Grissop, CDM Smith

Leveraging Geospatial Information Systems Technologies and Data Analysis Automation to Optimize Catch Basin Inspection and Cleaning Statewide
- Colin Bergmann, VHB

What Lurks Below—Utilizing Pipeline Condition Assessment Data in an "All Streets" Capital Plan
- Jesse Herman, CDM Smith
- James Carolan, CDM Smith
- Shawn Syde, city of New Bedford, MA

Managing Water, Wastewater, and Lead with Machine Learning
- Jim Fitchett, VODA

Leveraging an Advanced Asset Management Framework to Optimize Investment Decisions
- Hugh Sinclair, Arcadis

Session 24
Watershed Management 1: Nutrient Mitigation and Water Quality Restoration

Moderators:
- Sara Greenberg, GHD
- James Plummer, NEIWPCC

Implementing a Coastal Water Quality Restoration Program through an Adaptive Management Approach—Falmouth, MA Case Study
- Anastasia Rudenko, GHD
- Lenna Quackenbush, GHD

Protecting a Great Pond—Watershed Management Strategies to Control Nutrient Pollution
- Carly Quinn, Woodard & Curran
- Maggie Anderson, Woodard & Curran
- Paul Ferland, city of Fall River, MA
- Scott Medeiros, Woodard & Curran

Understanding the Role of Human Bacteroides Analysis in IDDE Investigations
- Janelle Bonn, Woodard & Curran
- Rich Niles, Woodard & Curran

The Culmination of Monitoring and Modeling Healthy Lake Boon Initiative
- Fiona Worsfold, Brown and Caldwell

Session 25
Collection Systems 3: For Those About to Dig...We Salute You

Moderators:
- Scott Lander, Retain-it
- Allison Shivers, Tata and Howard

A Clean Start for the Beachmont-Sales Creek Neighborhood of Revere
- Angela Moulton, CDM Smith
- John Viotto, CDM Smith
- Nick Rystrom, city of Revere, MA

Cohas Brook Sewer Project (Contracts 3 and 4)—Applying Construction Lessons Learned to Collection System Planning and Design
- Ian Gervais, Kleinfelder
- Frederick McNeill, city of Manchester, NH
- Robert Robinson, city of Manchester, NH

KISS 108-Year-Old Interceptor Goodbye—Rerouting Franklin's Oldest and Most Critical Asset, the Beaver Street Interceptor, out of the Mine Brook
- Amy Anderson George, Arcadis
- Doug Martin, town of Franklin, MA

Between a Rock and a Hard Place—Expanding Sewer Service in the town of Stoughton, MA
- Andrew Grota, Environmental Partners
- Ziad Kary, Environmental Partners
- Marc Tisdelle, town of Stoughton, MA
- Craig Horsfall, town of Stoughton, MA

Session 26
Stormwater 3: Stormwater Tools and Technology

Moderators:
- Cindy Baumann, CDM Smith
- Brutus Cantoreggi, town of Franklin, MA

New Technology for Real Time Detection of Illicit Connections in Storm Drains
- Matthew Davis, Brown and Caldwell
- Martha Wells, Brown and Caldwell
- Nicholas Federico, city of Newburyport, MA
- Stephanie Alimena, Brown and Caldwell

How Using Biochar-amended Iron-enhanced Sand Filters Can Reduce the Flow of Bacteria (E. coli) and Phosphorus into Water Bodies
- Erik Megow, Stantec

Optimizing Stormwater Treatment by Using the MassDOT Stormwater Design Guide and Water Quality Data Form
- Lauren Caputo, VHB
- Henry Barbaro, MassDOT

Best Practices Online Mapping Tools and Lessons Learned to Improve Your IDDE Program
- Nate Pacheco, VHB

Session 27
Plant Operations 4: Pushing the Limits of N & P Removal

Moderators:
- Varun Srinivasan, Brown and Caldwell
- Pam Westgate, Kleinfelder

The Role of an Adequate Anaerobic Mass Fraction on RAS Hydrolysis/Fermentation for Sustainable EBPR Process
- Parnian Izadi, Stantec

Challenges in Upgrading One of the Last Municipal Powdered Activated Carbon/Wet Air Oxidation Plants in the U.S to Achieve Low Level Nutrient Removal
- Frederick Mueller, Tighe & Bond
- Paul Moran, Tighe & Bond
- Rob Grasis, town of Vernon, CT

Ditch Your Nitrate Problems by Optimizing that Oxidation Ditch!
- John Scheri, Mott MacDonald

New England's Largest Continuously Backwashing Sand Filter Helps the Meriden WCPF Achieve Low Effluent Phosphorus
- Matthew Formica, AECOM
- Frank Russo, city of Meriden, CT
- Jeffrey Reade, AECOM
- Rene Laliberte, city of Meriden, CT
- Richard Meskill, city of Meriden, CT

Session 28
Contaminants of Emerging Concern 2: The Break Down on PFAS—Destruction Technologies and Panel Discussion

Moderators:
- Amy Hunter, AECOM
- Christian Pasichny, University of Massachusetts

Byproduct Formation During Electrooxidation of PFAS
- Anilkumar Krosuri, Aclarity

Some Like It Hot, but PFAS Does Not! Advancing Thermal Destruction of PFAS in Biosolids
- Natalie Sierra, Brown and Caldwell

WEF's PFAS Roadmap for Water Utilities
- Janine Burke-Wells, NEBRA

Followed by a Panel Discussion:
- Julie Bliss Mullen, Aclarity
- Jeff McBurnie, Casella Resource Solutions
- Sean McBeath, UMass Amherst
- Natalie Sierra, Brown and Caldwell
- Claudio Ternieden, WEF
- Ray Frigon, CT DEEP

Session 29
Small Community

Moderators:
- Ian Catlow, Tighe & Bond
- Andrea Braga, Jacobs

Comprehensive Wastewater Planning to Address Environmental and Economic Objectives in Littleton, MA
- Kara Johnston CDM Smith
- Corey Godfrey, Littleton Electric Light & Water
- William Lengyel, CDM Smith

Detailed Facility Planning for Impending TN Limits in Hanover
- Michael Theriault, Wright-Pierce

Small Town—Big Steps Toward Combating Future Effluent Limits, Population Growth, Environmental Sustainability
- Casey Maranto, Wright-Pierce

The Messy Economics of Septage Treatment
- Austin Weidner, Tighe & Bond

Session 30
Collection Systems 4: Who let the Water Out?

Moderators:
- Brendan O'Brien, Stantec
- Tom Loto, AECOM

Close Collaboration with BWSC Leads to a Comprehensive Design-ready Product
- Denise Prussen, CDM Smith
- Adam Horst, BWSC

To CCTV or not CCTV, that is the question
- Chris Baggett, Wright-Pierce
- Adam Iben, city of St Petersburg, FL

I/I Study Finds H2S Corrosion to be the Critical Priority—Utilizing Institutional Knowledge to Guide Sewer Investigations and Rehab in Darien, CT
- Lindsay McCarthy, Arcadis
- Edward Gentile, town of Darien, CT

Long Term Maintenance Done Right—Inspection, Assessment, and Construction Activities
- Steve Perdios, Dewberry
- Miles Bateman, Dewberry

Session 31
CSO/WWI 3: CSO Model Approaches for Public Notification and System Optimization

Moderators:
- Peter Frick, IDEX
- James Drake, CDM Smith

Forecasting Combined Sewer Overflows for Advanced Public Notification Using Data-driven Modeling
- Varun Srinivasan, Brown and Caldwell

Building a Practical Digital Twin to Address Public Awareness of Sewage Pollution Legislation
- Rajan Ray, Trinnex

Operating a Collection System Like a Stock Exchange to Optimize Operations
- Richard Loeffler, Xylem

Application of Mixing Zone Modeling in Facilitating Decision Making for CSO Tunnel Construction Dewatering Pretreatment
- Yuan Fang, Stantec

Session 32
Energy: Energy Efficiency & Management

Moderators:
- Tracy Chouinard, Brown and Caldwell
- David Michelsen, SESD

Strategic Energy Management is Decarbonization—Using the SEM Method to Achieve Your Climate Goals and Build Resiliency
- Matt Jensen, Cascade Energy

Coupling Energy Efficiency with Asset Management Prioritized Projects
- Sharon Nall, NHDES
- Steve Bolles, Process Energy

Energy from Wastewater—a Renewable Resource
- Jeff Hammer, UHRIG

Don't Forget Your Energy Costs! Comparing and Reducing Lifecycle Costs for Treatment Facilities
- Lenna Quackenbush, GHD
- Sara Greenberg, GHD

Session 33
Watershed Management 2: From Stormwater to Regulations—Building Tools to Restore our Ecosystems

Moderators:
- Steve Wolosoff, GEI
- Helen Gordon, Environmental Partners

Using the New England Retrofit Manual to Support BMP Selection and Design for MS4 Compliance
- Kelly Siry, VHB

Using Smart Stormwater Controls to Meet Stormwater Requirements and Preserve the Aesthetic Character of Two Historic Ponds in Harrisburg, PA
- Andrea Braga, Jacobs

Making Dollars and Cents of Growing Risk—Showcasing a New Digital Tool to Understand Flood Risk, Obtain Funding, and Build Resilience
- Heather Sprague, Arcadis
- Trevor Johnson, Arcadis

Long-term Water Quality Monitoring Program to Evaluate Benefits of Infrastructure Improvements and Advocate for Science-based Regulations
- Zachary Eichenwald, CDM Smith
- Karla Sangrey, Upper Blackstone
- Tim Loftus, Upper Blackstone

Session 34
Public Awareness: Essential Public Outreach Strategies

Moderators:
- Deborah Mahoney, Brown and Caldwell
- Phil Tucker, York Sewer District

Leveraging Partnerships to Create a Stellar Public Outreach Campaign
- Emily Cole-Prescott, city of Saco, ME
- Emily Roy, city of Saco, ME

Preparing for Effective, Adaptive Risk Communication about PFAS in Drinking Water, Water Reclamation, and Residuals
- Sarah Baryluk, CDM Smith

Open Houses 101: an Invitation to Improving Public Education, Awareness, and Support
- Bill Patenaude, RIDEM
- Janine Burke-Wells, NEBRA
- Scott Goodinson, town of Narragansett, RI

CSO Public Engagement Toolkit—Engaging a Diverse and Multi-Generational Urban Community to Craft an Effective CSO Long Term Control Plan
- Sabina Martyn, Mott MacDonald

Undergraduate Student Poster Board Competition

A Community Assessment on the Perceptions of Water Quality and the Impacts Associated with Legality and Safety in Fall River, Massachusetts
- Karlen Alenó Hernández, Massachusetts College of Pharmacy and Health Sciences

PFAS Removal Via Phytoremediation Using Juncus Effusus
- Brant Barbera-Hwang, Benjamin Lanava, Blade Kalikow, Northeastern University

Biosynthesis of Manganese Oxide Nanoparticles for Improved Production and Water Treatment Application
- Caroline Canales, Avalon Fiore, Kamil Obrycki, University of Rhode Island

Kinesthetic and Practical Teaching Styles
- Ryan Douglas, Cailin Hesketh, University of Hartford

Water Quality Labs
- Kyle Hilliard, Aaron Champagne, Michaela McNutt, University of Hartford

WBE Tracking of Influenza Virus on the UMass Amherst Campus
- Lauren Kelly, UMass Amherst

Sand Bar State Park Wastewater Treatment
- Venus Rohra, Amelia Kennedy, Anastasia Allen, Yuang Li, University of Vermont

Turtle Mountain Design Team
- Noah Mantz, Josh Fiorentino, Kitty Lovell, UMass Amherst

Effect of Raw Materials and Manufacturing Procedures on Flow Rate through Ceramic Water Filters
- Alexia Martin, University of Rhode Island

Impact Of Short and Long-Term Stagnation on Corrosion in Drinking Water Distribution Systems
- Kate Moloney, Northeastern University

UMass Amherst EWB Local Project
- Rachel Rannikko, Jia Ganti, UMass Amherst

Bristol Stormwater Best Management Practice Evaluation and Redesign
- Nick Courtney, Travis Lajoie, Tyler Roy, Parker Urie, Roger Williams University

Best Practices for Use of ISE Sensors in Wastewater Biological Nutrient Removal Systems
- Gus Boyer, Siena Salyer, Faye Kuszewski, UMass Amherst

Working with International Communities to Implement Projects Remotely
- Marie Rausch, Cullen Calhoun, UMass Amherst

Graduate Student Poster Board Competition

Evaluation of Uncertainties in Well Water Impact Estimates After Hurricane Florence
- Kyla Drewry, Northeastern University

Assessing the Potential for Remotely Sensed Discharge to Estimate Carbon Fluxes for Ungauged Rivers
- Jaclyn Gehring, Northeastern University

Sizing and Maintenance of Floating Treatment Wetlands for Regulatory Compliance
- McNamara Buck Rome, Northeastern University

Validating Well Model Estimates in Wake County, NC
- Tiffany Tang, Northeastern University

Uncertainty in Private Well Locations in Greater Boston
- Linnea Wilson, Northeastern University

Impact of pH on the Reaction Kinetics of Nitroglycerin Removal from Wastewater Using nZVI-biochar
- Roxana Rahmati, Stevens Institute of Technology

Accumulation of COVID-19 Signal in a Simulated Sewer using Passive Samples
- Andrew Kennefick, UMass Amherst

Pulsed Electrolysis Production of Hypochlorous Acid for Water Disinfection
- Khoa Kieu, University of Maine

On-Site Disinfectant Production and Integration at a Wastewater Treatment Facility
- Deborah Sebagisha, University of Maine

Enhanced Electrochemical Oxidation of Concentrated Waste Streams Using an Fe-TAML Catalyst (Iron Based Tetra Amino Macrocyclic Ligand)
- Shane Hancox, Christian Pasichny, UMass Amherst

An Analysis of The Transition from Intermittent to Continuous Water Supply in Coimbatore City, India
- Ciara Little, UMass Amherst

Towards a Better Understanding of Disinfection Byproducts in Intermittent Water Supply
- Thomas Roberts, UMass Amherst

Next-Generation Sequencing to Evaluate Seasonal Bacterial Community Dynamics in a Drinking Water Reservoir
- Gabriel Mesole, UMass Amherst

Investigating the Effect of Crosslinking on Heterogeneous Diffusion of Polystyrene Nanoparticles in Alginate Matrix
- Timothy Onuh, UMass Amherst

Proof of Concept: In-Situ Microbial Cages to Track PFAS Biotransformations in Wastewater Systems
- Lindsay Guertin, University of New Hampshire

Per- and Polyfluorinated Alkyl Substances (PFAS) in Great Bay Estuary Surface Waters: Temporal and Spatial Trends
- Gage Moran, University of New Hampshire

Biosynthesis and Purification of Manganese Oxide Nanoparticle for Pollution Remediation Application
- Zachary Shepard, University of Rhode Island

Assessment of the Effect of Ferrate and Activated Ferrate on Natural Organic Matter
- Jacira Soares, Caitlin Murray, Katherine Cretella, Carrie Ellis, University of Rhode Island

Microbial Insights into the Stability and Resiliency of the Full-Scale Co-Digestion of Food Waste and Cow Manure
- Amy DeCola, University of Vermont

Oscillating Electric field-assisted Inactivation of Escherichia Coli in Wastewater
- Kamruzzaman Khan, University of Vermont

Demographic and Data Bias in North Carolina Well Water Testing
- Wesley Hayes, Northeastern University

Examining the Influence of Consumption on the Cost of Point-of-use Devices for PFAS Treatment
- Richard Rogers, UMass Amherst

Assessing the Applicability of Local-Scale Event Rainfall Characteristics from Hurricane Florence to Identify Likely Microbial Contamination in North Carolina Private Drinking Wells
- Elizabeth Bartuska, Northeastern University

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2023 Awards & Recognitions

Tess Laffer and Amy Hunter admire Tess's Young Professional Award

U.S. EPA REGION I AWARDS

Wastewater Treatment Plant O&M Excellence
- East Greenwich, Rhode Island represented by Shawn T. O'Neill, Superintendent
- Sunapee, New Hampshire represented by David Bailey, Superintendent

Wastewater Treatment Plant Operator of the Year Excellence
- Adam Federau, Westerly, Rhode Island
- Jamie Kreller, Suffield, Connecticut
- David Lovely, Pease WWTP, Portsmouth, New Hampshire

Wastewater Trainer of the Year
- Eddie Davies, Quonset Point, Rhode Island
- Anthony Drouin, New Hampshire DES

Industrial Pretreatment Program of the Year
- City of Manchester, New Hampshire represented by Christopher Crowley, Pretreatment Supervisor
- City of Chicopee, Massachusetts represented by Laurie Goff, Industrial Pretreatment Coordinator

WEF – MA AWARDS & RECOGNITIONS

George W. Burke, Jr. Award
- Billerica, MA WRRF

Arthur Sidney Bedell Award
- Lauren Hertel

William D. Hatfield Award
- Chelsey Little

Laboratory Analyst Excellence
- Kim Sandbach

WEF Fellow
- Susan Sullivan

WEF Service Delegate
- James Barsanti

Operations Challenge Division III 2nd Place
- MASS Chaos

Operations Challenge Division II 3rd Place–Process Event
- CT Storm Surge

Bobby Williams Competitive Spirit Award
- Eddie Davies

Operator Scholarship
- William Branton

Public Officials Award
- Patrick Leahy

Quarter Century Operator
- Kathy Perez
- Raymond Vermette

Life Membership
- Ray Bahr
- Michael Bisi
- Frank Cavaleri
- John Hart
- Clayton M. Richardson
- Ronald Wade

Award winners from Veolia gather for a group shot following the annual awards luncheon

NEWEA award recipients: 1. Robert Rak, Clair N. Sawyer Award 2. Sharon Lawson, E. Sherman Chase Award 3. William Smith, Operator Safety Award 4. Isabella Cobble, Diversity, Equity, & Inclusion Leadership Award

NEWEA RECOGNITIONS

Scholarship Recipients 2022–23

Environmental Major
- Alexis Eaton
  University of New Hampshire

Graduate Student
- Lindsay Guertin
  University of New Hampshire

Kate Biedron Scholarship
- Ella Quinn
  University of Massachusetts

Student Design Competition
- Jacob Wasserman, Lauren Howe, Daniel Diament, Evan Anderson, Dillon McCormick, Matthew Biega—Northeastern University, Boston, MA

Stockholm Junior Water Prize
- Adam Kleshchelski, Greenwich, CT
- Alexander Busko, Bangor, ME
- Akhila Ram, Worcester, MA
- Abhinav Avvaru, Nashua, NH
- Saksham Bhardwaj, South Burlington, VT

NEWEA AWARDS

NEWEA Operator Award

Connecticut
- John Torre, New Haven, CT

Maine
- Michael Courtenay, Warren, ME

Massachusetts
- Jason Swain, Holyoke, MA

New Hampshire
- Mark Corliss, Franklin, NH

Rhode Island
- Dylan Chase, New Shoreham, RI

Vermont
- Richard Chaput, Jr., Vergennes, VT

Alfred E. Peloquin Award

Connecticut
- William Brink, Stamford, CT

Maine
- Mark Holt, Livermore Falls, ME

Massachusetts
- Aaron Fox, Lowell, MA

New Hampshire
- Chris Perkins, Portsmouth, NH

Rhode Island
- Peter Hassel, Smithfield, RI

Vermont
- Steve Perron, Burlington, VT

NEWEA AWARDS

Operator Safety Award
- William Smith, Chatham, MA

James J. Courchaine Collection Systems Award
- Joe Boccadoro, Ashland, MA

Paul Keough Award
- Thomas Shevlin, Newport, RI

Young Professional Award
- Tess Laffer, Chelmsford, MA

Youth Educator Award
- Philip Tucker, York, ME
- Theresa Tucker, York, ME

Biosolids Management Award
- Karla Sangrey, Millbury, MA

Asset Management Award
- Megan Moir, Burlington, VT

Wastewater Utility Management
- Newmarket, NH, Environmental Services

Energy Management Achievement Award
- Sharon Nall, Concord, NH

Energy Management Achievement Award
- South Essex Sewerage District, Salem, MA

Committee Service Award
- Alexandra Greenfield, Salem, MA

Green Steps Award
- Tuscan Village, Salem NH

Diversity, Equity, & Inclusion Leadership Award
- Isabella Cobble, Westwood, MA

E. Sherman Chase Award
- Sharon Lawson, Millbury, MA

Clair N. Sawyer Award
- Robert Rak, Bristol, MA

Elizabeth A. Cutone Executive Leadership Award
- Mickey Nowak, Springfield, MA

Founders Award
- Paul Dombrowski, Holyoke, MA

Past President's Plaque and Pin
- Virgil Lloyd, Manchester, CT

NEWEA Acknowledged Retiring Officers, Directors, Delegates and Committee Chairs

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Deborah Mahonely (Communications)

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MaryJane Meier (Certification*)
Mary Lee Santoro (Awards)
Brian Olsen (Sponsor)
Lauren Hertel (Program)
John Adie (Plant Operations)
Eric Spargimino (Residuals Management)
Art Simonian (Utility Management)
Scott Lander (Collection Systems)
Rebecca Weidman (Industrial Wastewater)
Scott Firmin (Government Affairs)
John Digiacomo (Assessment & Developement)
Ray Vermette (Nominating)
Scott Lander (Collections Systems)
Meg Tabacasko (Registration)
* Ad hoc

Upcoming Meetings & Events

OPS CHALLENGE TRAINING DAY
Holyoke WPCF, Holyoke MA
March 30, 2023

NEWEA CONGRESSIONAL BRIEFING IN CONJUNCTION WITH WEF/AWWA NATIONAL WATER WEEK,
Washington, D.C.
April 25–26, 2023

LABORATORY PRACTICE SPECIALTY SEMINAR
Narraganset Bay Commission. Providence, RI
May 3, 2023

YOUNG PROFESSIONAL WEBINAR "HOW TO DEVELOP A PROFESSIONAL SLIDE DECK"
Online, **May 5, 2023**

YOUNG PROFESSIONAL WEBINAR "HOW TO DELIVER AN ENGAGING PRESENTATION"
Online, **May 12, 2023**

STORMWATER SPECIALTY SEMINAR
TBD, **May 2023**

NEWEA/NYWEA SPRING MEETING & EXHIBIT
Saratoga Hilton, Saragtoa Springs, NY
June 7–9, 2023

NEWEA/RCAP SMALL COMMUNITIES WORKSHOP
Millbury, MA
June 14, 2023

NEWEA GOLF CLASSIC
Derryfield Country Club, Manchester, NH
September 29, 2023

AFFILIATED STATE ASSOCIATIONS AND OTHER EVENTS

MEWEA/JETCC NORTH COUNTRY CONVENTION
Northern Maine Community College
Presque Isle, ME
April 5–6, 2023

NEWWA SPRING CONFERENCE
DCU Center, Worcester, MA
April 5–6, 2023

NHWPCA TRADE FAIR
Sheraton, Nashua, NH
April 14, 2023

CTWEA SPRING WORKSHOP
AquaTurf, Plantsville, CT
May 8, 2023

MAWEA TRADE SHOW
Wachusett Mountain Resort
Princeton, MA
May 18, 2023

GMWEA SPRING MEETING
Killington Grand Resort and Conference Center, Killington, VT
May 25, 2023

MAWEA GOLF TOURNAMENT,
Heritage Country Club, Charlton MA
June 15, 2023

CTWEA SEWER OPEN
Skungamaug River Golf Club
Coventry, CT
June 16, 2023

RICWA GOLF TOURNAMENT
Potowomut Golf Club, Warwick, RI
June 19, 2023

NEAPWA
Sea Crest Hotel, Falmouth, MA
June 21–23, 2023

NHWPCA GOLF TOURNAMENT,
Beaver Meadow, Concord, NH
August 3, 2023

Measurement unit conversions and (abbreviations) used in the *Journal*

U.S.	International System of Units (SI)
Liquid volume	
gallon (gal)	liter (L)
cubic feet (ft^3)	cubic meters (m^3)
cubic yards (yd^3)	cubic meters (m^3)
acre-feet (ac ft)	cubic meters (m^3)
Flow	
million gallons per day (mgd)	million liters per day (ML/d)
for larger flows (over 264 mgd)	cubic meters per day (m^3/d)
gallons per minute (gpm)	liters per minute (L/min)
Power	
horsepower (hp)	kilowatts (kW)
British Thermal Units (BTUs)	kilojoules (kJ) / watt-hours (Wh)
Velocity	
feet per second (fps)	meters per second (m/s)
miles per hour (mph)	kilometers per hour (km/h)
Gas	
cubic feet per minute (ft^3/min)	cubic meters per minute (m^3/min)

U.S.	International System of Units (SI)
Length	
inches (in.)	centimeters (cm)
feet (ft)	meters (m)
miles (mi)	kilometers (km)
Area	
square feet (ft^2) or yards (yd^2)	square meters (m^2)
acre (ac)	hectare (ha)
square miles (mi^2)	square kilometers (km^2)
Weight	
pounds (lb)	kilograms (kg)
pounds per day (lb/d)	kilograms per day (kg/d)
ton – aka short ton (tn)	metric ton or tonne (MT)
Pressure	
pounds/square inch (psi)	kiloPascals (kPa)
Inches water column (in wc)	kiloPascals (kPa)
Head	
feet of head (ft of head)	meters of head (m of head)

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- Increased corporate visibility and marketing opportunities before a wide audience of water industry professionals
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- Recognition as an environmental leader among peers and customers

For more information
contact Jordan Gosselin
Email: jgosselin@newea.org
Phone: 781-939-0908

NEWEA
WORKING FOR WATER QUALITY

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Upcoming *Journal* Themes

Summer 2023—**Small Systems**

Fall 2023—**Nutrient Control**

Winter 2023—**Innovative Solutions**

NEWEA/WEF* Membership Application

Water Environment Federation® the water quality people®

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		Member Benefit Subscription	Dues
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☐ **Corporate** (member benefits for one person)	Companies engaged in the design, construction, operation or management of water quality systems. Designate one membership contact.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online) ■ *WEF SmartBrief* ■ Complimentary WEF Webcasts and more	$420
☐ **Dual**	If you are already a member of WEF and wish to join NEWEA		$50
☐ **Associate Membership**	This membership category is a NEWEA only membership reserved for the general public who have an interest in water and the environment but are NOT currently employed in the industry (e.g., attorney or supplier). Examples of Associate Members include: teachers; journalists who cover water quality issues; citizen samplers/members of various watershed/ sportsman/conservation organizations, etc.		$45
☐ **New England Regulator**	This membership category is a NEWEA only membership reserved for New England Environmental Regulatory Agencies, including: USEPA Region 1, CT Department of Energy and Environmental Protection, ME Department of Environmental Protection, MA Department of Environmental Protection, NH Department of Environmental Services, VT Department of Environmental Conservation, and RI Department of Environmental Management		$50

WEF Utility Partnership Program (UPP): NEWEA participates in the WEF Utility Partnership Program (UPP) that supports utilities to join WEF and NEWEA while creating a comprehensive membership package for designated employees. As a UPP Utilities can consolidate all members within their organization onto one account and have the flexibility to tailor the appropriate value packages based on the designated employees' needs. Contact WEF for questions & enrollment (703-684-2400 x7750).

Payment

☐ **Check or money order enclosed** Made payable to NEWEA 10 Tower Office Park, Suite 601 Woburn, MA 01801 For more information: 781.939.0908 Fax 781.939.0907 NEWEA.org	**Charge** ☐ Visa ☐ American Express ☐ Master Card ☐ Discover	Card #	Security/CVC
		Signature	Exp. Date
		Name on Card (please print)	
Billing Address (☐ check here if same as above)	Street/PO Box	City, State, Zip	

Depending upon your membership level, $10 of your dues is allocated towards a subscription to the NEWEA Journal.
By joining NEWEA/WEF, you acknowledge the WEF Code of Conduct (www.wef.org/wef-member-code-of-conduct) is applicable for all members.

NEWEA/WEF Membership Application

MEMBERSHIP PROFILE

Please take a few moments to tell us about your background and professional interests.

What is the nature of your ORGANIZATION? (select only one–required) (ORG)

1 Consulting, Contracting, Planning Services

2 Educational Institution

3 Industrial Systems/ Plants)

4 Manufacturer or Distributor of Equipment & Supplies (including representatives)

5 Non-profits/NGOs

6 Finance, Investment, and Banking

7 Laboratories

8 State or Federal Government

9 Utility: Wastewater

10 Utility: Drinking Water

11 Utility: Stormwater

12 Utility: Wastewater, Drinking Water, and Stormwater

13 Utility: Wastewater and Drinking Water

14 Utility: Wastewater and Stormwater

15 Other

_____

(please define)

What is your Primary JOB FUNCTION? (select only one) (JOB)

1 Executive Level

2 ManagementLevel

3 Elected or Appointed Official

4 Educator

5 Student

6 Consultant/Contractor

7 Engineering/Design

8 Operator

9 Scientist/Researcher

10 Legislator/Regulator

11 Analyst

12 Sales/Marketing

13 Manufacturer's Representative

14 Communications/ Public Relations

15 IT/OT

16 Other

_____

(please define)

What are your KEY FOCUS AREAS? (circle all that apply) (FOC)

1 Air Quality and Odor Control

2 Biosolids and Residuals

3 Climate

4 Collection Systems

5 Disinfection and Public Health

6 Drinking Water

7 Energy

8 Finance and Investment

9 Industrial

10 Intelligent Water Technology

11 Laboratory Analysis and Practices

12 Nutrients

13 Plant Operations and Maintenance

14 Public Communications and Outreach

15 Regulation, Policy, Legislation

16 Research and Innovation

17 Resource Recovery

18 Safety, Security, Resilience

19 Small Communities

20 Stormwater

21 Utility Management and Leadership

22 Watershed Management

23 Wastewater Treatment, Design, and Modeling

24 Water Reuse and Reclamation

25 Workforce

Demographic Information (Check box) The following is requested for informational purposes only.

Gender: ☐ Female ☐ Male

Education: ☐ Doctorate ☐ MA/MBA/MS ☐ BA/BS ☐ AA/AAS ☐ Technical School ☐ High School

Race/Ethnic Origin (Check box) The following is requested for informational purposes only.

☐ African-American (Not of Hispanic Origin) ☐ American Indian or Alaskan Native ☐ Asian ☐ Caucasian ☐ Hispanic/Latino ☐ Pacific Islander or Native Hawaiian ☐ Other

Did Anyone Recommend that You Join WEF?

Referring member's name: _____ Referring member's email: _____

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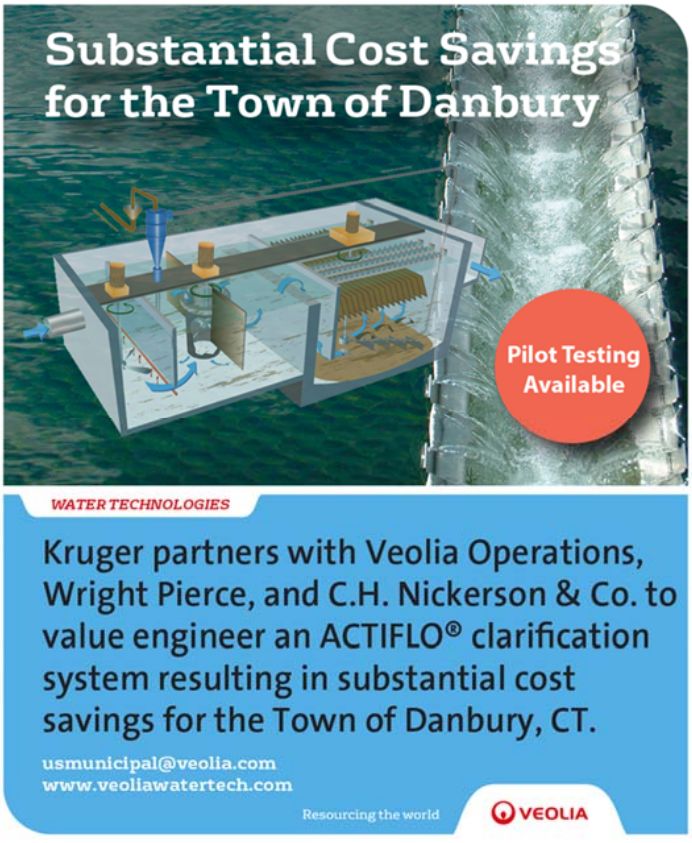

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