JOURNAL

OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

VOLUME 56 NUMBER 2 / ISSN 1077-3002 SUMMER 2022

CLEAN WATER ACT'S 50th ANNIVERSARY

The mighty Merrimack River—a Clean Water Act success story

Stakeholder collaboration achieves low level nitrogen removal and improved peak wet-weather capacity at Warren, Rhode Island

Rhode Island's communal response to the Clean Water Act

The Early Bacteria Alert Tool for the Merrimack River recreational hub

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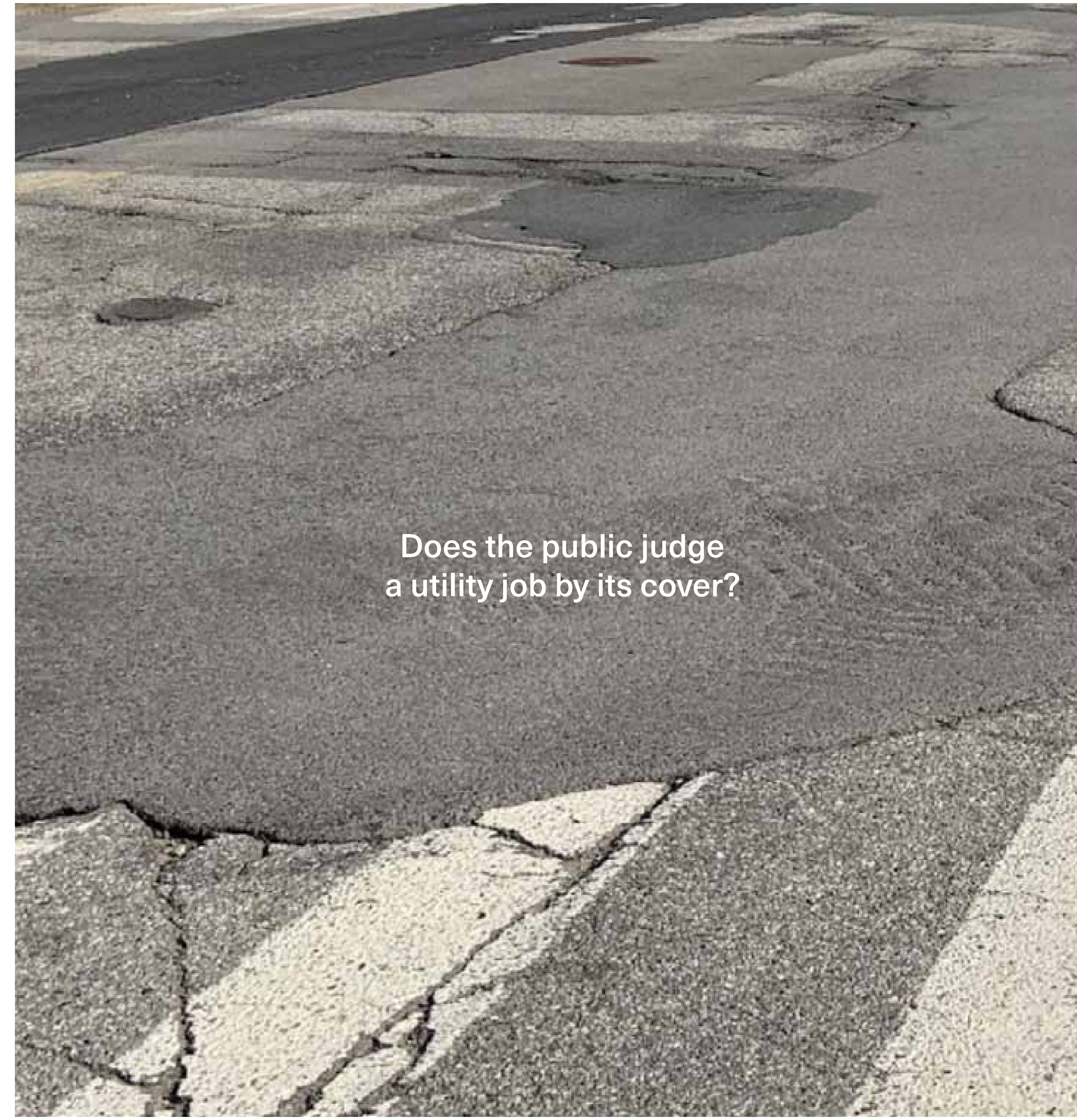
WORKING FOR WATER QUALITY



OUR ASSOCIATION WAS ORGANIZED NINETY-THREE 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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Corporate Member—shall be a sewerage board, department or commission; sanitary district; or other body, corporation or organization engaged in the design, consultation, operation or management of water quality systems.

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Academic Member—shall be an instructor or professor interested in subjects related to water quality.

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Total paid and/or requested circulation		2,208	2,208
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Total distribution		2,208	2,008
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President's Message

Welcome to the summer issue of NEWEA's *Journal* where we celebrate the 50th Anniversary of the Clean Water Act (CWA)—*a job well done.* Having just returned from our Spring Meeting at the majestic Mt. Washington Hotel in the beautiful White Mountains of New Hampshire, I am energized and motivated by our active and vibrant association. At the Spring Meeting over 250 water professionals celebrated the achievements of old friends and met new friends who represent our future leadership. Celebrating the CWA's 50th anniversary has led me to reflect on how we realized these great achievements and, more importantly, to ponder what future challenges lie ahead for our profession.

In reflecting on the CWA I want to recognize the five key partners that have cooperatively and collaboratively worked so hard over the past 50 years to achieve such success. These partners are (1) the owners, who are generally municipalities or authorities, (2) the regulators, such as EPA and the six New England state agencies, (3) the engineers who designed the treatment plants, pump stations, and collection systems, (4) the contractors who built the environmental infrastructure, and (5) the vendors who supplied all the equipment and materials to construct the infrastructure. The five partners represent different aspects of our industry, yet none could survive or succeed without their other four partners. I will examine each of these five partners and give shout-outs to some of these NEWEA industry leaders as we celebrate the CWA's 50th anniversary.

Owners, such as municipalities and authorities, represent the front line of environmental stewardship. These water professionals are working 24/7/365 operating our treatment plants and ensuring regulatory compliance. Often underpaid, understaffed, and struggling with the current economic times, the owners are to be commended for making the most out of the least resources. Most New England owners are small municipalities often staffed by only a few operators. New England also has several major owners, including the Massachusetts Water Resources Authority (MWRA). Formed in 1985, the MWRA is New England's largest public water authority, employing around 1,200 and providing drinking water and sewage services to the metro-Boston area.

At this year's Spring Meeting over 250 water professionals gathered at the Mt. Washington Hotel in New Hampshire

Our industry is a regulatory compliance-driven one. These regulations are developed, implemented, and enforced by federal and state agencies. This regulator segment of our industry is often misunderstood and underappreciated. As always, our regulators are striving to balance environmental stewardship in a socially and fiscally responsible manner often during volatile political periods. Unfortunately, social and fiscal responsibility can at times be at odds with one another. This struggle often leads to a misunderstanding of our regulatory industry. In New Hampshire I am proud to work with the Department of Environmental Services, which offers a partnership based on environmental stewardship, Yankee frugality, and common sense.

The engineers are the foundation of our profession. Their ideas and designs were instrumental in cleaning our nation's polluted waterways over the past 50 years. The environmental engineering profession blossomed during the advent of the CWA as treatment plants and collection/conveyance systems were being designed and constructed across the country. This period was a time of tremendous growth for the environmental engineering industry as many local firms rapidly expanded nationally and internationally. Mergers and acquisitions became common business practice. I was privileged to work with CDM Smith for almost two decades, including 10 years internationally. This provided me with a firm foundation as a water professional that groomed me for my leadership position today.

The contractors take the engineer's designs and bring their vision to life. Their common sense, real-world approach has saved many an engineer embarrassment and money over the past 50 years. Our profession's contractors require special skills to be successful. Our construction and process contractors often have to work with huge volumes of water to keep facilities in operation while constructing new works. Our pipeline contractors, owing to New England's topography and geography, must often perform deep excavations in solid rock formations. This difficult and dangerous work is critical to successfully convey wastewater to our newly constructed plants via gravity. Kudos to our many New England treatment plant construction contractors for their amazing work, and for continually proving themselves leaders in this challenging field over the past 50 years.

Finally, we recognize the vendors that represent all our industry's equipment representatives and manufacturers. Manufacturers are at the forefront of our industry's innovation. Energy efficiency, treatment processes, and new and improved materials have all contributed to the success of the CWA. In many ways our vendors have one of the most difficult jobs, as they must work with our engineers to have their products specified for a project. Then they begin financial negotiations with the contractors to finalize the purchase of their equipment and ensure it is properly installed and functional. It is often years from specification to equipment installation. The support from our vendors for post-construction and long-term operational support is critical for the industry. A shout-out to long-time NEWEA member Paul Sussman, who is retiring after 42 years with The MAHER Corporation, a provider of water and wastewater process equipment in northern New England.

The most critical success factor our new generation of water professionals has enthusiastically echoed and embraced from the previous generation is a passion for our profession

As I reflect on the success of these five partners in the work of the CWA, I imagine what our next generation of professionals will be celebrating 50 years from now. I am confident that the achievements of the next 50 years will be even greater than the past 50 years. Our young professionals are better educated, better tooled, and better prepared than we were when I started my clean water career. Our educational systems are better equipped and supported to prepare our next generation with a strong foundation. The tools available to our young professionals today are much advanced over the implements of 50 years ago. A handheld phone today contains more information, has more functions, and is more productive than the mainframe computers that filled entire rooms in the 1970s. Science has advanced so much that we now identify pollutants in parts-per-trillion! Our workforce has embraced diversity and inclusion, greatly expanding our family of clean water professionals. Lastly, the most critical success factor that our new generation of water professionals has enthusiastically echoed and embraced from the previous generation is a passion for our profession. I believe that this *passion* drives us to ask that extra question, take that extra step, and reach ahead to successfully lead our profession into the next 50 years.

From the Editor

In today's world, it is easy to be overwhelmed by all the challenges we face. On top of rising summer temperatures, the threat of hurricanes and tornadoes (in New England?!), and Covid-19, I am sure we all have abortion rights, gun control, and Ukraine on the mind. If anything, I hope this edition of the *Journal* offers a glimmer of hope among all the mental chaos.

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Fifty years ago, the federal government acknowledged that access to clean, safe water is a human right, and passed the Clean Water Act (CWA). This powerful legislation ended the country's culture of dumping raw sewage and industrial waste into its waterways, and has since led to significant improvements in the health and safety of New England's rivers and ecosystems. As an environmental engineer, I feel empowered knowing that we can reverse the detrimental impacts of previous generations. It is tough for me even to imagine the Nashua River running orange, as shown in Frederick McNeill's article about the Merrimack River watershed. Instead, I am deciding if I want to join the crowd for the annual, state-sanctioned swim in the Charles River on City Splash Day.[1]

Unquestionably, we did not get to where we are today without the hard work of previous (and current!) generations of NEWEA members, and I truly feel honored to play a small role in preserving their accomplishments in this *Journal* issue. Mr. McNeill's article brings us through a whirlwind history of the Merrimack River in a true fairy tale fashion, recounting the river's demise and recovery (spoiler alert—the story has a happy ending). William Patenaude's article takes a similar approach through the history of Rhode Island's waterways, this time highlighting the importance of collaboration and teamwork to achieve success.

By recalling our past, hopefully we are all reminded that we must never take our natural resources for granted; the two remaining articles focus on our industry's current steps to protect these resources for future generations. Jon Himlan and Paul Dombrowski describe the creative thinking that goes into designing today's wastewater treatment plants to protect downstream waterways and ecosystems year-round from the adverse impacts of wastewater effluent.

The final article, spearheaded by Fiona Worsfold, truly has an eye on the future, describing the process of predicting downstream bacteria outbreaks from combined sewer overflows and alerting the public when recreational activities (such as swimming and boating) are potentially unsafe. Before the CWA, only one-third of the United States' waterways were considered clean enough to be swimmable or fishable. It is amazing we have reached a point where many people assume recreational waters are safe, rather than accepting unsafe water as the norm.

I do not expect the challenges for the next 50 years of the CWA to be small. Nevertheless, the progress highlighted in this issue makes these challenges seem ever so slightly more manageable. I am particularly hopeful for progress through the Justice40 Initiative, a whole-of-government effort to direct at least 40 percent of overall benefits from certain federal investments to disadvantaged communities most affected by climate change and pollution. Twenty-one existing federal programs have been identified as Justice40 Pilot Programs to accelerate implementation of the Justice40 Initiative, including several water-centric ones: the Flood Mitigation Assistance Program, the Building Resilient Infrastructure and Communities Program, the Drinking Water State Revolving Fund, and the Clean Water State Revolving Fund.[2] I look forward to digging deeper into these programs in the winter issue, with its theme of "Funding the Work." In the meantime, I hope you enjoy this issue about the positive impacts of the CWA!

1. https://thecharles.org/city-splash/. Accessed 6/18/2022.
2. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf. Accessed 6/18/2022.


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Industry News

EPA is proposing the first Clean Water Act aquatic life criteria for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS)

EPA's three water commitments for PFAS strategic roadmap

On April 28, EPA announced three actions to protect communities and the environment from per- and polyfluoroalkyl substances (PFAS) in our nation's waters. The announced actions advance progress under the Biden–Harris Administration's Plan to Combat PFAS Pollution by improving methods to detect PFAS in water, reducing PFAS discharges into our nation's waters, and protecting fish and aquatic ecosystems from PFAS. These efforts complement the investment of $10 billion to address PFAS and emerging contaminants under the Bipartisan Infrastructure Law.

"EPA is using all available tools to address PFAS contamination as part of a broader, whole government effort to protect communities across the country from these chemicals," said EPA Administrator Michael S. Regan. "This is why we put a Strategic Roadmap in place, and why President Biden fought for billions in funding under the Bipartisan Infrastructure Law to tackle this challenge. These three actions help protect the health of all Americans as we deliver on our commitment to research, restrict, and remediate PFAS."

The three commitments, discussed below, include a new testing method, a new permitting direction, and new protective levels.

1. New testing method will help detect PFAS in water

Robust, accurate methods for detecting and measuring PFAS in air, land, and water are essential for understanding which PFAS are in the environment and how much are present. Detection methods are also essential for evaluating the effectiveness of different technologies for remediating PFAS and for implementing future regulations.

EPA has published a new method that can broadly screen for the presence of PFAS in water at the part per billion level. EPA's new *Screening Method for the Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC)* provides an aggregate measurement of chemical substances that contain carbon-fluorine bonds. PFAS are a common source of organofluorines in wastewater. This new method is especially useful for understanding the presence and forms of PFAS in wastewater when used with methods that target individual PFAS. EPA's Draft Method 1621 has successfully completed single laboratory validation. Multi-laboratory validation will take place this summer, and EPA intends to publish an updated version of the method later this year.

Note: All EPA industry news provided by EPA Press Office

2. New permitting direction will help reduce discharges of PFAS to our waters

The National Pollutant Discharge Elimination System (NPDES) program interfaces with many pathways by which PFAS travel and are released into the environment, and ultimately affect people and water quality. EPA is seeking to proactively use existing NPDES authorities to reduce discharges of PFAS at the source and obtain more comprehensive information through monitoring of PFAS sources.

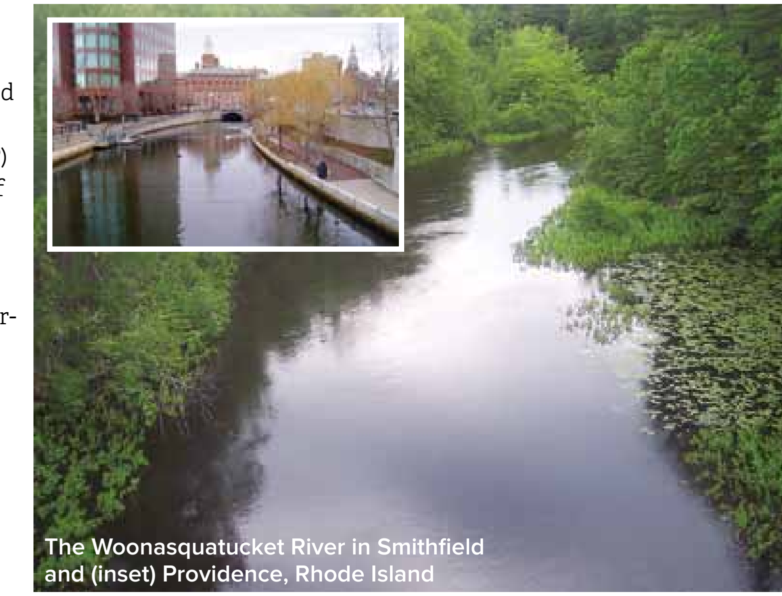
EPA has issued a memo, *Addressing PFAS Discharges in EPA-Issued NPDES Permits and Expectations Where EPA is the Pretreatment Control Authority.* This memo provides instructions for monitoring provisions, analytical methods, the use of pollution prevention, and best management practices to address PFAS discharges. These provisions will help reduce PFAS pollution in surface water, as EPA promulgates effluent guidelines, multi-validated analytical methods, and water quality criteria recommendations that address PFAS compounds. EPA also plans to issue new guidance to state permitting authorities to address PFAS in NPDES permits in a future action.

3. New protective levels will help support healthy fish and aquatic ecosystems

EPA is also developing national recommended ambient water quality criteria for PFAS to protect aquatic life. States and Tribes may use EPA-recommended water quality criteria to develop water quality standards that protect and restore waters, issue permits to address PFAS discharges, and assess the impact of PFAS pollution on local communities and the environment.

EPA is proposing the first Clean Water Act aquatic life criteria for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS)—two of the most well-studied chemicals in this group. The criteria are intended to protect aquatic life in the United States from short-term and long-term toxic effects of PFOA and PFOS. Following the comment period, EPA intends to issue final PFOA and PFOS recommended criteria, considering public comments and any new toxicity data. States and Tribes may consider adopting the final criteria into their water quality standards or can adopt other scientifically defensible criteria that are based on local or site-specific conditions.

Woonasquatucket River selected for pilot watershed



The Woonasquatucket River in Smithfield and (inset) Providence, Rhode Island

EPA has selected the Woonasquatucket River Watershed Council (WRWC) as the fifth pilot watershed funded through EPA's Southeast New England Program (SNEP) addressing coastal water quality issues. The addition of the Woonasquatucket River to SNEP's inaugural Pilot Watershed Initiative will bring further attention to urban water quality issues in five Rhode Island towns and two cities within the Woonasquatucket River watershed (Glocester, North Smithfield, Smithfield, North Providence, Johnston, Providence, and Cranston).

Under the management of the WRWC, EPA funding of $150,000 will support the council in increasing community capacity to improve river water quality, develop a community-centered climate resilience plan, and implement a sustainable funding mechanism for stormwater management and maintenance of green- and gray-water systems. Like the other four SNEP Watershed Pilot programs, EPA expects to award $750,000 over the next five years to WRWC to improve the health of the Woonasquatucket River and anticipates this will yield transferable skills and techniques to apply in other communities.

The WRWC project joins four previously announced watersheds included in the SNEP Pilot Watershed Initiative. The five watersheds are intended to demonstrate how concentrated, collaborative efforts and holistic planning can more effectively address common environmental challenges in coastal southeast New England. Demonstrating watershed scale solutions is a key piece of SNEP's Five-Year Strategic Plan and ultimately important in promoting safe and clean water, healthy habitats, and thriving communities. With the funding of this fifth pilot watershed, total EPA funding is expected to reach $3,750,000 across the five projects, with an additional $1,277,380 in matching funds over the next five years.

"The WRWC is thrilled to be selected for a SNEP Pilot Watershed Initiative grant," said Alicia Lehrer, Executive Director of Woonasquatucket River Watershed Council. "This five-year investment will allow us to make deep connections and facilitate coordination among the seven communities WRWC serves. We are poised to expand our K-12 educational programming watershed-wide, build flood resilience, improve water quality, and connect people to the river through recreation programs. We will all take pride in making all of our water resources swimmable, fishable, healthy, and accessible.

The four additional pilot watersheds are as follows:

- **$149,998 to the Buzzards Bay Coalition** to identify and prioritize sources of watershed impairments and develop solutions to address stream alteration and nutrient loading in an urbanized area of the Buttonwood Brook–Apponagansett Bay area of Massachusetts. Project partners include the City of New Bedford, the Town of Dartmouth, Buttonwood Zoo, the Friends of Buttonwood Park, and the Dartmouth Natural Resources Trust.
- **$149,995 to the University of New Hampshire Stormwater Center** to demonstrate the effectiveness of using distributed, small-scale stormwater control measures to restore hydrologic balance and address water quality and flooding in Tisbury, Massachusetts. Project partners include the Town of Tisbury, the Martha's Vineyard Commission, and the Massachusetts Department of Transportation.
- **$150,000 to the Barnstable Clean Water Coalition** to apply an innovative nature-based solution to reduce nitrogen impacts from a retired cranberry bog in Marstons Mills, Massachusetts, while also restoring habitat. Project partners include the Town of Barnstable, The Nature Conservancy, and the Native Land Conservancy.
- **$150,000 to the Town of Charlestown, Rhode Island** to help address the impacts of excess nutrients from septic systems and stormwater on Greater Allen's Cove and Ninigret Pond through installation of nitrogen-reducing septic systems and nature-based stormwater solutions. Project partners include the University of Rhode Island, the Salt Pond Coalition, and Save the Bay.

EPA issues final permit decision on Housatonic River cleanup

EPA has issued its final permit decision obligating the General Electric Company (GE) to clean up the Rest of River portion of the GE-Pittsfield/Housatonic River Site.

The Revised Final Permit is a significant step toward reducing polychlorinated biphenyls (PCBs) in and around the river and will reduce risk of human exposure. Some of the goals of this permit include reducing the following:

- Risks to children and adults from direct contact with contaminated soil and sediment
- Soil contamination in the floodplain, allowing recreational and residential use without unacceptable risk
- PCB concentrations in fish to levels that allow increased consumption of fish caught from the river in Massachusetts and Connecticut

After a public comment process, EPA issued the Revised Final Permit, outlining the cleanup plan for the Rest of River in Massachusetts and Connecticut, on December 16, 2020. Following that, the Housatonic River Initiative and the

Housatonic Environmental Action League petitioned EPA's Environmental Appeals Board for review of the Revised Final Permit.

On February 8, 2022, the board issued a 122-page decision denying the appeal of the revised permit. The board denied the appeal in all respects. On March 1, 2022, EPA notified GE of the final permit decision, and the permit became effective and fully enforceable.

The Revised Final Permit requires GE to clean up contamination in river sediment, banks, and floodplain soil that pose unacceptable risks to human health and to the environment. The cleanup is estimated to cost $576 million and will take two to three years for initial design and 13 years for implementation.

GE will excavate PCB contamination from 45 ac (18 ha) of floodplain and 300 ac (121 ha) of river sediment, removing more than 1,000,000 yd^3 (765,000 m^3) of PCB-contaminated material. Most of the sediment and floodplain cleanup will happen within the first 11 miles (18 km) of the Rest of River in the city of Pittsfield and the towns of Lee and Lenox. Phasing the work will mitigate the construction effects over time and locations. The excavated material will be disposed of in two ways: materials with the highest concentrations of PCBs will be transported off-site for disposal at licensed disposal facilities, and the remaining lower-level PCB materials will be consolidated on-site at a location in Lee.

EPA recognizes wastewater treatment facilities and individuals for excellence

EPA's New England regional office recently announced 2021 Regional Wastewater Treatment Awards for facilities and individuals. The awards program recognizes and honors the employees of publicly owned wastewater treatment plants for their commitment to improving water quality with outstanding plant operations and maintenance.

Wastewater Treatment Plant Operator of the Year Awards

Three New England operators were recognized for their outstanding work over the years operating and maintaining their facilities:

- Louise Grant, Paris, Maine Utility District. Ms. Grant retired at the end of 2021 after working for the district for many years as laboratorian as well as treatment plant operator managing process control. She also performed drinking water testing for the district, and she was recognized for her contributions to the facility's effectiveness following extensive plant upgrades in 2011–12.
- Jeff LeMay, South Windsor, Connecticut Water Pollution Control Facility. Mr. LeMay has challenged himself and his staff to attain high levels of professional training and to operate their plant effectively to protect the community's water resources. The Connecticut Department of Energy and Environmental Protection (CT DEEP) was instrumental in nominating Mr. LeMay for this recognition.
- Brian Sullivan, Colebrook, New Hampshire Wastewater Treatment Facility. Mr. Sullivan has been the superintendent of the well-managed facility for several years.

Wastewater Treatment Plant Excellence Awards

Two organizations were recognized for exceptional work in operating and maintaining their wastewater treatment plants during the past year and were credited with being an exceptional public service for their communities:

- Stonington Sanitary District, Stonington, Maine, led by Sanitary District Operators D. Gay Atkinson II and Tom Brophy.
- Exeter Wastewater Treatment Plant, led by Wastewater Operations Supervisor Joshua Scotton.

Industrial Pretreatment Program Excellence Awards

Two excellent Industrial Pretreatment programs each earned a 2021 Regional Wastewater Treatment Award for their commitment to improving water quality:

- City of Brockton, Massachusetts. Brockton's Wastewater Treatment Facility's Industrial Pretreatment Program for wastewater, led by Pretreatment Coordinator Sherry Caldeira, was recognized for its excellent work implementing the city's program at the wastewater facility.
- Town of Milford, New Hampshire. Milford's Industrial Pretreatment Program, led by Director Jim Pouliot, was recognized for its excellent job of conducting industrial pretreatment at the wastewater facility.

Wastewater Trainer of the Year Award

- Ryan Peebles, Clean Waters Inc. Mr. Peebles has conducted multiple training sessions across New Hampshire on topics including polymer and corrosion control. He was applauded by New Hampshire Department of Environmental Services wastewater experts as an excellent resource.

$106 million investment in water infrastructure for Long Island Sound

In mid-February, EPA and partners from Connecticut and New York virtually celebrated $106 million over a five-year period going to the Long Island Sound Study Program under the Bipartisan Infrastructure Law. This unprecedented funding will improve Long Island Sound's environmental health, climate resilience, and economic vitality equitably in communities across the sound's watershed.

This funding will catalyze current and future work by EPA and its partners to protect and restore Long Island Sound and protect its watershed. The Bipartisan Infrastructure Law funding will assist communities in reducing stormwater pollution, decreasing flooding, increasing coastal resiliency, improving water and wastewater infrastructure, and restoring vital habitats. Initiatives under this funding include the following:

- Creating a new Environmental Justice Program to provide technical assistance to build capacity among organizations that work with underserved communities
- Administering a grants program to support projects in communities with environmental justice concerns
- Providing technical and financial assistance to communities for planning and implementing projects to increase coastal resiliency
- Improving water and wastewater infrastructure, including green infrastructure and stormwater practices to reduce water pollution and flooding
- Restoring and protecting habitats critical to water quality, living resources, and recreational activities

Through the Bipartisan Infrastructure Law, EPA is making the largest ever investment in water by the federal government, with more than $50 billion earmarked to improve our nation's drinking water, wastewater, and stormwater infrastructure. In 2022, EPA is providing $7.4 billion through the State Revolving Funds, with more to come in the next five years. In December, Administrator Regan sent a letter to the governors of every state and territory, calling for resources to be targeted to overburdened communities, to make rapid progress on lead-free water for all, and to address forever chemicals.

EPA determines lower Neponset River is a Superfund site

EPA has added the 3.7 mi (6 km) stretch of the Lower Neponset River, in eastern Massachusetts, to the Superfund National Priorities List (NPL), requiring further investigation and cleanup. Listing it as an NPL site under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) will transform the river, improving its ecological health and benefiting the communities that share it.

The stretch of the river listed is from the point where it merges with Mother Brook in Hyde Park, extending downstream to the Walter Baker Dam in Dorchester and Milton. Its channel is 40 to 300 ft (12 to 90 m) wide and comprises an estimated 40 ac (16 ha) within or bordering the city of Boston (Hyde Park, Mattapan, and Dorchester sections) and the town of Milton.

The Lower Neponset River site was referred to EPA by the Commonwealth of Massachusetts in 2015. For more than a decade, the surrounding communities have expressed concern about the potential contamination. The site is bordered by residential, commercial, industrial, and public parcels of land, including the Neponset River Greenway. Historically, numerous mills were established along this portion of the Neponset River in the neighborhoods of Dorchester, Milton, Hyde Park, and Mattapan, initially using dams to generate power to turn mill grinding wheels and later to operate large industrial mills. These mills and other industrial facilities in the area contributed to the river's contamination.

In referring the site to EPA, Massachusetts agreed that listing the site on the NPL is best for ensuring investigation and cleanup. EPA determined that the Lower Neponset River site qualified for the NPL because this portion of the river contains sediment contaminated with elevated levels of PCBs that may pose a risk to human health and the environment. Protecting the people directly affected by this industrial contamination in the river, including the urban neighborhoods, is EPA's primary goal for the site.

The Bipartisan Infrastructure Law passed last year invests $3.5 billion in the Superfund Remedial Program and reinstates the Superfund chemical excise taxes, making it one of the largest investments in American history to address legacy pollution. This investment is important in EPA's ability to tackle threats to human health and the environment, and EPA is acting to clear a backlog of 49 sites across the country that had been awaiting funding to start remediation and accelerate progress.

Toxics release inventory data show decline in chemical releases in New England

In early March, EPA released its 2020 Toxics Release Inventory (TRI) National Analysis, which shows that companies that manage chemicals continue to make progress in preventing pollution and reducing chemical releases into the environment. The report shows continued reductions in toxic chemical releases in New England, and that between 2019 and 2020 total releases of TRI chemicals nationwide decreased by 10 percent.

This 2020 analysis includes enhancements to make data more useful and accessible to communities, including communities with environmental justice concerns. EPA has added demographic information to the Where You Live mapping tool, making it easy to overlay maps of facility locations with maps of overburdened and vulnerable communities. Community groups, policymakers, and other stakeholders can use this information to identify potential exposures to air and water pollution, better understand which communities carry a disproportionate pollution burden, and act locally.

In 2020, 95 percent of the TRI chemical waste managed at facilities in New England was not released into the environment and was instead managed using preferred practices such as recycling, energy recovery, and treatment. This is 6 percent higher than the national average. Facilities in the region reported releasing 14.3 million lbs (6.5 million kg) of TRI chemicals, a 14 percent decrease from 2019. From 2011 to 2020, releases in New England decreased by 5.9 million lbs (2.7 million kg) or 30 percent, driven by reduced air releases from paper manufacturing facilities and electric utilities. For 2020, 8 percent of New England facilities reported implementing new source reduction projects. Among the sectors with the highest source reduction reporting rates was the plastics and rubber products manufacturing sector.

To assist communities with reducing pollution, EPA is offering $23 million in grant funding for states and Tribes to develop and provide businesses with information, training, and tools to help them adopt pollution prevention (P2) practices. For the first time, roughly $14 million in grant funding from the Bipartisan Infrastructure Law is available with no cost sharing/matching requirement, increasing access to funding for all communities. These grants are integral to the President's Justice40 initiative by providing a meaningful benefit to communities affected by legacy pollution issues. As such, EPA will administer this program in accordance with this initiative to ensure at least 40 percent of the benefits are delivered to underserved communities.

The mighty Merrimack River—a Clean Water Act success story

FREDERICK McNEILL, PE, City of Manchester, New Hampshire's Environmental Protection Division

ABSTRACT | In celebration of the 50th Anniversary of the Clean Water Act—*a job well done*—this article chronicles the history of northern New England's Merrimack River and its cleanup from one of the most polluted rivers in the country. The Merrimack River has been the center of life and commerce in New England since humans inhabited this land. It has also inspired generations who have seen and been touched by it; one of our country's first environmentalists, Henry David Thoreau, published *A Week on the Concord and Merrimack Rivers* in 1849, recounting his journey with his brother on this majestic waterway. Beatnik author and Lowell native, Jack Kerouac, reminisced about the river and its 1936 flood in his 1952 novel *Doctor Sax*. Several naval ships have been christened the USS Merrimack in honor of it.

This article is also about my journey as a 41-year water professional. I grew up about 1 mi (1.6 km) from the site of the wastewater treatment plant that I presently manage on the banks of the Merrimack River. The Merrimack has inspired me since I saw its roaring rapids as a child. I have a lifetime of river memories, and I take great pride in now being a trusted steward of it. This article will look at many of the historical, social, and economic factors that contributed to the river's pollution, cleanup, and revitalization.

KEYWORDS | Merrimack River, Clean Water Act, Industrial Revolution, legacy pollution

For centuries the Merrimack River was the lifeline of the Indigenous peoples of northern New England, providing them food, clean water, and transportation. Many tribes including the Agawam, Amoskeag, Pawtucket, and Pennacook lived on its riverbanks; in fact, the name "Merrimack" is derived from the Indigenous American name meaning "swift water place."

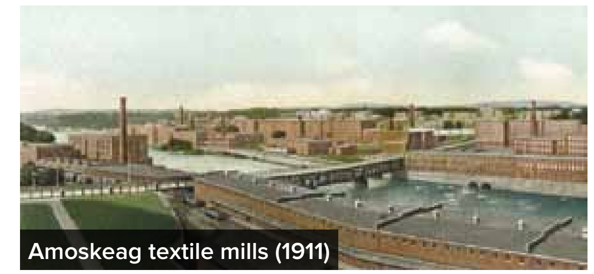
The first European to document the Merrimack River was the French explorer Samuel de Champlain in 1605. As more immigrants from Europe came to New England in the early 1700s, they settled along this river for the same reasons that the Indigenous people did—food, clean water, and transportation.

Late in the 1700s, the lower Merrimack Valley transformed quickly from an agrarian society to an industrial society. The Merrimack River soon became a chief means of commerce and to this day has been the economic engine for the Merrimack Valley. This quest for commerce led to the river's pollution and near-death. Ironically, this same quest has also led to its cleanup and revitalization.

INDUSTRIAL REVOLUTION

The Pawtucket Falls in Lowell offered a source of water power that enabled the construction of sawmills and gristmills in the early 1700s. The Merrimack Valley's rich fields of timber gave local merchants a bountiful harvest. Transporting the timber down to the sawmills and the cities via the river, however, was problematic due to a series of waterfalls. In 1792, the Proprietors of Locks and Canals Association was established by timber merchants from Newburyport. In 1796, they built the Pawtucket Canal to bring timber products around the Pawtucket Falls. This was followed in 1807 by the first lock and canal system in Manchester, New Hampshire, which navigated around the Amoskeag Waterfalls. These locks and canals were built without any environmental awareness or consideration, and the Merrimack River was forever altered.

In the early 1800s, at the dawn of the Industrial Revolution in England, textiles became one of the most dominant industries. The wealthy merchants on this side of the Atlantic, such as Francis Cabot Lowell and Benjamin Prichard, soon followed suit. The Merrimack Valley would transform over the next 100 years into a worldwide textile power led by the Amoskeag Mills, the world's largest single textile mill. The roaring flows of the mighty Merrimack River provided the power to drive this. The river was literally the engine that drove the textile industry into prosperity, and the river into pollution.



Amoskeag textile mills (1911)

The wealthy industrialists with their growing textile industry continued to control the river's destiny as they harnessed its hydraulic power. Starting in 1820 and over the next 28 years a series of dams were constructed on the river. In 1820, the Pawtucket Falls Dam was built in Lowell, providing 32 ft (10 m) of hydraulic power in the form of hydraulic head. In 1836, the Amoskeag Falls Dam was constructed in Manchester providing 50 ft (15 m) of hydraulic power. Last, in 1848, the Great Stone Dam was constructed in Lawrence providing 35 ft (10.7 m) of hydraulic power. In addition to these large-scale dams, canals were built in and around most mills, equipped with smaller dams with slide gates to control water release. Similar to the early locks, these dams and canals were constructed without environmental awareness or consideration. The slow killing of the Merrimack River continued.

Lowell mills (1910)

Huge textile mill complexes were constructed all along the riverbanks. From Franklin, New Hampshire, to Newburyport, Massachusetts, the Merrimack River powered the textile industry and New England's Industrial Revolution. By 1840 Lowell had grown to 32 textile factories employing almost 8,000 workers. The world's largest single textile mill grew along the river at Manchester's Amoskeag Manufacturing Company, which operated from 1810 to 1935. During its peak it employed over 17,000 workers spread over 40 buildings and 5.8 million ft^2 (0.54 million m^2) of flow space. The mills produced everything from military uniforms to the denim for Levi Strauss jeans. In addition to textiles, the company's foundries produced everything from guns to locomotives to fire engines. The mid-1800s represented the peak of the textile industry in New England and along the banks of the Merrimack River.

The harnessing of the mighty river was a civil engineering marvel for its time. Every inch of hydraulic power was used by these pioneers. Mill buildings were constructed to maximize water use. Massive turbines were constructed to harness the river's energy. Networks of canals and gates were constructed to distribute the water and its energy

THE MERRIMACK RIVER WATERSHED

The 117 mi (188 km) long Merrimack River is one of the largest and most important rivers in northern New England. It starts in Franklin, New Hampshire, at the confluence of the Pemigewasset and Winnipesaukee rivers, and discharges into the Gulf of Maine in the Atlantic Ocean in Newburyport, Massachusetts. Its lower 22 mi (35 km) in Newburyport and Amesbury are considered tidal. A watershed of 5,010 mi^2 (12,980 km^2) and 12 rivers contribute to its 4.8 billion gallons (18.2 billion liters) of flow per day. Several major cities sit along the river's banks, including Concord, Manchester, and Nashua in New Hampshire, and Lowell, Lawrence, and Haverhill in Massachusetts. Over two million people live in the river's watershed.

The Nashua River, a tributary of the Merrimack River, was severly polluted (left) circa 1960 and (right) before and after the CWA

throughout the mill complexes. This was truly a showplace of the golden age of civil engineering, constructed well before the birth of environmental engineering.

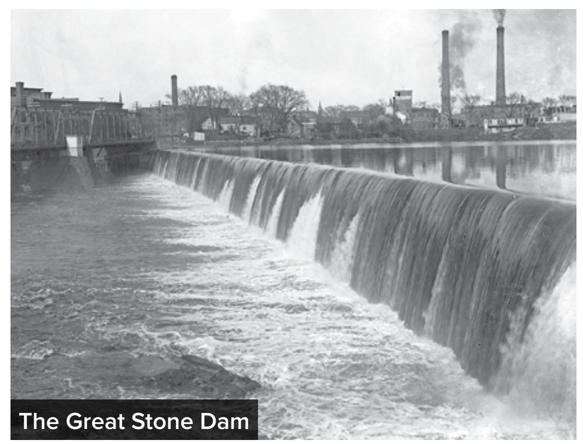
CONSEQUENCES OF THE INDUSTRIAL REVOLUTION

The Industrial Revolution was driven in the name of commerce by a relatively few wealthy industrialists and merchants. They realized most of the financial and social benefits of their work, but the rest of the Merrimack Valley's residents suffered the consequences for decades to come.

For centuries the river had been home to several species of diadromous fish that migrate between the ocean and freshwater. Shad, river herring, salmon, alewives, and eels served the river with several vital ecosystem functions throughout their life cycle. Diadromous fish transport nutrients from the ocean to inland ecosystems. During spawning migrations, they also provide a seasonal abundance of food for species living year-round in marine, freshwater, and transitional habitats. Eagles, ospreys, otters, and many others rely on these diadromous fish to feed their young.

Dam construction to fuel the Industrial Revolution all but killed the river's annual fish migration. The Great Stone Dam constructed just 30 mi (48 km) from the Atlantic Ocean in Lawrence created almost a complete barrier for diadromous fish that had fed Indigenous peoples for centuries. In addition to building dams, several "mill ponds" created stagnant water that further degraded the ecosystem supporting the river's aquatic life.

While the altering of the Merrimack River's natural course harmed its biology, the mill pollution further deteriorated the river. Dyes and bleaches from the mills were discharged to the river daily. One of the most damaging pollutants was the "wash water" from cleaning equipment that contained oils,



The Great Stone Dam

greases, and heavy metals. In addition to the textile mills, dozens of other industries such as foundries, tanneries, and paper mills contributed to the pollution. In Concord, New Hampshire, coal tar from the manufacture of coal gas to energize the city was stored in holding ponds within the river's floodplain.

Population growth also contributed to the pollution. Mill workers had to live within walking distance of work, creating dense urban populations within the river's immediate watershed. Judicious wastewater collection and treatment was still decades in the future, and domestic waste was discharged directly to the river. Stormwater runoff that also discharged into the river carried everything from horse manure to mill tailings to slaughterhouse waste, further deteriorating water quality.

The Merrimack River that had served generations of Indigenous peoples and early settlers became so polluted that it was an unsafe drinking water source. Waterborne diseases such as cholera, gastroenteritis, and giardiasis traveled downstream from one river city to another. In 1832, a cholera outbreak in Manchester killed 674 residents. In 1849, 149 residents of Lowell died from the disease. The river also no longer provided food, as the fish migrations had ended, and the water was so polluted that even

boating on it was a serious health risk. The river had become so odorous in some areas that it was a hardship to live adjacent to it. The mighty river that had served generations was now almost dead.

PERIOD OF INACTION AND FURTHER DEGRADATION

The decline of the textile industry started shortly after the Civil War. The increased cost to ship cotton north, heat buildings, and pay workers contributed to the industry's demise along the Merrimack River. Most of the mills closed during the Great Depression. Urban populations deserted the cities for the suburbs. By 1940 the vacant mills began a depressed era of inactivity.

During this period our nation faced three great challenges that would take all its focus and resources: World War I, the Great Depression, and World War II. Although it was an acknowledged and growing problem, the state or federal government had done little to address the environmental degradation and water pollution.

One of the first local laws to protect our waterways was enacted in 1878 when the Massachusetts General Court prohibited the discharge of refuse or any "polluting substances" into streams or public ponds. Commerce was again the priority, however, as lawmakers bowed to corporate pressure and exempted from this law the Connecticut and Merrimack rivers as well as the Concord River within Lowell.

In 1886, the Massachusetts Legislature required its board of health to adopt water pollution standards. This led to our engineering opening, with several notable activities taking place. In 1893, the Lawrence Experiment Station became home to groundbreaking wastewater engineering research. In 1899, the Rivers and Harbors Appropriation Act was passed, arguably our country's first federal environmental law. Ironically, this act addressed navigation of harbors but not the water quality. Once again, the law was driven by commerce; our harbors and adjacent waterways had become so full of solid waste that ships carrying goods could not navigate them.

In 1912, the federal government passed the Public Health Service Act to study problems of sanitation, sewage, and pollution. In 1917 Lowell prepared an engineering report recommending "the construction of proper sewerage facilities" along the Merrimack River. In 1929 our organization, NEWEA, was founded as the New England Sewage Works Association with 40 charter members. Environmental awareness was increasing, and small but positive steps were addressing the pollution of the Merrimack River.

Merrimack River as it flows from Haverhill to Newburyport, Massachusetts

With the end of World War II our nation could turn its attention to other challenges, including water pollution. In 1945, the surgeon general warned that over half of the U.S. population relied on drinking water supplies of "doubtful purity." In 1947, the New England Interstate Water Pollution Control Commission was created—one of several interstate water pollution control commissions created by Congress to address water pollution at the state level. By now the post-World War II generation recognized that water pollution was a national problem, and in 1948 the Federal Water Pollution Control Act was enacted. Although initially a weak law with no funding and little leadership, it was the foundation of the legislation that would ultimately enable the cleaning of the United States' waterways. The Federal Water Pollution Control Act was amended in 1956, 1961, 1965, and 1966, and each time it became stronger and more sustainable. Meanwhile, along the Merrimack River the Anadromous Fish Conservation Act of 1965—a joint state–federal effort to restore migratory fish such as salmon and shad—was enacted. Fish ladders and elevators were constructed around dams to facilitate the migration of these fish. Progress was slowly being made.

CLEAN WATER ACT

In the late 1960s, as a result of decades of inaction and continued raw wastewater discharges, the Merrimack River was named one of the 10 most polluted rivers in the country. However, the 1960s also brought change to our country. Social activism was bringing an end to an unpopular war in Vietnam. This same spirit of social activism embraced the environment. In 1970, the first Earth Day was held in support of environmental

Manchester, New Hampshire WWTP

protection. Also in 1970, EPA was created and at long last the United States' environmental leadership void began to be filled. Soon after, in the same year, the Clean Air Act was passed to address the smog choking our cities. Next up was water.

One of New England's own, Senator Edmund S. Muskie of Maine, championed clean water in the 1960s. Mr. Muskie grew up in Rumford, Maine, near the Androscoggin River, which received pollutants from paper mills, municipal sewers, and agricultural runoff. He knew firsthand that our nation's rivers were dying. In 1972, the U.S. House and Senate voted nearly unanimously to pass a set of sweeping amendments to the 1948 Federal Water Pollution Control Act; President Nixon, however, vetoed the bill. The Mr. Muskie-led environmental coalition quickly secured the votes for an override by the Senate and House, and the bill became law on October 17, 1972. The newly amended Federal Water Pollution Control Act, now strengthened, funded, and provided leadership by the EPA, would ever after be known as the Clean Water Act (CWA).

The CWA established environmental stewardship as one of our nation's priorities. It was also the catalyst for one of the most significant and successful engineering achievements over the past 100 years, the cleaning of our nation's waterways that had been polluted for over 200 years. The CWA established two key regulations to govern and protect our rivers: permits and water quality standards. The most important permit created was the National Pollutant Discharge Elimination System (NPDES), which regulates point sources discharging pollutants into U.S. waters. Water quality standards were generally left to the states because of the geographical, climatic, and aquatic life variations among them.

These numerical criteria provided clear guidance to our industry for meeting the CWA's goals.

Most important to the CWA was federal funding. Many previous water projects suffered from lack of funding and lack of financial responsibility for the polluting industries. The CWA provided federal funding for construction of wastewater treatment plants WWTPs and collection systems nationwide, with the funding sources established at 90 percent federal, 5 percent state, and 5 percent local. With the water quality standards, permits, and funding in place, our industry was ready to go to work.

SUCCESS OF THE CWA

The Merrimack River communities began the construction of nine WWTPs, starting at the river's confluence in Franklin and ending at its discharge in Newburyport. These nine WWTPs were the most cost-effective investment to address the polluted waters of the Merrimack River. As plants started up in the mid-1970s, river water quality improved immediately.

As our nation embraced environmental stewardship, EPA determined that WWTPs were only a partial solution. Therefore, over the next 30 years EPA established several other programs under the CWA that further improved water quality. In 1981, the Industrial Pretreatment Program was established to prevent the introduction of pollutants to a WWTP. In 1990, the Municipal Separate Storm Sewer System (MS4) stormwater permit was issued to address polluted runoff affecting waterways. In 1994, EPA issued its Combined Sewer Overflow (CSO) Control Policy. This policy greatly affected the Merrimack River, as five large communities had combined sewer systems: Manchester, Nashua, Lowell, Lawrence, and Haverhill. These communities each established long-term control plans to mitigate CSO discharges, and collectively they have invested over $1 billion in addressing CSOs. As a result, "separated" collection systems now direct flows to WWTPs.

In the 2000s, EPA continued to improve water quality through NPDES permits by regulating dissolved pollutants such as nutrients including nitrogen and phosphorous. This multi-phase water pollution abatement approach over the past 50 years has restored the health and well-being of the Merrimack River, which is now the cleanest and healthiest it has been in almost 200 years. The river is the second largest surface drinking water source in New England, serving 600,000 people through five water treatment plants. Manchester is constructing its new $40 million, 7 mgd (26.5 ML) water treatment plant on the banks of the Merrimack River.

Merrimack River as it empties into the Atlantic Ocean

The reclaimed river has once again become the economic engine of the Merrimack Valley, but this time sustainably so. The river is still used to power our industries, but in a more environmentally responsible manner. Eight dams along the Merrimack furnish over 264,000 gps (1,000 M^3/s) of flow to turbines creating power in accordance with today's rules and regulations. The textile mill buildings along the river's banks are again thriving with high-tech companies, schools, and offices of several engineering firms contributing to our industry. While our nation's thirst for commerce and wealth has not subsided, we have recognized that this pursuit must be done environmentally, responsibly, and sustainably for our health and well-being.

In my youth I was in awe of the mighty Merrimack River with its white water rapids and raw power as it roared during spring snowmelt and rains. I fished the river and witnessed firsthand the pollution and devastation done to this great waterway. During the winters in the 1960s I watched city trucks dump, as was standard practice, all the snow full of roadway contaminants and solid waste into the river through the bridge grating. In my lifetime the river has gone from unsightly, not swimmable, and unsuitable for aquatic life to its cleanest and healthiest state in almost 200 years. Full recreational activities are offered on the northern portion, including swimming, boating, water skiing, and fishing. Salmon are stocked annually in the upper reaches. Many of the aquatic species that disappeared during the industrial revolution have slowly returned to their natural habitat. The river has once again become an inspiration to me and, I hope, to our next generations of environmentalists. The CWA was critical in achieving one of our nation's greatest engineering achievements in the past 100 years: the cleaning of the Merrimack River and the United States' waterways.

ABOUT THE AUTHOR

Frederick McNeill is the chief engineer of Manchester, New Hampshire's Environmental Protection Division, where he manages northern New England's largest wastewater utility. In addition to his current role as NEWEA president, Mr. McNeill is a member of the New Hampshire Rivers Management Advisory Committee and has been a NEIWPCC commissioner since 2007. A long-time industry advocate, Mr. McNeill has published/presented over 50 technical papers on a wide range of environmental engineering topics.

| MIGHTY MERRIMACK RIVER |

Stakeholder collaboration achieves low level nitrogen removal and improved peak wet-weather capacity at Warren, Rhode Island

JON HIMLAN, PE, Woodard & Curran
PAUL DOMBROWSKI, PE, BCEE, F.WEF, Woodard & Curran

ABSTRACT | At 50 years, the Clean Water Act (CWA) has directly and indirectly benefited not only our planet but also our citizens and economy. While innumerable people and programs have contributed to the CWA's success, the collaboration among stakeholders in our industry and communities has solidified it. Each group of stakeholders, including public officials and employees who manage and operate wastewater treatment facility facilities (WWTFs), regulators, funding agencies, contractors, equipment suppliers, researchers, trainers, and consultants, have contributed to maintaining and improving water quality. The evaluation, design, construction, and operation of the Warren, Rhode Island WWTF upgrade exemplifies how stakeholders throughout the wastewater industry can effectively collaborate to improve water quality and serve our communities.

KEYWORDS | Permitting, nitrogen removal, wet weather capacity, secondary clarification

BACKGROUND

The town of Warren is in eastern Rhode Island on a peninsula that separates Mount Hope Bay and Narragansett Bay. Warren is home to around 11,400 residents and numerous commercial and industrial businesses, most served by the municipal sewer system and the Warren wastewater treatment facility (WWTF). The WWTF is on the western edge of town, along the Warren River just upstream of where it discharges into Narragansett Bay. The WWTF was constructed in the 1940s and upgraded in 1981 to include secondary treatment. Although modest improvements were completed after the 1981 upgrade, most of the WWTF's mechanical and electrical systems were well past their useful life in 2010, when the planning for a plant upgrade was initiated in response to issuance of a new Rhode Island Pollutant Discharge Elimination System (RIPDES) permit.

PERMITTING COLLABORATION

The 2010 RIPDES permit included stringent total nitrogen (TN) limits based on an 80 percent nitrogen reduction in the summer (May–October) and a 20 percent reduction during the winter (November–April). These proposed TN reductions resulted in summer and winter permit monthly mass limits of 83.8 lb/day (38.0 kg/d) and 239.7 lb/day (108.7 kg/d), respectively, at a permitted flow of 2.01 mgd (7.61 ML/d). In addition, the 2010 RIPDES permit also included monthly concentration TN limits of 5.0 mg/L and 14.3 mg/L in the summer and winter, respectively, to reflect concentrations to meet the proposed mass-based limits at the permitted flow.

Moreover, because of the combination of new sewer connections and infiltration and inflow (I/I), the Warren WWTF regularly experienced flows higher than the RIPDES permit flow limit of 2.01 mgd (7.6 ML/d) (see Figure 2), suggesting an increase in the RIPDES permitted flow was required. These needs, along with an aging WWTF vulnerable to coastal storm events and on a constrained site, needed a collaborative solution among town officials, regulators, consulting engineers, equipment suppliers, construction contractors, and WWTF contract operations staff.

In response to the need for an upgrade together with the newly issued permit, the Town of Warren entered into a consent agreement with the Rhode Island Department of Environmental Management (RIDEM) to determine the required flow increase to include in a permit modification. It was recognized that such a permit modification could also include changes to TN and conventional pollutant concentration limits, so that the mass of the pollutants in the WWTF effluent would not increase.

Following a flow study, the Town of Warren, its consulting engineer, and RIDEM developed permit limits that would meet the water quality criteria of the WWTF discharge while providing flexibility to reduce the capital cost of the upgrade. The new permit included the following:

- Monthly flow limits of 2.53 mgd (9.58 ML/d) and 3.43 mgd (12.98 ML/d) that coincide with the periods when summer and winter seasonal nitrogen limits, respectively, are in effect
- Seasonal average mass limits for TN of 83.7 lb/day (38.0 kg/day) and 239.7 lb/day (108.7 kg/day) for summer and winter permit seasons, respectively, with these seasonal mass limits equating to seasonal concentration limits of 4.0 and 8.4 mg/L, respectively

Figure 1. Key stakeholders in the success of the Clean Water Act

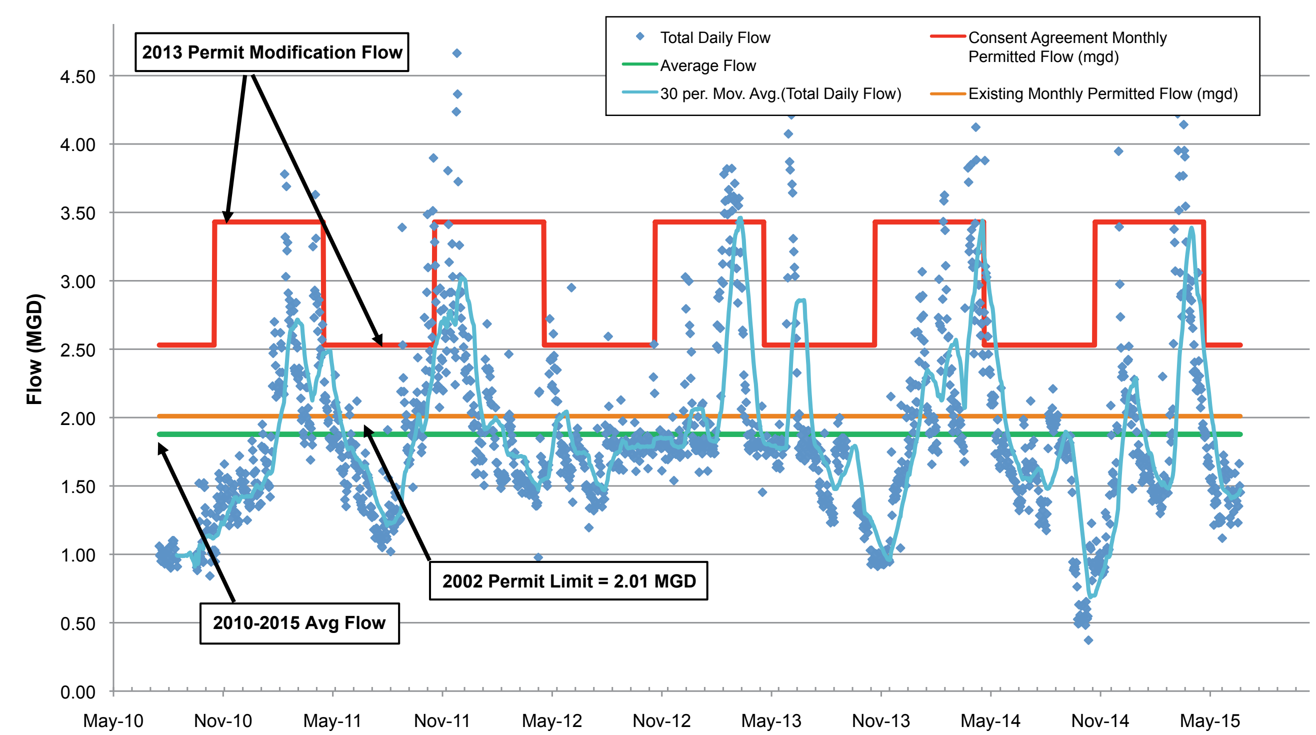


Figure 2. Primary effluent flow and proposed flow permit limits

- Monthly concentration limits for TN of 5.0 and 9.5 mg/L for summer and winter permit seasons, respectively
- Reduction in monthly average BOD5 and TSS limits to 23.8 mg/L and 14.6 mg/L summer and winter permit seasons, respectively, due to the increase in flow

This permit development process enabled the Warren WWTF to be designed for a higher TN concentration (5 mg/L vs. 2.9 mg/L without the seasonal flow limits) at a lower flow rate (2.53 mgd vs. 3.43 mgd [9.58 ML/d vs. 12.98 ML/d]) during the summer, when more stringent limits need to be met. Although the WWTF site's limited space required a compact treatment technology, the more accommodating permit limits allowed both proprietary and conventional technologies and equipment to be considered. Table 1 summarizes the flow and TN pollutant values included in the permits.

Table 1. Summary of flow and nitrogen permit considerations

Permit Season	Flow MGD (ML/d)	Monthly Mass Limit lbs/d (kg/d)	Seasonal Mass Limit lbs/d (kg/d)	Equivalent Conc. based on Seasonal Load Limit mg/L	Monthly Avg. Conc. Limit in Permit mg/L
Limits from 2010 RIPDES Permit					
Winter	2.01 (7.61)	239.7 (108.7)	N/A	14.3	14.3
Summer	2.01 (7.61)	83.8 (38.0)	N/A	5.0	5.0
Limits using typical monthly flow limit approach					
Winter	3.43 (12.98)	239.7 (108.7)	N/A	8.4	8.4
Summer	3.43 (12.98)	83.8 (38.0)	N/A	2.9	2.9
Limits from 2013 RIPDES Permit Modification					
Winter	**3.43 (12.98)**	**N/A**	**239.7 (108.7)**	**8.4**	**9.5**
Summer	**2.53 (9.58)**	**N/A**	**83.8 (38.0)**	**4.0**	**5.0**

Figure 3. WWTF prior to upgrade

WWTF PROCESS EVALUATION AND DESIGN

The 2013 modification to the RIPDES permit initiated a facilities plan to evaluate the needed improvements to upgrade the Warren WWTF, particularly the biological treatment process, to provide capacity for the increased flows and to achieve TN limits. The evaluation of biological treatment alternatives was completed in two steps. The first step screened several technologies. The second step evaluated the three most favorable technologies that would provide the target flow capacity and fit on the constrained WWTF site. The three processes evaluated were (1) magnetite-ballasted activated sludge, (2) integrated fixed-film activated sludge (IFAS), and (3) variable operating mode (VOM), which incorporates several conventional activated sludge treatment configurations. The evaluation determined that the VOM process had the lowest capital and operating costs, with a net present worth cost 25 percent lower than the next-lowest-cost alternative.

Again, the WWTF's limited space to construct additional tank volume was a key factor in evaluating the biological treatment alternatives. The original 1981 aeration tank reactors, piping gallery, and secondary clarifiers were all constructed as continuous units that did not include a flow distribution structure immediately upstream of the secondary clarifiers. As shown in Figure 3, the layout was designed to split the flow to the two reactors, but not to recombine the flow prior to secondary clarification. With no space in the piping gallery to construct a new flow distribution structure prior to secondary clarification, the design could not incorporate a third secondary clarifier without significant rework of the piping gallery with the associated capital cost. This constraint guided the design toward using only the two existing secondary clarifiers and adding a flow distribution structure at the beginning of the new reactor train rather than between reactors and secondary clarifiers, as is common.

The VOM configuration for the Warren WWTF includes two treatment trains with eight zones per train. The process configuration includes the following:

- Two pre-swing zones that can be operated as either aerobic (aerated) or anoxic (un-aerated but mixed) reactors
- Two post-swing zones that can be operated as aerobic or anoxic reactors

- Capability to draw internal mixed liquor recycle (IMLR) flow from either of the post-swing zones or to turn these pumps off completely
- Ability to operate in a modified version of the contact stabilization mode to protect the secondary clarifiers from washout due to excessive solids loading during storm events, while still providing some TN removal

The contact stabilization mode of the activated sludge process relocates the feed point of the primary effluent to the contact zone, typically 50 percent or more down the length of the reactor train. As the return activated sludge (RAS) flow is still added to the beginning of the reactor train, the stabilization zone holds solids at RAS concentration, effectively storing the RAS solids and lowering the mixed liquor suspended solids (MLSS) concentration in the contact zone. As secondary clarifier capacity relates directly to MLSS concentration entering the clarifier, the contact stabilization mode allows manipulation of the biological solids inventory; this increases secondary clarifier capacity during wet weather events by lowering the solids loading rate on the secondary clarifiers.

Each operating mode also can add alkalinity or supplemental carbon to enhance the process. Sodium hydroxide can be added to the reactor influent to increase alkalinity as well as pH, and it is commonly used during the winter and spring when I/I is higher, with corresponding lower influent alkalinity. A commercial carbon product can be added as a supplemental carbon source to the reactor influent or to either of the post-swing zones. Supplemental carbon can be added year-round to any of the operating modes but is likely needed only when the WWTF is operating with the four-stage Bardenpho process during the summer when TN limits are lower.


Mixer-aerator installation in post-swing zone

These features allow the VOM process to operate in three primary modes depending on the seasonal permit limits and operating conditions. Volumes of the aerobic and anoxic zones can be altered by changing the operating environment (aerobic, anoxic, or low dissolved oxygen aerobic) of each reactor zone. The three operating modes are shown in Figures 4a, 4b, and 4c.

Figure 4a. Four-stage Bardenpho process with dual anoxic and aerobic zones. This mode was the basis of design for summer conditions. The process can achieve an effluent TN of less than 5 mg/L.

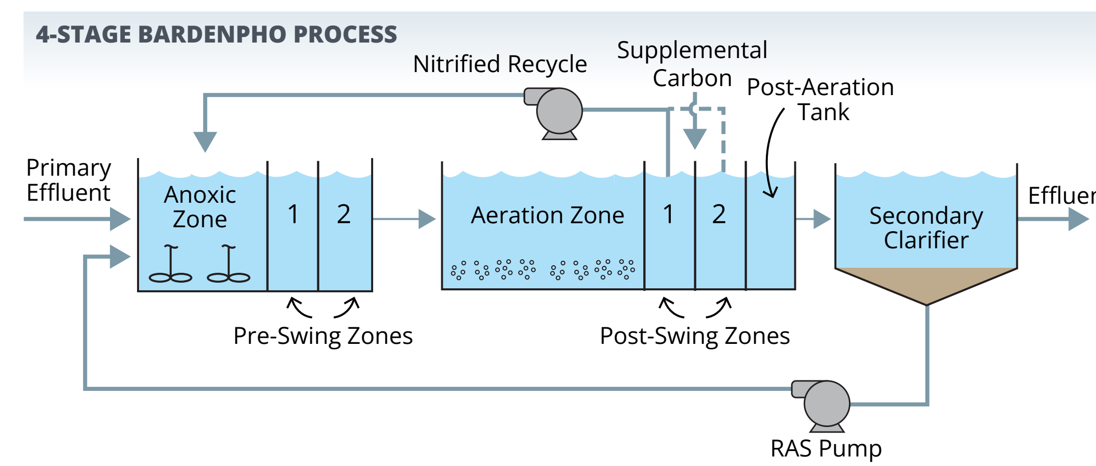
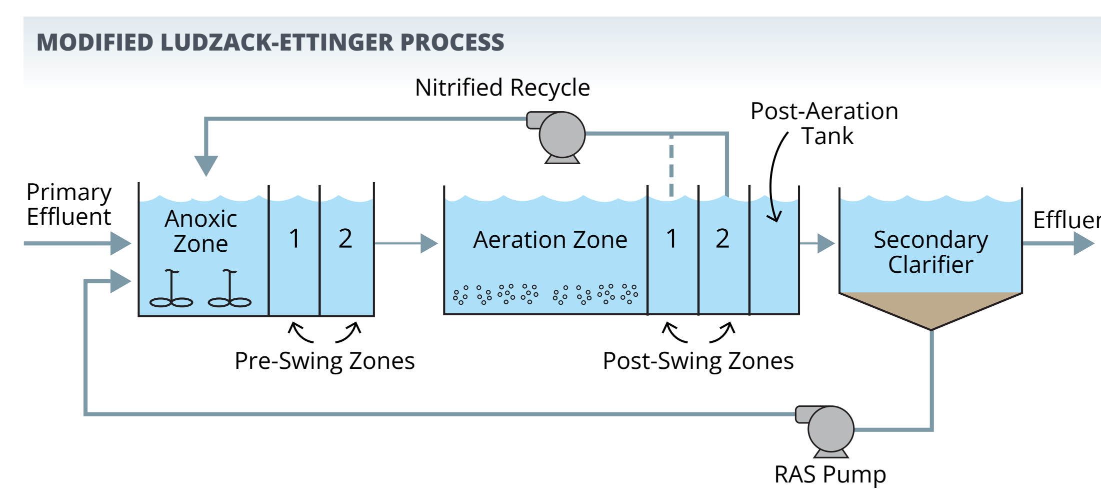


Figure 4b. Modified Ludzack-Ettinger (MLE) process with a pre-anoxic zone and main aeration zone. Changing from the four-stage process to MLE simply requires activating the aeration system in the post-swing zones and changing the IMLR pump suction location. This mode was the basis of design for winter conditions. The MLE process can achieve an effluent TN of less than 8 mg/L.



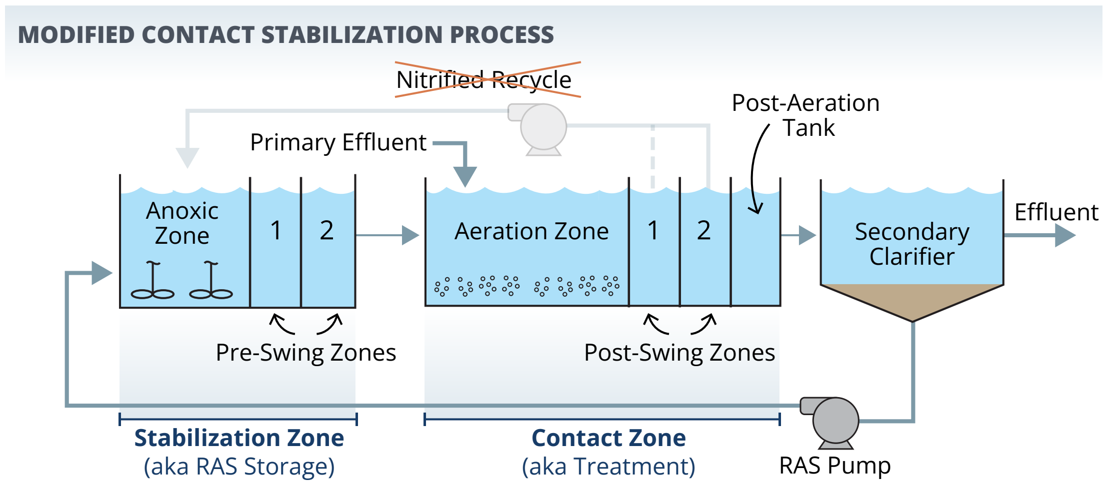


Figure 4c. Modified contact-stabilization process that stores solids in the stabilization zone and provides treatment in the contact zone. The variation of this operating configuration allows portions of each train to be maintained as anoxic zones to continue to provide some nitrogen removal during high flow events. This mode was the basis for design when flows exceeded winter season maximum week flow of 4.43 mgd (16.77 ML/d). When used as an intermittent, short-duration operating mode, the modified contact stabilization process can achieve an effluent TN of between 8 and 12 mg/L.

Incorporating these three activated sludge operating modes allows the system to operate as a compact, high-biomass process for up to moderate wet weather flow conditions. The switch to the modified contact stabilization process can then be used to manipulate the solids concentration at the end of the reactor train to stay within the limits of the secondary clarifier capacity during severe wet weather events to help prevent solids overload and washout. Owing to the high peak hourly flow to maximum monthly flow ratio of the Warren WWTF influent, the VOM process reduced the reactor size by 40 percent compared to using a conventional design approach.

For swing zone flexibility in the modified contact stabilization process, each zone required the ability to independently mix and aerate the MLSS. In addition, modeling of the system during the design phase determined that under low-loading cold weather conditions, the oxygen demand of the main aeration zones would result in mixing-limiting conditions. As a result, combined aeration and mixing systems were investigated, and a proven proprietary technology in the modeled circumstances was selected.

Additional recommended WWTF improvements included new influent screening, new primary and secondary clarifier mechanisms, primary effluent pumps, rotary drum thickening, a standby generator, a new electrical service, and a new SCADA system, as well as structural, architectural, and HVAC improvements.

RESILIENCY TO ADDRESS CLIMATE CHANGE

Resiliency of both the process and the physical facilities to severe weather, storm events, and high flows was considered while planning the WWTF upgrade. Process resiliency was achieved with the VOM process, which allows different operating modes depending on permit limits, storm magnitude, and operating conditions at the time of the storm. Specifically, the combination of a process configuration that could be quickly adjusted to increase wet weather capacity, mechanical equipment that could function over a wide range of operating conditions, and extensive operational training to proactively control the process were essential in achieving excellent effluent quality over a wide range of flows associated with storm events.

To address the WWTF's physical resiliency, the upgrade required protection from flooding, severe storms, projected sea level rise, and wave action. Resiliency features included relocation of electrical equipment and motor drives above the projected flood elevation and replacing pumps and mixers with units having submersible motors where raising motors was not feasible. The evaluation of the site structures and equipment was completed in cooperation with RIDEM and the Rhode Island Coastal Resource Management Council (CRMC) and was consistent with the flood protection and resiliency recommendations of the 2016 update to TR-16, "Guides for the Design of Wastewater Treatment Works," published by NEIWPCC. Incorporating various resiliency features into the project was important in securing funding from the Rhode Island State Revolving Fund Program.

STARTUP AND PROCESS OPTIMIZATION

As little growth was projected for the town's sewer service area, the upgraded WWTF was projected to start up at approximately 80 percent of design loading. Figure 5 shows the primary effluent flows to the secondary plant since startup and illustrates the actual flows compared to the seasonal limits developed during permitting.

The upgraded WWTF started operation with the new VOM process configuration using one train in August through October 2019 while the second train was being constructed. During the winter of 2019–2020, the process was operated in MLE mode using both trains and achieved an effluent TN of approximately 5.5 mg/L. The consent agreement required compliance with the new permit limits starting on June 1, 2020. During the summer of 2020, the VOM configuration was changed to the four-stage Bardenpho mode and averaged an effluent TN of less than 3 mg/L, well below both the seasonal and monthly TN permit limits. Operation at the end of the summer in 2020 also included a trial of the supplemental carbon feed and control system, which demonstrated the capability to reduce the effluent TN to approximately 2 mg/L. Current WWTF performance does not require the addition of supplemental carbon to achieve summer permit compliance.

Pre-anoxic and pre-swing zones

In the fall of 2020, the WWTF experienced mechanical problems that tested the VOM configuration. In November, one of the IMLR pumps was damaged by a piece of concrete falling into the IMLR chamber, which disabled the impeller. Two weeks later, a second IMLR pump was also damaged by an unknown object, possibly a tool or piece of metal conduit that fell into the other IMLR pump chamber. Both pumps were inoperable and, because of supply chain challenges associated with Covid-19, the WWTF had no IMLR pump capability for four months.

To achieve permit compliance, the VOM process was operated in four-stage Bardenpho mode so that the aerobic zones were completely nitrifying, and denitrification was accomplished by the dual anoxic zones. Unlike typical four-stage Bardenpho mode with IMLR pumps operating, a greater percentage of denitrification was performed in the second-stage, post-swing zone, anoxic reactors. Performance during this challenging period achieved an average TN of 7 mg/L, below the winter monthly average limit of 9.5 mg/L.

Upon delivery of one repaired and one new IMLR pump in March 2021, WWTF staff cleaned and inspected the tank to confirm no objects were within that could damage the repaired or replaced

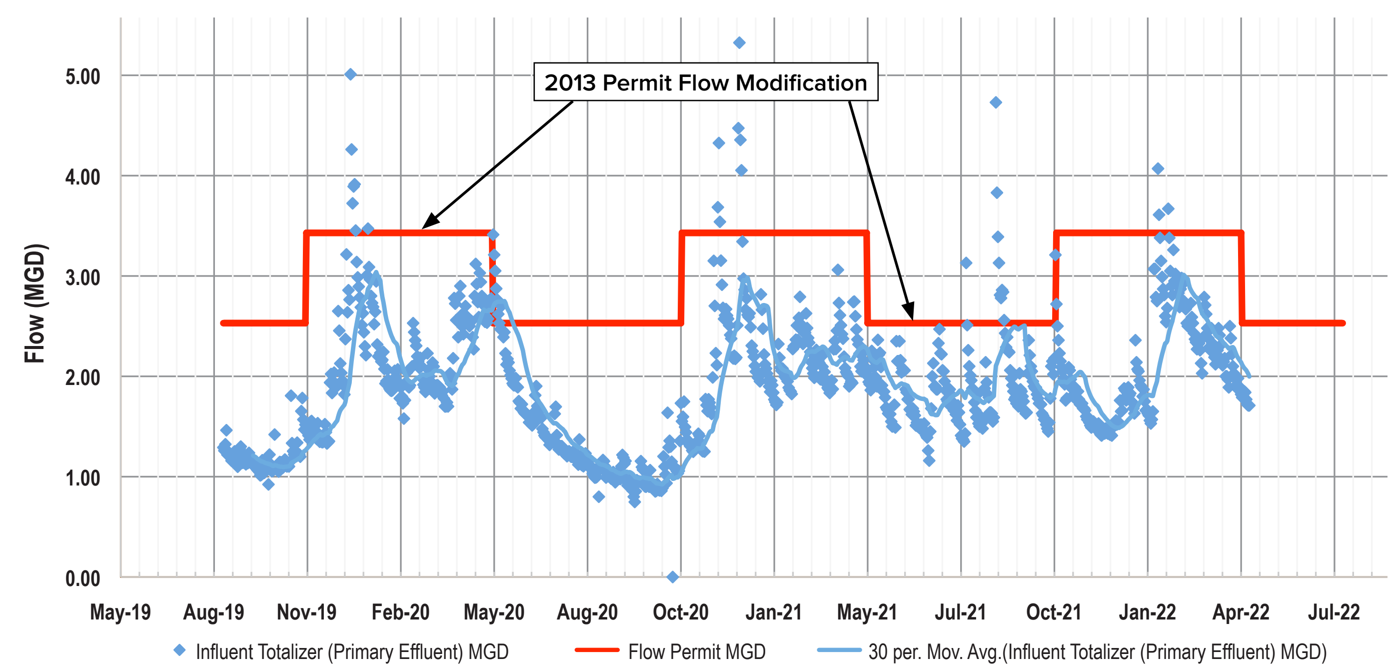


Figure 5. Primary effluent flows since WWTF startup

IMLR pumps. To do so, however, the two trains had to be emptied of MLSS inventory, one at a time. WWTF operators faced two options: (1) waste roughly 50 percent of the solids inventory to reduce the MLSS concentration below the limit of secondary clarifier overload if wet weather flows were experienced or (2) operate in the modified contact stabilization mode. The WWTF operators decided to use the modified contact stabilization process and modulate the RAS flow to provide the needed secondary clarifier capacity while achieving the TN permit compliance. Over the three weeks that it took to fully clean and inspect all the reactors, the

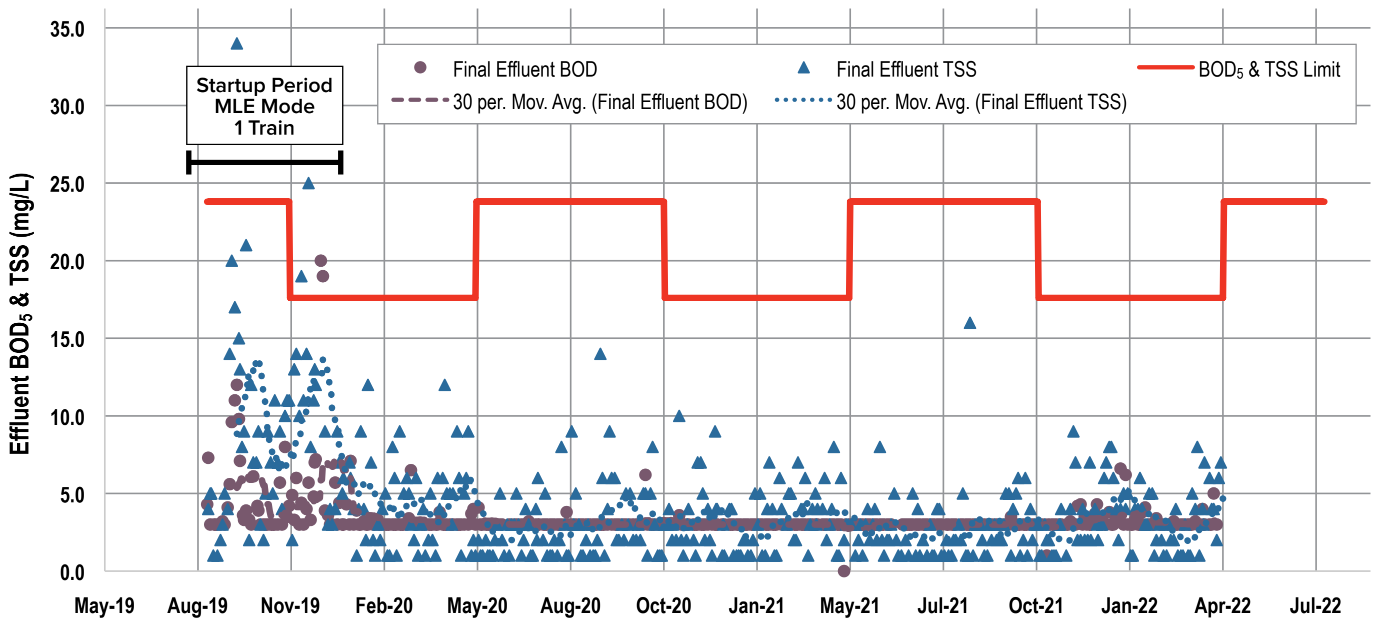


Figure 6. Final effluent BOD_5 and TSS

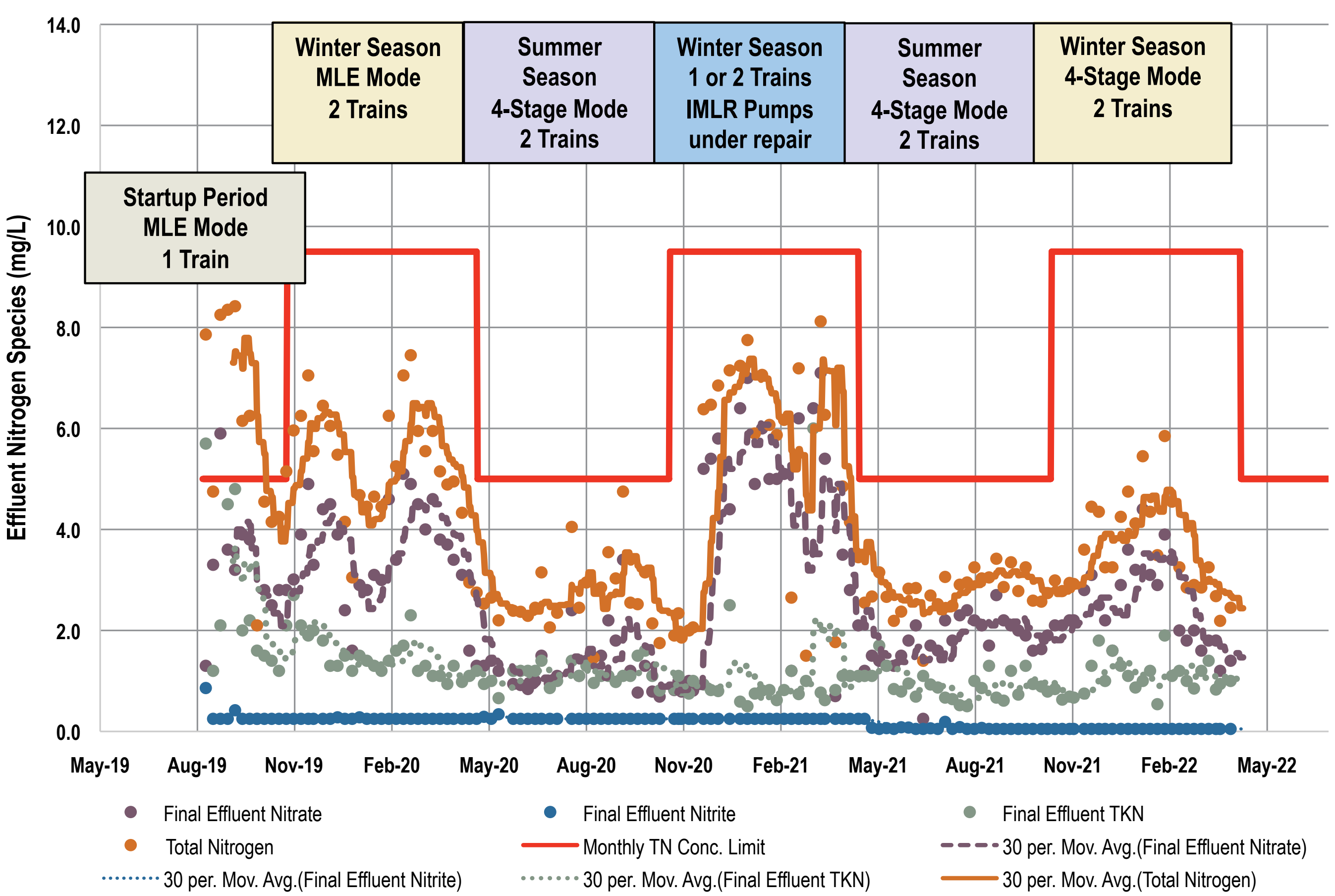


Figure 7. Final effluent nitrogen species

system achieved effluent TN of approximately 7 mg/L as well as low BOD5 and TSS.

Following tank inspection and cleaning, the IMLR pumps were placed back into service just before the summer. Similar to 2020, WWTF process performance during the summer of 2021 achieved an effluent TN of approximately 3 mg/L even though flow increased, including conditions in September when weekly, daily, and peak hourly flows were all the highest ever recorded at the WWTF due to rainfall associated with Tropical Storm Ida.

Performance during the summer and fall of 2021 benefited from ongoing optimization. The combination of operating using precise control of solids retention time, dissolved oxygen concentrations, and RAS rate, while actively managing the sludge volume index, contributed to the WWTF achieving effluent performance of less than 5 mg/L for BOD5 and TSS and 3 mg/L for TN during Tropical Storm Ida, and lowering effluent TN during the winter of 2021–2022 compared to prior years.

SUMMARY

The success of the CWA in developing and implementing water quality improvements in watersheds across New England depends on collaboration and cooperation of key stakeholders. The Warren WWTF upgrade is an example of this, from the collaborative permitting to the innovative and effective design, construction, and startup. At each step of the process, teamwork among stakeholders and participants was integral to accomplishing an effective, affordable water quality improvement that can serve the town for decades.

ACKNOWLEDGMENTS

Many individuals and organizations contributed to this project. Most important was the support and drive of the Town of Warren, especially Town Manager Kate Michaud and Director of Planning Bob Rulli. In addition, Dave Komiega, Norm Blank, and Eric Komiega from the contract operations firm, H2OInnovation (formerly with Suez), were and continue to be instrumental in the transition to the upgraded WWTF and its performance. Also, thanks to the staff at RIDEM and to Hart Engineering, the project general contractor.

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NEWEA
WORKING FOR WATER QUALITY

Rhode Island's communal response to the Clean Water Act

WILLIAM PATENAUDE, Rhode Island Department of Environmental Management, Providence, Rhode Island

ABSTRACT | When asked about the implementation of the Clean Water Act (CWA), Rhode Island environmental regulators and advocates both consistently credit the state's networks of professional and personal relationships, as well as the partnerships made possible by those relationships, for the eventual successes that may have once seemed unachievable or, worse, unnecessary. According to Angelo Liberti, PE, a retired administrator in Rhode Island's Department of Environmental Management's (RIDEM's) Office of Water Resources, the tools provided by the act "set a high bar, which made it difficult to back off from high expectations." While aiming for those expectations sometimes seemed too lofty, Mr. Liberti said that "the voters always approved state clean water bonds, which made us cautiously optimistic" about the long-range goals that, today, are being celebrated. This article presents a timeline of Rhode Island's communal response to the CWA, starting with Rhode Island's initial efforts to improve water quality and ending with a look forward to the state's next steps.

KEYWORDS | Public health, CSOs, water quality, Clean Water Act, modeling, innovation

In the decades before the Clean Water Act (CWA), clean water work in Rhode Island was rooted in the public health crises of the 19th century, such as cholera epidemics, especially in the city of Providence,[1] as well as in the expectations for the appearance and cleanliness of local waterways.

The mill-lined Blackstone River, for instance, generated documented complaints about its appearance and odor as early as the mid-1800s.[2] In response, the heavily industrialized city of Woonsocket—through which the Blackstone River flows—built the state's first municipal wastewater treatment facility in 1897.[3] Rhode Island's capital soon followed; modeling its collection system on the sewers of Paris, Providence began its treatment plant operations in 1901. At the time, it was the third chemical precipitation plant of its kind in the United States, and the largest ever built.

Later, as other communities grew, so did water quality concerns and responses. In 1927, two primary wastewater treatment facilities were built within smaller urban centers—one in the town of East Greenwich and the other in the town of Westerly, with the latter plant incorporating the recently developed Imhoff cone technology—rudimentary sewage treatment using cone-shaped underground tanks. Woonsocket and Providence upgraded their treatment systems to achieve secondary treatment in 1931 and 1934, respectively. The Town of Bristol completed construction of its primary treatment plant in 1935. During and just after World War II, a second phase of water pollution concerns arose. Expanding suburban communities and the industrial growth of the 1940s and 1950s brought a growing awareness of human activity's impacts on state waters. In response, more communities built sewage collection and treatment facilities. Some municipalities such as the City of Cranston and the neighboring Town of West Warwick constructed state-of-the-art secondary treatment systems, both in 1942, for cutting-edge levels of pollution reduction.

Not all communities, however, were quick to embrace such modern and more expensive treatment methods. As late as 1955 and 1957, respectively, the City of Newport and the Town of Westerly, both iconic seaside communities, built primary treatment facilities—although in fairness, such systems were often replacing more rudimentary ones.

Removing sludge from beds at a sewage disposal site, circa 1900

Statewide, as advances in collection and treatment technologies called for more savvy workers, leaders within Rhode Island's wastewater operator profession formed the Narragansett Water Pollution Control Association (recently renamed the Rhode Island Clean Water Association) in 1952. That organization's mission was and still is to support water pollution control by advocating for frontline wastewater treatment operations and maintenance workers.

Even with growing awareness of the importance of water pollution control infrastructure and the investments made to build needed infrastructure, the operation and maintenance of those systems was not always adequately funded or prioritized. A 1960 summary of wastewater treatment systems in Rhode Island[4] cited poor sludge handling and disinfection issues at the Bristol treatment facility. The Newport facility was cited for a "lapse in the application of chlorine as a disinfectant." The cause, according to the report, was "a lack of funds." The West Warwick treatment facility lacked "adequate sludge disposal facilities," a deficiency that "seriously interferes, at times, with the proper operation of the sewage treatment works." The report called for steps to be taken "without delay" to address the issue. The coastal communities of South Kingstown and Narragansett also had significant pollution impacts in local waters, but no definitive plans for addressing them.

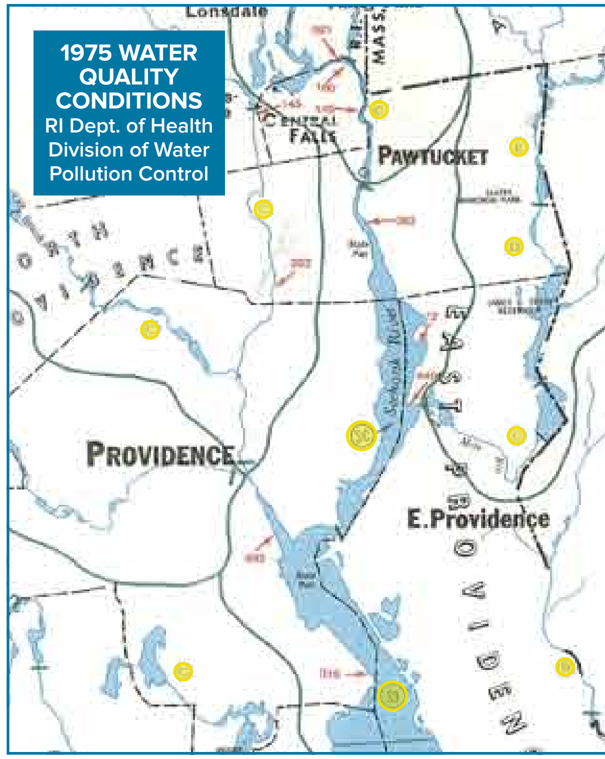
Throughout this post-war period, the growing field of water quality science provided systematic evidence for the need to plan for, construct, and operate wastewater infrastructure and other clean water initiatives. Such efforts culminated in Rhode Island with the 1967 issuance of water quality standards, or goals, which were meant to align with the 1964 Federal Water Pollution Control Act.

Transition to modern operations at the now closed T. F. Greene Airport wastewater treatment facility, circa 1970

Yet, while Rhode Island officials aligned state efforts with that federal law, mounting public pressure called for even better protection and preservation of the nation's waters. Congress agreed, and with strong bipartisan support, in October 1972 it passed a bold, transformative re-issuance of the Federal Water Pollution Control Act, which quickly became known as the CWA.

EMERGENCE OF THE CLEAN WATER ACT

With its high bar of fishable–swimmable waters, its tools, and its federal authority, the CWA put Rhode Island officials, environmental advocates, and engaged citizens in a better position to build on prior successes.



1975 WATER QUALITY CONDITIONS
RI Dept. of Health Division of Water Pollution Control

CLASSIFYING POLLUTION

Over time, classifications have helped tell the story of the effectiveness of the Clean Water Act. A 1975 map of the "present water quality condition" of state waters includes five classes of waters each for fresh and sea waters. The classes range from Class A (or SA) for the best waters to Class E (or SE) for the worst—for "nuisance" waters "unsuitable for most uses."

In the 1970s, with the E/SE classification in use, it was implied that the quality of some waters was so poor that it was not worth bringing them to higher, cleaner, standards—that they were not worth saving. A perception lingered that some water bodies were a mere means to an end, and that end often conveyed human and industrial wastes to successively larger bodies of water, which, it was expected, would do the work of water pollution treatment mostly by dilution. In 1937, for instance, the Commonwealth of Massachusetts State Planning Board declared the Blackstone River an "industrial river,"[5] which meant that industrial uses superseded cleanup, a sentiment echoed 40 years later—just after the passage of the CWA—by cautious Rhode Island officials who could not foresee "where this river will meet B conditions." By 1997, however, the E/SE classifications were no longer in use. Today, only the highest— A/SA and B/SB—are used.

One of the first impacts in Rhode Island was the act's call for high water quality standards, which came with three components—water quality criteria, designated uses (seen as water quality goals or classifications in each water), and antidegradation, a provision protecting water quality already achieved. While water quality criteria today are goals—and thus are the designated uses (i.e., fishable, swimmable) that state and local communities must work to achieve as well—prior to the late 1970s they reflected water quality conditions that were adjusted each time the standards were reviewed and revised. Consequently, much of the 1970s and 1980s saw tensions among federal, state, local, and citizen expectations surrounding the recording of current conditions and stating goals for future ones.

After EPA's 1977 requirement that national waters be upgraded to a swimmable–fishable goal wherever attainable, Rhode Island officials resisted. For instance, they argued that areas downstream of wastewater treatment facility discharges must be held to less stringent expectations, especially as communities sought justification to build better, more expensive treatment systems. State officials aimed to maintain a classification that would preclude the fishable–swimmable goal when on-the-ground realities prevented its swift attainment in all state waters—especially those, like the Blackstone River, with a long history of industrial use. In one instance, state officials rejected a request from a member of the public to upgrade the Blackstone River to Class B, which would allow swimming. In their response, state officials noted with resignation that they "cannot foresee where this river will meet B conditions."

According to RIDEM's Mr. Liberti, the focus on standards and classifications, rather than public benefits, may have occasionally backfired.

"Sometimes we focused on just meeting standards," Mr. Liberti said, "but then opposition would criticize [clean water project proposals] as just more bureaucracy to meet seemingly arbitrary standards. Instead, we should have focused on public use of water or on aquatic life—on people rather than what sounded like a bureaucratic focus." He added that "with a focus on standards, it sometimes didn't seem like we were making progress because of just one parameter, even if most other parameters and the water body itself had improved."

FULL IMPLEMENTATION OF CLEAN WATER ACT

Through the Department of Health and later in the then newly formed RIDEM, the state expanded its environmental protection capacity, and it moved quickly, if sometimes pragmatically, to spearhead the implementation of the CWA. In 1977, the state adopted the act's surface-water quality classification system and associated standards. In 1978, a study by the Urban Institute rated the state's legislation that protected freshwater bodies as the most stringent and comprehensive in the United States. The licensing of wastewater operators also took place in 1978. Sampling of wastewater effluent for priority pollutants came later—and with that sampling came one of Rhode Island's first big water quality wins: reducing toxins at the source.


1


2


3

1. East Greenwich Sewage Treatment Plant (1930)
2. Woonsocket Sewage Treatment Plant (1931)
3. Providence Wastewater Treatment Facility undergoing major upgrades under the new management of the Narragansett Bay Commission (1984)

With the priority pollutant sampling data, "we were out in front to have the data needed to reduce toxins, especially via pretreatment," Mr. Liberti said. In 1983, Rhode Island could implement industrial pretreatment requirements with that data; this led to dramatic reductions in metals and other pollutants discharged by industries into public wastewater systems—a reduction that benefited treatment plants as well as receiving waters.

BATTLES PERSISTING AND COMMUNITY RESPONSES

Save the Bay, Rhode Island's leading clean water advocacy group, developed out of a movement that predated the CWA. Having spared Narragansett Bay from proposed oil refineries in the mid-1950s and again in 1970, two citizen groups responsible for those victories joined forces and founded Save the Bay in 1970. With the issuance of the CWA, the group swiftly put it to use.

Topher Hamblett, Save the Bay's longtime director of advocacy, cited one of the most valuable components of the CWA: "It gives United States citizens the right to sue those not complying with the rules laid out in the CWA, Citizens also have the right to bring suit in federal court against the EPA for failure to perform 'any act or duty under this act which is not discretionary.'"

With such tools, Save the Bay became early champions of several major clean water initiatives. The most significant may have been the condition of Providence's municipal wastewater treatment facility—the state's largest. Once a state-of-the-art showcase of modern wastewater collection and treatment, through the continued lack of funding and support the Providence system became one that provided no treatment at all. With the help of Save the Bay, the state passed an $87 million clean water bond, part of which funded the facility's repair and upgrade. Eventually, the state shifted the ownership of the city's wastewater treatment plant and major collection components to the Narragansett Bay Commission (NBC), an independent public utility established by Governor J. Joseph Garrahy to examine how to improve wastewater treatment in greater Providence. Citing the CWA's legal recourse to private citizens, Mr. Hamblett noted that "this bedrock accountability provision of the act is what led to the creation of the NBC and its success."

Reflecting on the decades of work to improve wastewater infrastructure in metro Providence, longtime NBC Chairman Vincent Mesolella said that his goal was nothing less than that "the next generation of Rhode Islanders will never know a polluted bay, [that] they will only know clean and healthy waters."

As a newly elected member of the Rhode Island House of Representatives in 1979, Mr. Mesolella was assigned to serve as NBC commissioner. "At that time," Mr. Mesolella said, "the Providence sewage treatment plant was literally held together with chicken wire and duct tape. City workers endured unsanitary conditions without proper equipment. Approximately 60 MG (227 ML) of sewage traveled though the plant without any treatment—there were trees growing in the primary clarifiers!"

He added that with EPA's declaration in the late 1970s that the facility was the second worst municipal pollution problem in New England, "it was clear what we had to do."

After the 1982 state seizure of the wastewater system, NBC spent close to a decade redesigning and rebuilding the Providence sewage treatment plant and, later, rebranded it the Field's Point Wastewater Treatment Facility. "By 1995," Mr. Mesolella added, "Field's Point was named best in the country by EPA."

In 1992, after a Save the Bay lawsuit over plant performance, Rhode Island transferred the ownership, operations, and maintenance of the state's second largest treatment facility—the state-run Blackstone Valley District Commission facility in East Providence—also to NBC. Rechristened under NBC ownership, today the significantly upgraded Bucklin Point Wastewater Treatment Facility is largely responsible for water quality improvements in the Seekonk River. In tandem, NBC's oversight, operations, and maintenance of both the Field's and Bucklin Point treatment facilities and corresponding sewer systems protect the many rivers that flow through the metro Providence area, as well as upper Narragansett Bay itself, in award-winning fashion.[6]

LITTLE RHODY

Many of Rhode Island's clean water successes have resulted thanks in large part to a unique reality within the smallest state in the union—a web of silo-breaking, long-standing personal and professional relationships among men and women who may have worked at RIDEM but who now work as environmental advocates, engineering consultants, or within cities and towns; or who interned as environmental advocates and later became high-ranking environmental regulators; or who are employed as advocates or regulators but are neighbors, friends, or relations with local officials, or vice versa.

The 1980s saw another community needing an intervention by federal and state authorities and groups such as Save the Bay. Newport, at the southern end of Narragansett Bay, had long argued that the cost to upgrade its primary treatment facility, originally built using Imhoff cone technology, to a modern secondary facility would be excessive and unnecessary. City officials went so far as to seek a waiver from the CWA. Instead, however, city residents, statewide environmental advocates, and state officials took action to push Newport into the modern era of wastewater collection and treatment.

Threats of a sewer tie-in moratorium and a 1984 public display by Save the Bay President Michael Keating of dark, polluted waters taken from Newport Harbor added mounting pressure as state and federal officials built their own cases. In 1985, RIDEM denied the City's request for a waiver from secondary treatment and in the years to follow Newport did build its secondary treatment facility—although the plant struggled due to construction and long-term maintenance issues.

Today, after a similar citizen-led lawsuit and years of planning and hard work by a new generation of city engineers and contractors, the recent upgrades to the Newport Water Pollution Control Facility, in addition to efforts to minimize combined sewer overflows (CSOs), have made that wastewater utility one of the best run in the state.

Recalling the legal actions and street theater that led to Newport's secondary upgrade, Sue Kiernan, a long-time member of RIDEM's senior staff, said that "the 1980s was definitely a rabble-rousing time." Ms. Kiernan worked for Save the Bay at that time and participated in much of the advocacy that led to cleaner water today. Her role in the Office of Water Resources remains heavily involved in administering the CWA, but she says, "there was a lot going on in the early years, and at the time we may not have noticed it, or how major the projects were. But working together, we all definitely laid the groundwork of what was to come."

Among what was to come were three major victories of the late 1990s and early 2000s: meeting the strict new limits of water quality-based discharge permits; the planning, design, and monumental construction projects needed to minimize CSOs in the two urban centers for which combined sewers were built—Providence and Newport; and the question of how to tackle sewage discharges from Rhode Island's iconic boating community.

"Narragansett Bay's transformation from an open sewer to the cleaner, healthier bay of today is no accident," said Save the Bay's Mr. Hamblett. "It is an achievement born of direct action, over decades, by dedicated people—within and outside of government—demanding action for clean water. It is also an achievement built upon the foundation of the landmark federal law provided by the CWA."

GROWING SUPPORT FOR NUTRIENT REDUCTION

A major source of harmful nutrient loadings into Narragansett Bay was the pollution from contributors on the Pawtuxet River, with its tributaries and main branch spanning much of central Rhode Island, flowing west-to-east into upper Narragansett Bay.

RIDEM's Mr. Liberti recalled the early efforts to control nutrient loadings from that river's three municipal wastewater treatment facilities—West Warwick, Warwick, and Cranston. "In the beginning, the three communities hired experts to say [that] our science was bad, that the communities shouldn't be forced to spend the money needed for nutrient removal upgrades."

The communities went so far as to call for the reclassification of the Pawtuxet River to preclude strict nutrient discharge limits.

Mr. Liberti recalled that there was a "fair amount of residents on both sides of the issue." He recalled the first, sizeable public meetings on the topic as "an interesting process to have gone through." Over time, he said, citizen advocates working alongside professional ones helped the state achieve its goal.

In November 2004, Warwick completed upgrades to meet seasonal limits in the warmer months for ammonia (2 mg/l), total nitrogen (8 mg/l), and phosphorus (1 mg/l). West Warwick and Cranston, required to meet the same limits, completed their upgrades in July 2005 and January 2006, respectively. RIDEM later required the three communities to meet a phosphorous limit of 0.1 mg/L, which led to new processes installed at these facilities in 2016.

In addition to expanding its regulatory authority and issuing such protective discharge limits, RIDEM also stressed operator training and support. Leveraging grants and dwindling federal funding, RIDEM brought in regional and national nutrient removal experts in the 1990s and early 2000s to train treatment facility staff, who were eager to do their part to usher in a new era of clean water technologies and processes.

Referring to the CWA as "the driver for historic reductions of nitrogen and phosphorus from the wastewater treatment plants of the upper (Narragansett) Bay and Pawtuxet River," Save the Bay's Mr. Hamblett added that such reductions "are all the more important because climate change is warming the bay and river waters and causing excessive algae growth and loss of oxygen."

Throughout his career, Mr. Liberti helped lead the state's efforts to control nutrients from wastewater discharges. Today, with a satisfaction shared by many, he recounted that once there was no measurable amount of dissolved oxygen in the Pawtuxet as it flowed into upper Narragansett Bay. "Today, there is," he said, noting that in 2008, RIDEM determined that oxygen was sufficient to support aquatic use, removing oxygen deficiency as an impairment to the Pawtuxet River. The credit, he added, largely goes to the upgrades and operations of the West Warwick, Warwick, and Cranston treatment facilities—and the "team effort" among many sectors that made it all possible.

Left to right: Steve Engborg and David Borkman of RIDEM's shellfishing monitoring program join then RIDEM Water Resources Administrator Angelo Liberti in May 2021 on the first day of shellfishing in the lower Providence River—an area that had never been open to shellfishing in the 70 years that records have been kept. State officials credit this achievement in large part to the construction and operation of the NBC's wastewater treatment facilities and CSO abatement projects, as well as nutrient removal upgrades at wastewater treatment facilities in the watersheds of the Blackstone and Pawtuxet rivers.

COMBINING FORCES OVER CSOs

A similar community-wide effort would be needed for the century-old issue of CSOs into rivers throughout metro Providence and Newport Harbor. As in many urban centers, the decision in the 19th and early 20th centuries to combine stormwater and sanitary wastes had since created a web of complex, interconnected pollution sources. Addressing them required massive cooperation among the public, private, and non-governmental organization sectors, including engineers, water quality scientists, lawyers, policy makers, communications experts and journalists, environmental advocates and advocates for underserved communities, and the citizenry.

Such cooperation had been the cornerstone of previous clean water wins. With CSOs, however, the number of stakeholders was much larger both in Newport and in the NBC service area. While the inevitable cost-versus-benefit discussions dominated both the Newport and NBC area conversations, publicly debating the pros and cons of various approaches—as well as the silo-breaking conversations outside formal meetings among neighbors, friends, and colleagues—allowed a wider acceptance of the resulting high-stakes decisions.

After years of meetings and public workshops, legal actions, and engineering studies, both Newport and NBC now own and operate sophisticated systems to control CSOs. In NBC's case, over 40 stakeholders were part of the decision to build a series of bedrock tunnels for offline storage. Today, with two-thirds of its CSO tunnel systems built and operating since completion of the first phase in 2008, approximately 1.1 billion gallons (4.2 billion liters) annually of combined stormwater and wastewater have been stored for subsequent treatment at the Field's Point Wastewater Treatment Facility rather than discharged into state waters.[7] Water quality scientists today credit the tunnels and the improved operations at the Field's and Bucklin Point treatment facilities as drivers in historic improvements in clean water within urban rivers and in upper Narragansett Bay.

FIRST IN THE NATION—NO-DISCHARGE ZONES

Pollutant loadings into state waters come from a variety of sources—some large, some small, some easier than others to determine and resolve. In Narragansett Bay and other coastal waters in Rhode Island, one such source is actually thousands of sources: commercial and recreational boats and other maritime vessels.

The CWA made it illegal to discharge untreated boat sewage into the waters of the United States. Providing an alternative for boaters would require much effort, but as Rhode Island demonstrated, it would not be impossible.

In 1998, Rhode Island became the first state to designate all its coastal waters as a "no-discharge area."[8] Leading the effort was Joseph Migliore, a now-retired supervisor at RIDEM's Office of Water Resources. In recounting the early days in making the no-discharge designation possible—as well as the effort in subsequent years that contributed to this historic achievement—Mr. Migliore especially remembered what was said as he was assigned the task by a senior RIDEM staff member. "He told me flat out that it can't be done," Mr. Migliore said, "probably because he knew hearing that would make me want to get it done all the more."

The first meeting with boaters about a no-discharge requirement was at the Rhode Island Yacht Club with the Rhode Island Marine Trades Association. "I have to say, I got beat up pretty bad," Mr. Migliore recalled. At that first meeting, after he listened to the impassioned concerns of his fellow Rhode Islanders, he said to them, "Look, I just came to talk about the concept, but I do know if we want to help protect [Narragansett Bay], we need to work together."

An avid boater since his youth, Mr. Migliore was known throughout the Rhode Island boating community. His prior relationships and first-hand knowledge of commercial and recreational boating allowed him to navigate that meeting (and later ones). In fact, the next morning he received several phone calls from those who had been at the meeting. They not only apologized for the treatment he had received but also offered support. In time, he began to help other boaters see their role in protecting the waters they cared so deeply about.

"In the end," Migliore said, "Narragansett Bay was the first marine no-discharge zone in the country not because of any one group, but because it was a partnership—and because boaters care about clean water. My key to success with this was that I grew up around boats, so I used that to my advantage. I was able to honestly tell other boaters that I was a boater myself, so I wasn't opposed to boating!"

The state made its historic no-discharge process possible—both in letter and in practice—because Mr. Migliore could focus on shared interests and common ground rather than legalistic, top-down strategies. He knew that solving a problem as unwieldy as stopping the sewage discharge from thousands of boats would not only take a lot of work by state and local officials, but more importantly would depend on the buy-in and ongoing support from the community of boaters.

SUCCESSES—AND NEXT STEPS

In 2001, just over two decades after cautious Rhode Island officials denied a citizen request to reclassify the Blackstone River, Woonsocket upgraded its wastewater treatment facility to meet a discharge permit limiting ammonia, total nitrogen, and phosphorus. In 2016, the facility then received stricter phosphorus and nitrogen limits, prompting a major upgrade. During this time, the Upper Blackstone River treatment facility in Massachusetts received a similar permit. Resulting reductions in nutrient loadings from those two facilities and several smaller ones greatly reduced in-stream levels of ammonia, phosphorous, and nitrogen. In time, the Blackstone's dissolved oxygen levels rose and the once "nuisance" industrial river was well on its way to returning to a pristine condition.

Further south, water quality in the lower Providence River had improved in 2021 to levels unseen in the seven decades that records were kept. State bacteria monitoring data even supported the conditional opening of new shellfish beds in areas historically closed permanently, giving way to a sun-drenched first day of quahogging in waters once considered unsavable. In announcing this major clean water win, state officials credited work from previous decades: improvements at NBC's two treatment plants and construction and operation of the first two phases of their CSO tunnels, as well as nutrient reductions from wastewater treatment system upgrades in the Pawtuxet River and Blackstone River watersheds.

The sophisticated wastewater infrastructure that made it possible to attain so many CWA goals underscored the value of a well-trained and supported wastewater operations and maintenance profession. With federal operator training funding having dried up in the early 2000s and a generation of wastewater managers retiring—just as RIDEM was issuing strict nutrient limits and communities were designing and constructing the systems to meet those limits—RIDEM took a new approach to support the wastewater profession. It founded a first-ever, no-cost, year-long program in 2007 to help nurture the next generation of wastewater treatment leaders. Since then, Rhode Island has offered its Wastewater Operator Leadership Boot Camp seven times and has graduated around 80 operations, maintenance, and laboratory professionals from across the state. Key to the success is the strong support of the profession itself, especially the Rhode Island Clean Water Association. Subject matter experts from communities, the private sector, NBC, and organizations such as NEIWPCC often volunteered their time and offered free training facilities.

Today, 13 of the state's 19 treatment facilities have plant superintendents or assistant superintendents who have graduated from the program—one dedicated to supporting the successes and investments resulting from the CWA by supporting the frontline wastewater operation staff.

A bicyclist enjoys the view of the Providence River along the East Bay Bike Path. In the background are the wind turbines of the Narragansett Bay Commission's Field's Point WWTF.

CLEAN WATER ACT WORK CONTINUES

Stories of improved water quality and the improvements in recreational uses, economic opportunities, and quality of life abound among Rhode Islanders. The large and small victories behind those stories—the innumerable meetings, phone calls, letters and emails, public workshops and engineering analyses, trainings, legal actions, and moments of political theater, as well as the work of many wastewater staffers and the elected officials—all have a common genetic code, a double helix connecting the tools offered by the CWA with a community that came together to protect the state waters.

While challenges remain, the blueprint for solving them has been handed to us in the stories of our predecessors. Addressing issues such as resiliency in an age of climate change, non-point sources of water pollution, and emerging pollutants is a new generation of leaders in the public, private, academic, and advocacy sectors who are already laying the groundwork for the victories that will be celebrated 50 years hence.

"The CWA is a living, breathing document," said Mr. Hamblett. "Its importance has not waned with the passage of time. Rising seas and greater storm intensity are threatening wastewater and stormwater management systems—the first lines of defense of Narragansett Bay. People love Narragansett Bay, and all state waters—and depend on them—and we will always need the CWA, and each other, to protect them."

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REFERENCES

1. Aronson, S.M. (1990, May), Cholera comes to Providence, 1832. RI Medical Journal 73, pp. 178-9.
2. Fierra, David, Arleen O'Donnell, and Edward S. Szymanski (1991). Blackstone River Initiative, Phase 1: Dry Weather Assessment Interim Report of Data 1991. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9400777B.txt Accessed May 26, 2022.
3. Prepared by The RI Department of Environmental Management (May, 2021). History of Rhode Island Wastewater Treatment Facility Construction & Upgrades, http://www.dem.ri.gov/programs/benviron/water/permits/wtf/pdfs/conuphis.pdf Accessed May 26, 2022. Note that all dates and information regarding wastewater infrastructure construction in Rhode Island use this source.
4. State of Rhode Island, Division of Sanitary Engineering. Summary of Status of Sewage Treatment in Rhode Island Cities and Towns, Providence, Rhode Island, July 25, 1960.
5. Water Quality History of the Blackstone River, RIDEM staff presentation.
6. Since 1995, the Narragansett Bay Commission has been recognized some 200 times for the management, operations, and maintenance of the both the Field's and Bucklin Point Wastewater Treatment Facilities and NBC-owned collection systems. Source: The Narragansett Bay Commission.
7. Narragansett Bay Commission. CSO History. https://www.narrabay.com/programs-and-initiatives/combined-sewer-overflow/ Accessed May 26, 2022.
8. Rhode Island Department of Environmental Management. DON'T DUMP IT, PUMP IT! Managing Boat Waste in Rhode Island's No Discharge Area. http://www.dem.ri.gov/programs/benviron/water/shellfish/pump/pdfs/nodschrg.pdf Accessed May 26, 2022.

The Early Bacteria Alert Tool for the Merrimack River recreational hub

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ABSTRACT | Communities throughout the Merrimack River watershed have invested hundreds of millions of dollars to help restore the river so that it supports healthy ecosystems, drinking water sources, recreational opportunities, and dozens of other uses. Despite major improvements, combined sewer overflows (CSOs) following heavy rainstorms along with urban stormwater runoff can bring undesirable levels of bacteria into the river. Cities that discharge combined sewage will spend over $1 billion collectively in reducing the overflows through their long-term control plans, and some are already showing up to 80 percent reduction in annual volume of discharge. These same cities are also producing public notifications whenever a discharge occurs, to raise awareness of health and safety issues associated with water contact. What has been missing is a way to confidently predict how far downstream, and for how long, the impacts of upstream CSOs may persist. With funding from the Merrimack River District Commission, a recently developed tool addresses this need; this tool is posted online and indicates the level of risk from bacteria at the mouth of the river following an upstream CSO event. This paper discusses the collaborative development, testing, and deployment of the tool, as well as opportunities for its growth.

KEYWORDS | Public health, CSOs, water quality, Clean Water Act, modeling, innovation

For over 50 years, EPA has regulated discharges from point sources, including wastewater pollution, to improve water quality in waterways through the Clean Water Act (CWA). Regulations have required utilities to create long-term control plans (LTCPs) to minimize discharges of untreated sewage. Many of these LTCPs include a decades-long schedule for separating sewers that transport combined stormwater and wastewater flows in one-pipe networks. After billions of dollars in investment to separate these systems across New England and across the country, many combined sewer outfalls are now closed, greatly reducing the frequency and volume of untreated discharges into local waterways. Many partially separated systems remain, however, where full separation is infeasible or cost prohibitive. Five of these partially separated systems in New England have combined sewer outfalls along the Merrimack River (Figure 1). High levels of bacteria and nutrients, such as phosphorus, are discharged to the Merrimack River from combined sewer overflows (CSOs) and stormwater runoff, and harmful algae blooms are observed on multiple days following storm events, particularly in the summer (EPA, 2021).

Along the main stem of the Merrimack River, five midsized cities have implemented LTCPs for decades to reduce the volume and frequency of CSOs. In 2017, for example, the City of Lowell estimated that its annual volume of CSO discharge had decreased by more than 80 percent since 2005, a striking example of effective investment in river health. Other communities have reported similar progress. Despite this effort and investment, CSOs still regularly occur.

Massachusetts requires the tracking, reporting, and communicating of CSOs and as of 2021 utilities must notify the public of discharge events within two hours of discovery (Massachusetts Department of Environmental Protection, 2022). These electronic alerts indicate a possibility of public risk, but do not translate risk into magnitude, duration, or location.

Understanding the public health impacts of CSO discharges near the primary recreational reach of the river—at the mouth in Newburyport, Massachusetts—is missing from all these advancements in CSO control and awareness. Here, approximately 50 mi (80 km) or more downstream from many of the CSO communities, elevated bacteria concentrations may occur three, four, or even five days after an initial discharge, and there is no system to alert swimmers and boaters of the potential water quality risks during the days following a CSO.

In 2019, the Merrimack River District Commission was created by the Massachusetts Legislature. The commission allocated funding for an Early Bacteria Alert Tool for CSO-impact notification in the Merrimack River's recreational hub in Newburyport, which is located several miles downstream from the CSO discharges. The Early Bacteria Alert Tool uses data from CSO public notifications and accounts for travel time, dispersion, and bacterial decay following CSO events. Thus, in the days following discharge(s), individuals can check on water quality risks in Newbury and Newburyport.

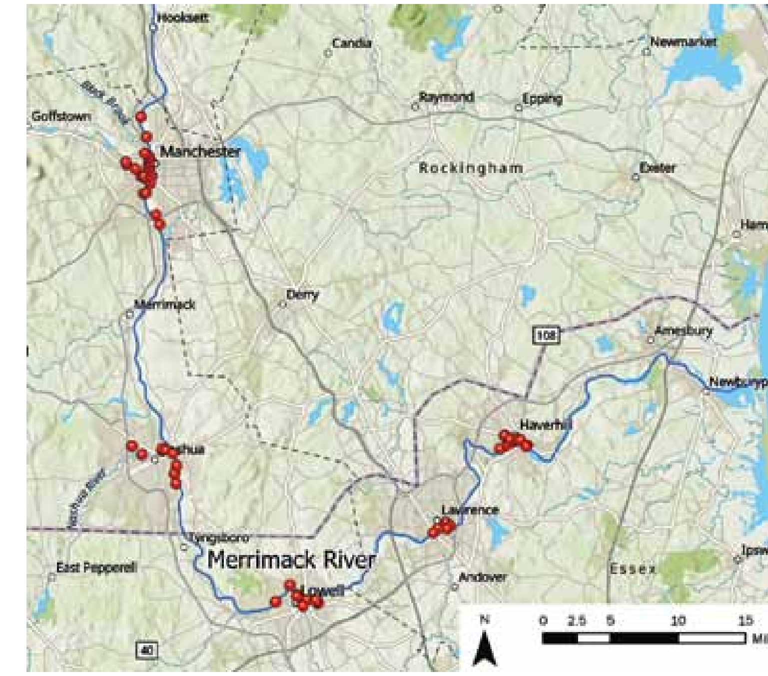

Figure 1. Combined sewer overflow locations along the Merrimack River

EARLY BACTERIA ALERT TOOL DEVELOPMENT

The Early Bacteria Alert Tool is a real-time bacterium loading model that takes CSO discharge information from upstream and predicts bacteria concentrations at downstream locations. This prediction couples with a notification system to alert Newbury and Newburyport residents of CSO-related swimming and boating hazards.

To factor in the amount and variety of variables influencing bacteria concentrations in the Merrimack River and the cumulative impacts from multiple CSO discharges, a science-based account of loading, travel time, decay, and dispersion was used to develop model predictions. Time-of-travel studies were used to model transport and dispersion of *E. coli* in the Merrimack River as a function of real time (U.S. DOI 1966 & USGS 2006). Historic CSO data were used for initial values in each of the five upstream cities (CDM Smith 2004). Historic CSO volumes were compared against rainfall accumulation, intensity, and CSO duration to develop and model correlations to in-river concentrations at the time of discharge.

The model was then applied to current conditions, where it pulled real-time rainfall data whenever a CSO alert was issued from an upstream community. The previously developed relationship was used to predict expected *E. coli* concentration at the CSO outflow point and then paired with a first-order bacteria decay model that leveraged river temperature and calculated time of travel to model downstream concentrations at West Newbury and Newburyport. Figure 2 shows the model flow.

EARLY BACTERIA ALERT TOOL CALIBRATION

The model was calibrated using data from two historic sampling efforts at outfalls along the Merrimack River (CDM Smith, 2017). Discrepancies between the modeled and sampled values were attributed to bacteria decay during the lag between the time of overflow and the time of the in-river

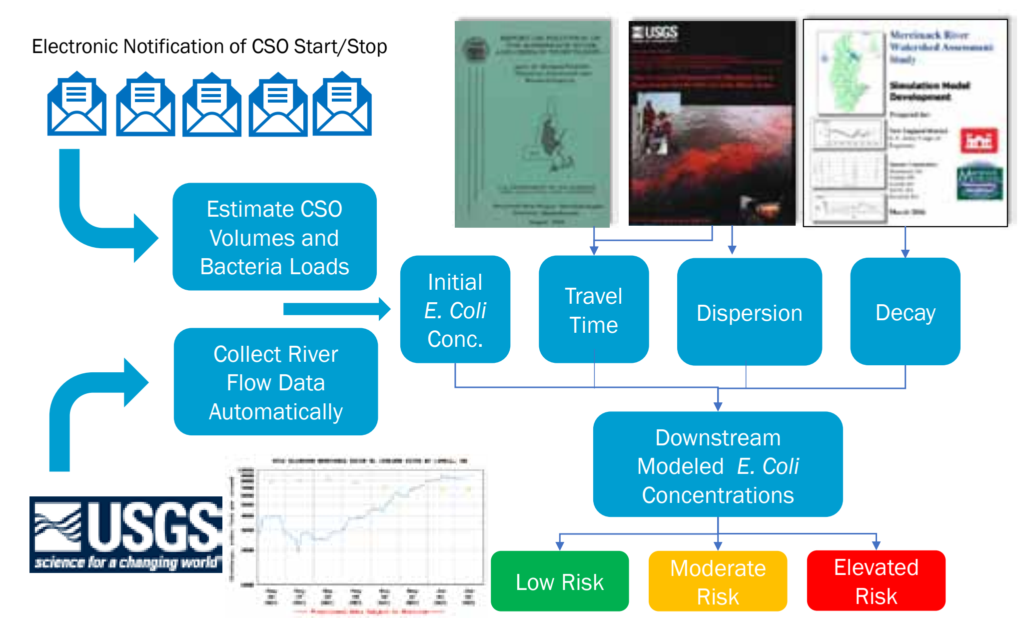

Figure 2. Early Bacteria Alert Tool inputs and outputs

sampling. By comparison, the model calculated bacteria concentrations at the exact time of overflow. Model calibration was accomplished for both events despite limited data (see Figure 3).

EARLY BACTERIA ALERT TOOL VALIDATION

To validate the model, bacteria concentrations collected from grab samples at two monitoring sites were compared to values predicted by the Early Bacteria Alert Tool during and after five storm events in 2020 and 2021. The validation period for each storm was three to five days from the start of the storm event, and each validation date included bacteria samples from West Newbury and/or Newburyport. Given the variability in the rate of bacteria decay and the contribution of bacteria from non-CSO sources (background concentrations), an exact match in concentrations was not anticipated; rather, the tool was expected to characterize the classification of risk into the elevated-, moderate-, or low-risk categories in alignment with analytical data. Elevated risk corresponds with predicted bacteria concentrations at either West Newbury or Newburyport above 300 colony-forming units per 100 mL of sample (CFU/100 mL), while medium risk corresponds with predicted values at either monitoring location between the state water quality standards, 126 CFU/100 mL and 300 CFU/100 mL, and low risk indicates that predicted values at both locations are under the state water quality standards.

As shown in Figure 4, the risk classification aligned with measured bacteria concentrations on 14 of 18 days for which sampling data was available, as indicated by the filled-in solid square inscribed within the larger hollow square. For two dates where classification did not align, measured bacteria levels were within the moderate-risk range for one or both monitoring sites, but the tool (solid square) characterized the risk as low. Measured bacteria concentrations in the moderate-risk range could be from background bacteria concentrations and stormwater runoff. For the two other dates, the tool was overly conservative, characterizing the risk as elevated when observed bacteria levels were in the low-risk range.

With accuracy during and after reported CSO events exceeding 75 percent, the validation results indicate that this tool can conservatively predict water quality risks associated with CSO events at varying river stages. Moreover, the model is sensitive to a wide range of observed bacteria concentrations, with many predicted bacteria concentrations within one order of magnitude of measured concentrations.

EARLY BACTERIA ALERT TOOL DEPLOYMENT

In 2021, the Early Bacteria Alert Tool went live. It is running in a cloud-based deployment and uses python scripting, SQL Server, and Power BI. The tool, shown in Figure 5, is embedded within public-facing websites, including the Merrimack Valley Planning Commission's, https://mvpc.org/cso-monitoring. At any given time, the tool displays one of three risk levels—low risk, moderate potential risk, or elevated potential risk based on estimated bacteria concentrations in West Newbury and Newburyport.

While the Early Bacteria Alert Tool characterizes public health risks following CSO events at two discrete downstream points, the tool's scope could be expanded to improve its applicability and use. Efforts are underway to increase the geographic reach of the tool to assist all Merrimack River watershed communities with regulatory requirements, providing a centralized location for reporting CSO events to the public and a resource for understanding bacteria risks.

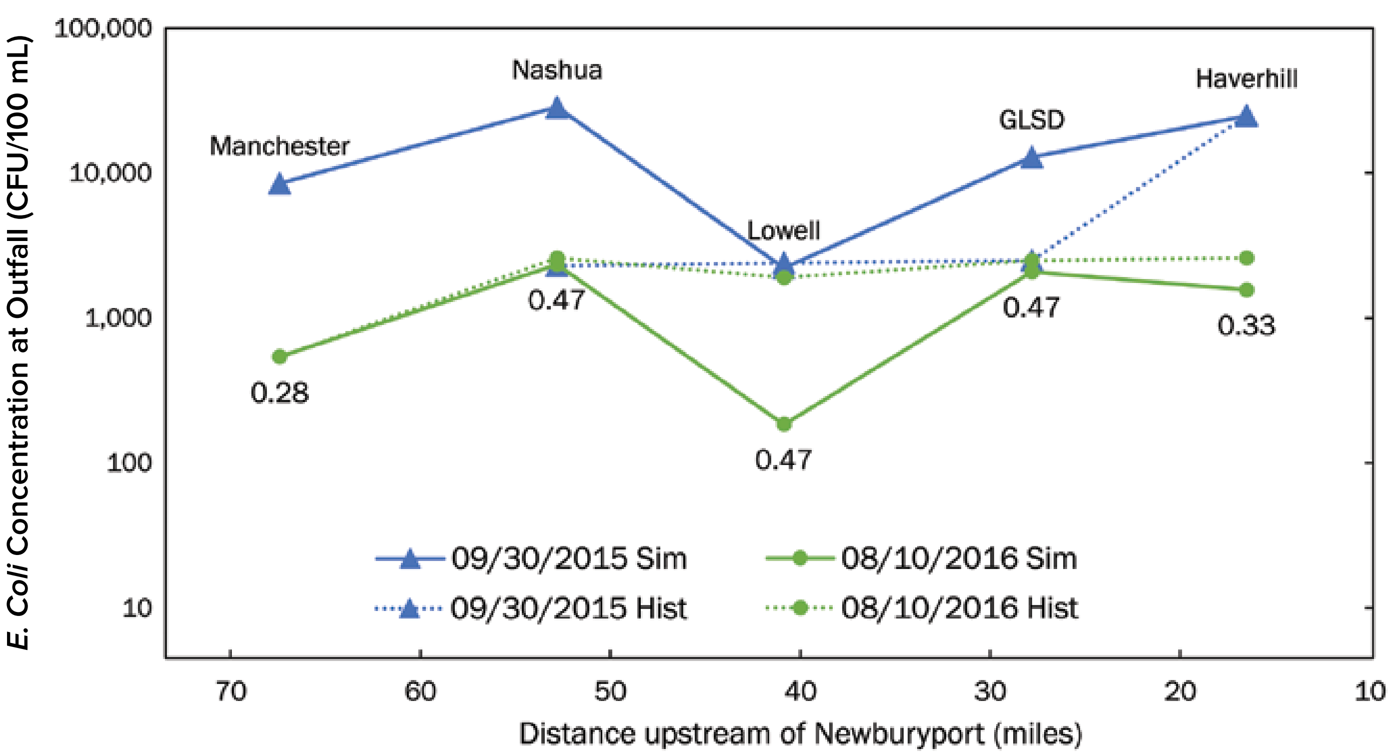

Figure 3. Calibrated simulated *E. coli* concentrations compared to historic *E. coli* concentrations for two events (CDM Smith, 2017), with decimals representing the fraction of peak concentration duration correction factors compared to CSO duration

Figure 5. Screenshot of the Early Bacteria Alert Tool

RELATED APPLICATIONS

Future plans include incorporating additional modeling techniques to improve the tool's prediction accuracy and to provide information about water quality risks at additional locations along the Merrimack River. These enhancements would improve the tool's trustworthiness and extend its usefulness to a larger population of potential users.

The existing tool also could be paired with other technologies to support additional applications. For example, research is ongoing into in situ water quality sensors for assessing background bacteria concentrations and those from stormwater runoff without CSOs. These data could validate the tool, whereas flow metering data from devices installed near outfalls could improve the quality of data in modeling calculations.

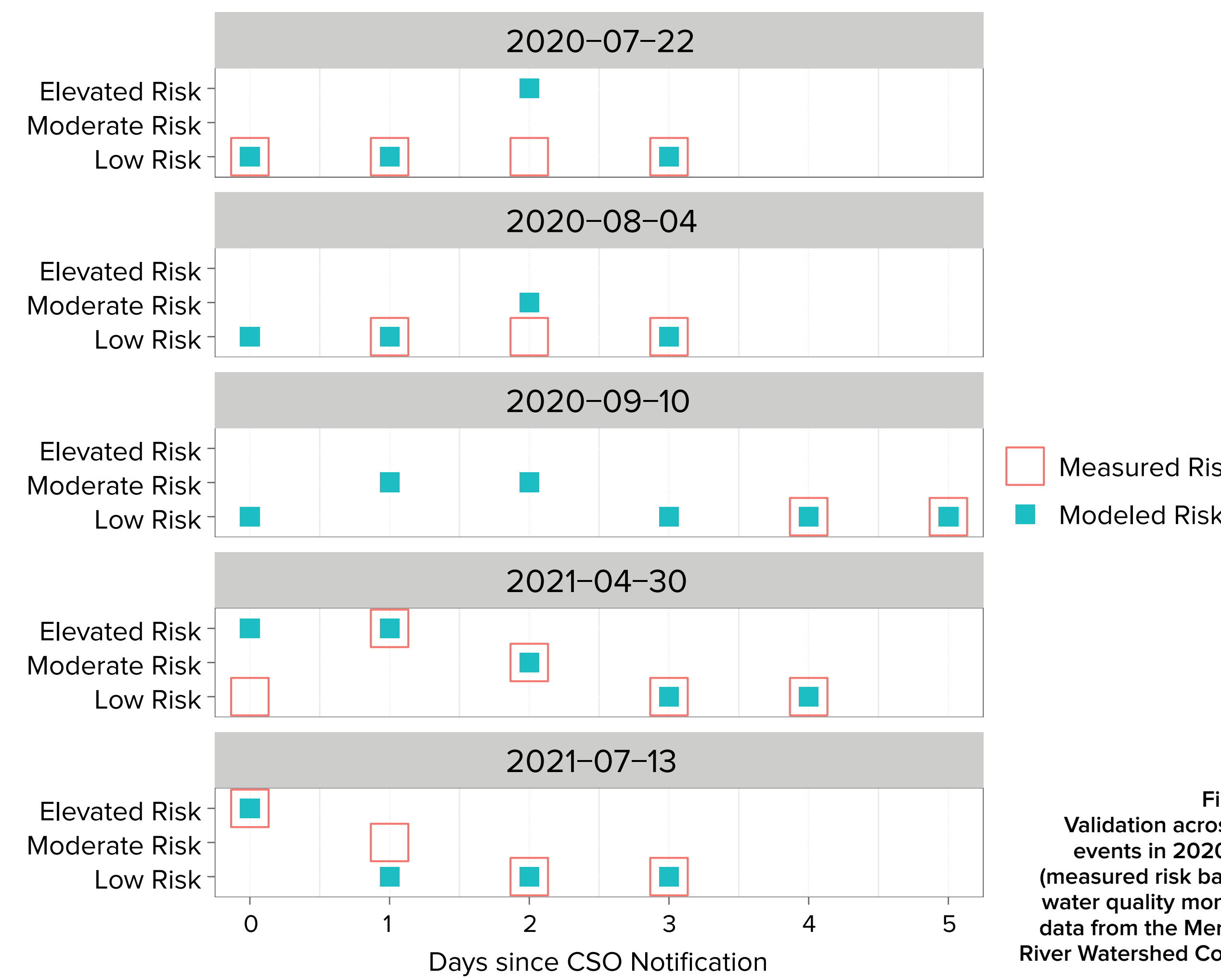

Figure 4. Validation across CSO events in 2020–2021 (measured risk based on water quality monitoring data from the Merrimack River Watershed Coalition)

Utilities across the country with combined sewers are exploring how data analytics can predict the timing, duration, and discharge volumes of wet weather CSO events that have not yet occurred. This tool, which uses real-time data, mechanistic models, and/or machine learning, could be paired with the Early Bacteria Alert Tool to forecast water quality risks in a river longer term before a CSO has occurred. These tools, when used in tandem, could support decision-making for utility operators as they mitigate excess flows through infrastructure management strategies such as advanced treatment or stormwater storage.

CONCLUSION

With the support of many partners, the Early Bacteria Alert Tool that accurately predicts the duration of downstream water quality impacts of CSOs along the Merrimack River has been deployed. This tool has broad applicability not just to one community in the Merrimack River watershed, but potentially to all communities in the watershed downstream of CSOs. Moreover, the approach may be extended to other watersheds that have tools for estimating bacteria levels at the point of discharge, but that now lack tools to predict the fate and transport of these bacteria downstream. Additional effort is needed to allow other communities to benefit from this tool, and collaboration with regional partners will be necessary to garner support for expanding its reach.

In testing during both high flow and low flow conditions (which affect the travel times in a river), the Early Bacteria Alert Tool predicts alert levels in West Newbury and Newburyport accurately or with conservatism in almost all cases. Additional sampling during CSO and non-CSO rain events would further improve confidence. The tool does not, however, capture the impacts of stormwater-induced bacteria loads, which may run off from urban areas with or without CSO discharge. Some instances of elevated bacteria levels in West Newbury and Newburyport may be significantly affected by stormwater runoff. Because the Early Bacteria Alert Tool estimates impacts only from CSO discharges, low risk levels predicted by the tool do not necessarily ensure a healthy recreational environment in the river.

Despite many studies of the Merrimack River watershed as a basin in its totality, the basin's management and regulation continue to occur town by town. The formation of the Merrimack River District Commission acknowledged that the basin must be managed regionally, and this tool is among the first to make basin-wide information available to the public in near real time. In fact, stakeholders from New Hampshire and Massachusetts identified holistic, basin-wide solutions as one of the six most important priorities for restoring and preserving the Merrimack River.

While the intended use of this Early Bacteria Alert Tool is to enhance public awareness about potential health risks in and around West Newbury and Newburyport due to upstream CSOs, it also aligns with recently passed legislation that requires communities to notify the public of CSO discharges earlier, and with more information than current regulations require. This tool is not intended to replace the reporting requirements, but to augment the intent to keep citizens aware of water quality risks when they occur—in this case, downstream of the CSO discharge locations and for days afterward.

It would be easy to expand the output reporting of this Early Bacteria Alert Tool to include other locations on the Merrimack River, particularly in the CSO communities and their neighbors. This would enhance the equity of information dissemination by including water quality predictions in disadvantaged communities along the river. It would also further the awareness that the Merrimack River basin is, and always has been, an interconnected system of cities, towns, and people who rely on the river for numerous beneficial uses.

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REFERENCES

- Brown and Caldwell to Merrimack Valley Planning Commission (2020). Integrated Decision Framework for the Merrimack River Basin.
- CDM Smith to U.S. Army Corps of Engineers (2017). Merrimack River Watershed Assessment Study: Phase III Appendix B: Data Plots.
- CDM Smith to U.S. Army Corps of Engineers (2004). Summary of Information on Pollutant Sources.
- Massachusetts Department of Environmental Protection (2022, January 21). Baker-Polito. Administration Announces New Regulations Requiring Public Notification of Sewage Discharges into Waterbodies https://www.mass.gov/news/baker-polito-administration-announces-new-regulations-requiring-public-notification-of-sewage-discharges-into-waterbodies Accessed Mar. 2022.
- Merrimack River Watershed Council, 2021 Water Quality Report https://merrimack.org/wp-content/uploads/2022/03/MRWC-WQ-Report-2021_Final_revised_for-upload.pdf Accessed Mar. 2022.
- Merrimack River Watershed Council, 2020 Year-End Report https://merrimack.org/wp-content/uploads/2021/03/MRWC-2020-Water-Quality-Monitoring-Report.pdf Accessed Mar. 2022.
- U.S. Department of the Interior, 1966. Report on Pollution of The Merrimack River and Certain Tributaries.
- United States. Environmental Protection Agency, Environmental Challenges for the Merrimack River https://www.epa.gov/merrimackriver/environmental-challenges-merrimack-river. Web. Accessed Mar. 2022.
- U.S. Geological Survey, 2006. Time of Travel and Dispersion in the Merrimack River in Massachusetts from the State Line to the Atlantic Ocean.

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NEBRA Highlights

Maine Bans Land Application and Distribution of Biosolids-based Products

On April 20, Governor Janet Mills signed LD 1911, "An Act To Prevent the Further Contamination of the Soils and Waters of the State with So-called Forever Chemicals," which bans the land application, sale, and distribution of biosolids-based soil amendments. The law will be effective in late July, 90 days from the end of the legislative session. The new law also establishes PFAS effluent testing requirements for water resource recovery facilities (WRRFs) but repeals the $10 per ton ($11 per tonne) handling fee on septage and sludge enacted in 2021.

The Maine Work Boots Alliance, a broad-based coalition including the Maine Farm Bureau, whose members are responsible for 95 percent of the food grown in Maine, joined in opposition to the ban

LD 1911 was amended significantly since originally introduced in early January. That early version would have prohibited the Maine Department of Environmental Protection (Maine DEP) from licensing the "land application or distribution of sludge or sludge-derived compost" unless the material met stringent ceiling levels for specific PFAS. The final version bans land application of "sludge" and the "sale and distribution of compost and other agricultural products and materials containing sludge and septage." In Maine's laws and regulations, biosolids—"treated sludge"—is now lumped together with "sludge." All wastewater solids generated in Maine will be going to landfill, and most likely some will go out of state due to high landfill costs and constraints on the end markets for biosolids regionally.

The new law prohibits Maine DEP from licensing any new septage land application sites and does not allow land application of septage for currently licensed sites if the nearby groundwater levels for PFAS exceed the state's interim drinking water standards set by the legislature in 2021: 20 parts per trillion for the sum of six PFAS (PFOA, PFOS, PFNA, PFDA, PFHxS, PFHpA). The law gives Maine DEP one year to come up with a plan to prohibit the land application of septage altogether.

The Maine Water Environment Association (MEWEA) opposed the ban. The Maine Work Boots Alliance, a broad-based coalition including the Maine Farm Bureau, whose members are responsible for 95 percent of the food grown in Maine, joined in opposition to the ban. The alliance was amenable to other options, including ceiling limits for PFAS in biosolids at levels that would likely have eliminated that option for 80 percent of wastewater solids currently generated in Maine.

NEBRA's executive director, Janine Burke-Wells, participated in a webinar on April 28, "Sludge: A Spreading Concern," along with NEBRA Reg-Leg Committee Chair Jeff McBurnie and NEBRA member Scott Firmin from the Portland Water District. With LD-1911 becoming law since the time the webinar was planned, the panel discussions focused instead on next steps, opportunities, and technology solutions. Ms. Burke-Wells mentioned the preliminary discussions NEBRA has had with NEIWPCC regarding regional solutions and specifically the potential for a "BioHub" of research and new biosolids technology solutions in Maine. That collaboration and those discussions will continue, even though it is unclear if these new technologies could be deployed in Maine.

NEBRA plans to work with its members in the other states in contacting local and state leaders about the unintended consequences and costs to their Maine counterparts.

Release of BEAM*2022 Behind Schedule

The 2022 version of the Biosolids Emissions Assessment Model (BEAM), a spreadsheet calculator of greenhouse gas emissions from various biosolids management practices, was not ready in April as originally planned. NEBRA has completed a scientific review of the old model, and several updates to emissions factors and calculations must be integrated into the new model. The website (biosolidsGHGs.org) is ready when the spreadsheet can be downloaded, which should be in July. To read more about the BEAM*2022, see the recent *Journal* article in the spring 2022 issue (on the NEWEA website).

North East Digestion Roundtable: Eat Lunch and Digest

Dr. Jeffrey McCutcheon, from the University of Connecticut, joined the North East Digestion Roundtable (NEDR) in January to discuss a research project funded by the U.S. Department of Energy to digitize, automate, and optimize anaerobic digestion operations, especially for co-digestion with food wastes. Using tiny sensors developed by the research team, the team hopes to better understand operational parameters and behaviors in real time at the Greater Lawrence Sanitary District.

On April 8, NEBRA hosted its 22nd quarterly NEDR, featuring Nick Elger and Tom Frankiewicz with EPA's Climate Change Division presenting on EPA's new biogas toolkit. The toolkit includes an anaerobic digestion screening tool and an organics economics tool to help project developers. EPA is promoting anaerobic digestion and other biogas projects worldwide as part of the Global Methane Initiative. The recordings, slide decks from both NEDRs, and a link to NEBRA's anaerobic digestion resources webpage are available at nebiosolids.org.

PFAS Conference Looks at "An Outsized Problem"

After almost two years of delay due to Covid-19, the North East Waste Management Officials' Association (NEWMOA) hosted a two-day conference on PFAS science research management and technology on April 5–6 in Marlborough, Massachusetts. Over 500 people attended from 26 states, including California, North Carolina, and Michigan, as well as British Columbia, Canada. The conference attracted a diverse crowd, including researchers, regulators, practitioners, and environmental advocates focused on solid waste disposal, drinking water, wastewater, residuals, air deposition, and other aspects related to PFAS.

Following a welcome by Terri Goldberg, NEWMOA's executive director, Michael Wimsatt of the New Hampshire Department of Environmental Services (NHDES) and current NEWMOA chair, spoke about PFAS as "an outsized problem."

Two sessions specific to biosolids, under the environmental behavior track, were well attended. The first session included Chris Evans from Maine DEP, Josh Burns with the Vermont Department of Environmental Conservation (VTDEC), and Anthony Drouin from NHDES. They presented data collection and research investigating PFAS in various media. Vermont's initial look at land application sites indicates higher PFAS concentrations than background, about 4 times higher at one site. The State of New Hampshire meanwhile is coordinating with the U.S. Geological Service on a soil study; the full report should be ready in October. Mr. Drouin mentioned that PFAS soil standards are likely coming at the end of 2023. Extensive PFAS investigations continue in all three states.

The second biosolids session, in the morning on the second day, was kicked off by Marco Propato of Stone Environmental. He spoke on the PFAS fate and transport modeling work being refined over the past few years. Andrew Carpenter of Northern Tilth spoke about the situation in Maine and the farmers he is working with who have been affected by PFAS contamination. Shelagh Connelly, from Resource Management, Inc., also spoke about the farm contamination issue and the impacts on her residuals recycling business. Finally, Scott Firmin spoke about the challenges water utilities face in managing biosolids in light of PFAS. He expressed concern about the land application bill that was pending in Maine and what would happen if there were a ban. He encouraged an adaptive management approach to allow a transition to other management methods.

Biosolids Movers and Shakers—Moving On

James Jutras, longtime water quality superintendent and NEBRA member from the Village of Essex Junction, Vermont, has retired. He will be missed by GMWEA and NEBRA, two organizations in which he was active. Mr. Jutras contributed greatly to NEBRA's Research Committee, including supporting the 2021 summer intern program. NEWEA honored him at its annual awards luncheon in late January with its Biosolids Management Award for his significant accomplishments in biosolids technology and management practices. On behalf of all NEBRA members, congratulations to Mr. Jutras and best wishes in your retirement!

Mickey Nowak, longtime clean water professional and executive director of the Massachusetts Water Environment Association (MAWEA), is warning about what he calls a "potential environmental and economic disaster visible on the horizon." He refers to the dwindling options for managing wastewater solids and septage in the Northeast. Mr. Nowak makes his case in recent Op-Ed pieces published in *VT Digger* ("Sewer plants running out of places to put biosolids" 4/6/2022), and a local Western Massachusetts paper, the *Greenfield Recorder* ("The growing problem of managing biosolids" 4/26/2022). Mr. Nowak plans to retire this year. MAWEA and NEBRA will miss his advocacy and tireless efforts. Thankfully, he is suggesting potential solutions for the next generation of advocates to advance.

GMWEA Facilitates Legislative Outreach on Water Utility Perspectives

The Green Mountain Water Environment Association (GMWEA) Government Affairs Committee is educating legislators and the public about PFAS. Several work groups have been busy this legislative session, including one on PFAS and emerging contaminants and one on residuals, co-chaired by NEBRA's Ms. Burke-Wells and Eamon Twohig from VTDEC. GMWEA has developed a one-pager on PFAS and videos that encourage members to share with elected officials.

Check out these short YouTube videos—*Sludge, Septage, and Biosolids Management in Vermont:*

Part 1: featuring Eamon Twohig, VTDEC
Part 2: featuring Chelsea Mandigo, Essex Junction
Part 3: featuring Chris Cox, Montpelier
youtube.com/channel/UC5l79XIzAF1TCepj6yc_IsQ

Talking to Farmers About PFAS Webinar

NEBRA hosted a webinar on March 4 to offer information members can use when talking to farmers about PFAS. The webinar featured several speakers with various perspectives on the topic, including a treatment facility operator (Nick Champagne/Kennebec Sanitary Treatment District), a farmer (Gene Barker/Casella), a regulator (Anthony Drouin/NHDES), and an advocate (Ned Beecher/NEBRA [retired]). Additional concerns and questions are anticipated about using biosolids for soil amendments, as it is a complex, sensitive subject. Check out the webinar on NEBRA's YouTube channel.

Earth Day Lunch & Learn on History of Biosolids Management

NEBRA's April 22 Lunch & Learn webinar was about the history of "sewage sludge" management and especially in the 50 years since the Clean Water Act of 1972. Subsequent amendments in 1977 and 1987 laid the groundwork for what would become the "Part 503" regulations. The original regulatory proposal in 1989 was widely challenged, so EPA withdrew it and went back to work on the science, eventually producing a set of regulations. Check out this webinar on YouTube to learn more about the history of biosolids management in the United States.

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

To view upcoming events, visit nebiosolids.org.

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

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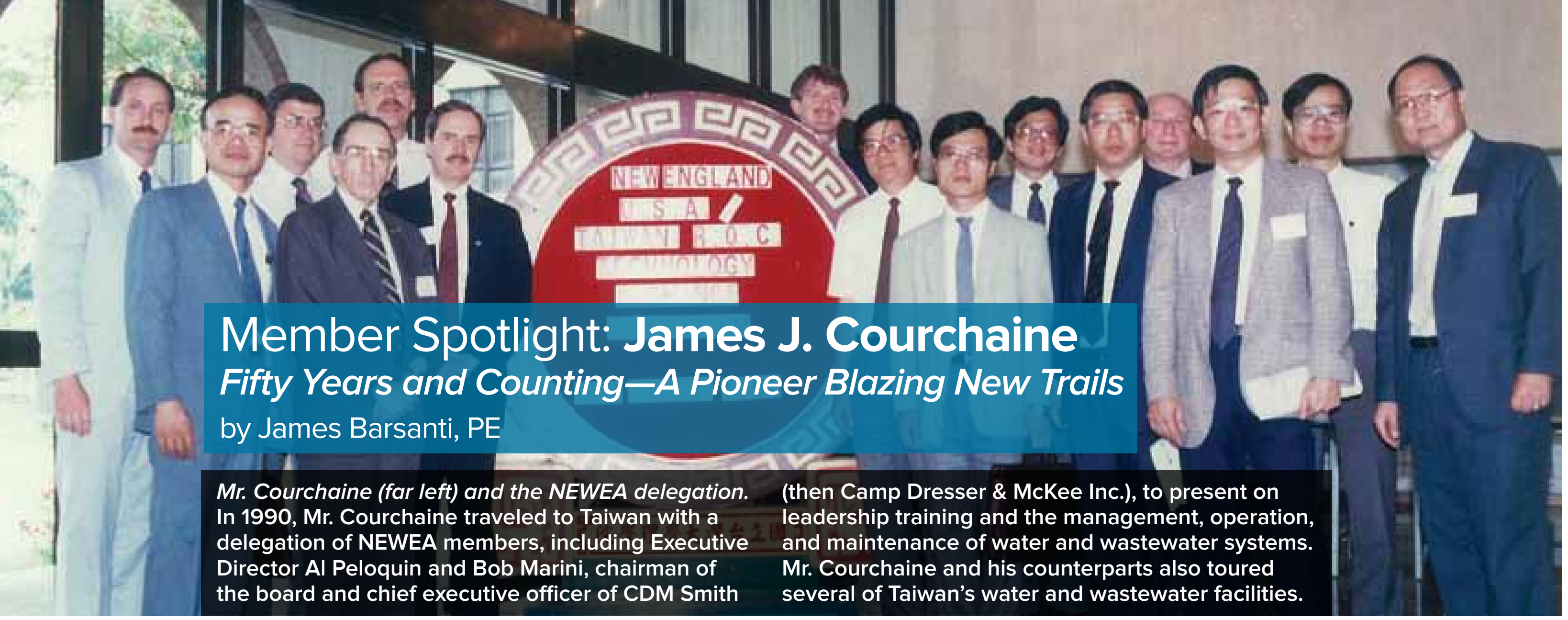
North East Biosolids & Residuals Association



Member Spotlight: **James J. Courchaine**

Fifty Years and Counting—A Pioneer Blazing New Trails

by James Barsanti, PE

Mr. Courchaine (far left) and the NEWEA delegation. In 1990, Mr. Courchaine traveled to Taiwan with a delegation of NEWEA members, including Executive Director Al Peloquin and Bob Marini, chairman of the board and chief executive officer of CDM Smith (then Camp Dresser & McKee Inc.), to present on leadership training and the management, operation, and maintenance of water and wastewater systems. Mr. Courchaine and his counterparts also toured several of Taiwan's water and wastewater facilities.

The number 50 has both thought-provoking and multifaceted connotations in our culture. Our great nation comprises 50 united, but independently governed (and minded), states. We think of a 50/50 proposition as being good odds or an equal partnership. We savor being seated on the 50-yard line as the best seats to watch the game. We recall the significance, during our younger days, of a gift of a crisply minted 50-dollar bill from a relative for a birthday, graduation, or holiday gift. We salute our friends and family who reach age 50, or are celebrating a golden wedding anniversary, as momentous milestones. However, it is unique and special to have a friend, colleague, and NEWEA member who for 50 years has not only remained active in our water industry in several roles but has continued to grow, adapt, and lead.


Mr. Courchaine at the beginning of his career—Burlington Department of Public Works (1973)

Jim Courchaine, vice president of operations and business practices for the South-Central Connecticut Regional Water Authority, is that rare person who has worked on virtually every side of our industry as an operator, utility manager, consultant, educator, innovator, and pathfinder. With no plans to slow down, let alone stop, Mr. Courchaine continues to forge the trail and show us, in his own inimitable way, how our work can be better accomplished and why our work as water professionals is so important to us personally and professionally. At the same time, we can reflect upon his core beliefs of valuing, empowering, educating, and challenging our most important assets, our people. Mr. Courchaine witnessed the birth of the Clean Water Act from its noble beginnings, along with the "trial by fire," that he experienced when standard operating procedures, training, and safe practices in collection systems and clean water facilities were in some cases non-existent or just evolving. Nevertheless, he saw these challenges as opportunities for his own self-development and growth and to share his knowledge with numerous water professionals to advance their own careers.

First 25 years—water industry finds Mr. Courchaine and student becomes teacher

Mr. Courchaine's Massachusetts roots run deep; he is a native Bostonian who grew up on Monument Square in Charlestown at the base of Bunker Hill. Perhaps growing up in such a historic place may have in some way influenced him, as he would soon begin a lifetime of challenging the status quo and inspiring those around him to learn, grow, contribute, be accountable, and achieve.

Mr. Courchaine entered the workforce in 1970 as a longshoreman and member of the Teamsters union, working on the wharfs of Boston's storied Atlantic Avenue. Work at the docks slowed down, however, and he was laid off, being one of the youngest members of the union and lacking seniority.

Never one to sit idly, Mr. Courchaine answered an advertisement for a laborer in the water and sewer division of the Burlington, Massachusetts Public Works Department. He was hired in 1972, and spent the next eight years in Burlington, learning the ropes primarily by doing, and following the procedures of those who were senior to him. As a young operator, he learned firsthand of the lack of training and safe practices in the water industry at that time: Confined space entry procedures, atmospheric monitoring, ventilation, and safety harnesses and tripods for manhole entry were not yet the standards. Virtually all maintenance was reactive; asset management consisted of merely "fixing what broke." Little did he know that these practices (or more accurately the lack thereof) would be the harbinger of his future pursuits in his career. Mr. Courchaine's skills rapidly expanded; he was learning the "tools of the trade" to operate the water distribution system, water treatment plant, and a collection system with 14 wastewater pump stations.

During this time, from 1975 to 1977, Mr. Courchaine enrolled in state-sponsored courses at nearby Lowell Technological Institute (now the University of Massachusetts Lowell) that emphasized drinking water and wastewater operations certification training. There he would meet one of his first mentors, Don Pottle, professor in the Industrial Technology Program. Mr. Courchaine's efforts bore much fruit; he completed the course curriculum and received his certification as a water and wastewater operator. Soon after, he became a Grade 4C water treatment and distribution operator and a Grade 4 wastewater treatment plant operator.

After completing his certification courses and attaining his operator's licenses, he was approached by Mr. Pottle to help develop basic and advanced courses in the management, operation, and maintenance of wastewater collection systems. Beginning in 1980, Mr. Courchaine became the lead instructor for these courses. During his 11-year tenure at Lowell Technological Institute, he taught hundreds of students who would later become NEIWPCC/NEWEA wastewater collection systems operators, managers, and engineers skilled in collection systems management, operations, and maintenance. During these years and continuing for two additional decades, he branched out and taught courses in collection systems and water distribution systems operations and maintenance, and confined space entry at the Massachusetts Water Resources Authority (1988 to 2000) and Boston Water and Sewer Commission (1982 to 2001).

In the early 1980s, Mr. Courchaine became the operations manager for the Town of Concord, Massachusetts and later moved on to the Town of Winchester in the role of assistant director of public works/director of water and sewer. In 1986, he decided to explore the challenges of life as a regulator and became the manager of the Infiltration/Inflow Program for the Massachusetts Department of Environmental Protection (MassDEP). In this role, he oversaw grants for the State Revolving Fund and worked with 137 cities and towns on 197 projects that removed 100 MG (380 ML) of infiltration and inflow. After seven years at MassDEP, his passion for operations and utility management beckoned, and he answered a call to serve the Town of Needham as its assistant public works director and water and sewer director in 1993. After five years in Needham, new challenges arose again, and his yearning to grow, take on new challenges, and make a positive impact by helping others to improve took hold. He was now 25 years into a career that in some ways had only just begun.

Next 25 Years—Mr. Courchaine goes nationwide

Over the next 25 years, Mr. Courchaine worked for various consulting firms—Malcolm Pirnie (now Arcadis), Brown and Caldwell, Tata and Howard, and Westin Engineering—on projects in New England and nationally in Arizona, Florida, Ohio, Indiana, Colorado, California, and Texas. He oversaw all aspects of infrastructure services, operator training, business practices evaluations, change management, safety, and asset management for several clients throughout the country. He remains a sought-after expert in developing an effective and sustainable Capacity, Management, Operation and Maintenance (CMOM) Program. One notable project included assisting the City of Lawrence, Massachusetts, which desperately needed an experienced operator and manager to address a crisis that included a lack of trained staff and an administrative consent order due to noncompliance on several permit issues. Mr. Courchaine stepped in to oversee and revamp the daily operation and maintenance of its 10 mgd (38 ML/d) water treatment plant and returned it to compliance, while simultaneously developing a comprehensive CMOM program from the ground up.


Mr. Courchaine at the helm as director of water and sewer and assistant director of public works, Winchester, 1986

As an industry leader in business practice evaluations, Mr. Courchaine worked hand-in-hand with public works directors, operations managers, supervisors, operators, and administrative staff for municipalities across the country to identify departmental inefficiencies as well as improve the delivery of water and wastewater services, enhance communication throughout the organization, and implement effective leadership, management, operation and maintenance, professional development, and safety training programs. After implementing these programs, he typically followed up with clients to evaluate the program and further refine their practices and delivery of services to customers. He continues to follow this passion in his current role as vice president of operations and business practices for the South-Central Connecticut Regional Water Authority, where he is training, leading, and inspiring the next generation of operators, managers, and engineers.


NEWEA President Al Schiff presenting Mr. Courchaine with the E. Sherman Chase Award (1986)

From NEWPCA to NEWEA and around the world

From the start, networking and professional development were always important to Mr. Courchaine, and he became an active member and leader in the Massachusetts Water Pollution Control Association (now MAWEA) and the New England Water Pollution Control Association (NEWPCA, now NEWEA). As a young operator, he found many ways to volunteer. Like many of us, he was active in committees, reviewing abstracts, developing program sessions, and moderating at conferences. In addition to being a member of the Collection Systems and Operations Challenge committees, he worked to found NEWEA's first Safety and Certification committees. His activities and service were quickly recognized, as he was honored with the E. Sherman Chase Award in 1985 and inducted into NEWEA's Select Society of Sanitary Sludge Shovelers (5S) in 1986.

Subsequent awards included the Alfred E. Peloquin Award (1996) and Founders Award (2006) for his service to wastewater operations, MAWEA, and NEWEA. In addition, he was the first ever recipient of the aptly named James J. Courchaine Collections Systems Award in 1996 in honor of his achievements and dedication to the profession.

Mr. Courchaine has served several roles on the Executive Committee, culminating with presiding over NEWEA's 75th Anniversary celebration as president in 2004. Following that, he remained a familiar face at NEWEA events and has always been available to provide historical perspectives and guidance to NEWEA members. In addition, he has been a long-standing and active member of the Water Environment Federation. He is a member of the Quarter Century Operator's Club and was honored as a Life Member in 2013 and as a WEF Fellow in 2018. He also served as the 5S Influent Integrator for over a decade with dignity, grace, and a respect for the importance of 5S to NEWEA and its members.

50 Years Later and Still Going Strong

Mr. Courchaine has truly had a unique career over the last 50 years. Where the future will take him, only he knows. However, we can rest assured that he does not intend to slow down, and he will likely lead us down a few more new trails along the way. His lifetime of experiences has provided us with important navigational beacons that have guided many of us toward our own professional destinies. I appreciate that I have been one of many who have been following and learning from him. His passion for water and wastewater systems, asset management, safety, operator training and certification, and mentorship, and his genuine concern for the professional and personal growth of colleagues are second to none. I can speak for many of us by saying we are so grateful for colleagues and friends like Mr. Courchaine, for taking the time to share their knowledge and life lessons with those around them for the benefit of our water industry and its people.

About the author

James Barsanti is an environmental engineer with the Massachusetts Department of Environmental Protection's Wastewater Section. He has been an active member of NEWEA and WEF for 30 years, currently serving as a WEF delegate and Bylaws Committee chair, and is a NEWEA past president (2017).


Teacher and student—Jim Courchaine and Jim Barsanti at the NEWEA 2020 Annual Conference

Committee Focus

Young Professionals

Young professionals will be leading the next 50 years of the Clean Water Act (CWA). In this spotlight, we showcase one of our talented young professionals, Jaimie Payne. Jaimie is an engineer with BETA Group, and has been active in her first year as a NEWEA (and Young Professionals [YP] Committee) member.

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

Jaimie: Surprisingly, I didn't at first; I went into business originally. I attended UMass Amherst's Isenberg School of Management and obtained my Bachelor of Business Administration in Corporate Finance and minored in Natural Resource Economics. I worked in the financial sector for about three-and-a-half years and decided it was not for me. I didn't feel like the work I was doing was impactful or brought a sense of accomplishment to my life. During that realization, I made the decision to go back to school and pursue engineering.

Jaimie Payne

Engineering was an easy and natural second choice. I always loved and excelled in my STEM (science, technology, engineering, and math) classes, and I felt that my business and client service background would partner well with it. It wasn't until I took my water resources and environmental engineering classes that I developed an interest in the clean water and environmental engineering professions. I loved the challenge that I felt in these classes and that they were multifaceted and incorporated other science and engineering disciplines. I also love the importance of our work and that we are making a difference in the communities that we work in.

■ *How long have you been in the clean water profession?*

I started with BETA Group, Inc., as an environmental engineer after I graduated from UMass Dartmouth in 2018. I am coming up on four years in the clean water profession, which is a significant year for me, as I will now be preparing to take my PE exam to become a licensed professional engineer.

■ *What has been the best/most surprising part of working in the clean water industry?*

The people I have met and been able to work with are the best part of working in the clean water industry. There are a lot of passionate people in this industry who want to share their knowledge and experience.

The most surprising part of working in this industry is how much I enjoy what I do. No two projects are alike, and each one has its challenges. This work keeps me engaged and constantly learning; I learn something new every day.

■ *What challenges do you see in the near future for the clean water profession (as we look forward to the next 50 years of the CWA)?*

I think my generation will have quite a few challenges ahead of us in the clean water profession, most notably continued climate change and emerging contaminants. As the climate continues to change, I think we are going to continue to see more extreme weather including droughts and severe flooding, which will test our existing infrastructure and force us to look at water as a more valuable resource. I think we will see an even bigger push toward water conservation and reuse. We also have some emerging contaminants such as PFAS (per- and polyfluoroalkyl substances) that we will have to contend with and continue to find ways to treat or remove from water and wastewater.

■ *What advice would you give to students or young professionals who are thinking about joining the NEWEA YP Committee?*

Do it! I have been a YP Committee member for a little over a year now, and it was one of the best decisions I've made. The members of our leadership group within the committee are some of the best people I know. They are a supportive group both professionally and personally. It is also a great way to develop your professional network and meet people within the industry. I look forward to our monthly meetings, and you can decide the level of involvement you want to pursue as a committee member. I jumped in the deep end during my first year as a committee member and joined the YP Summit Planning subcommittee to help plan the 2022 YP Summit at the Annual Conference. I had zero experience with planning an event like this, but the other committee members were right there to help me along the way. I will spend my second year as a YP Committee member helping to plan the 2023 YP Summit and running the newly created Events subcommittee. I'm so excited to launch the Events subcommittee and start rolling out some exciting events for NEWEA young professionals to attend!

Young Professionals Celebrate Earth Day

Earth Day was founded in 1970 to raise awareness about environmental concerns such as pollution, oil spills, and vanishing wildlife. The first Earth Day pushed environmental concerns onto the national agenda and led to EPA being founded in the same year. Since then, April 22 has been a day focused on improving our environment, the climate, and the communities we live in. This year, the YP Committee partnered with several local organizations to host Earth Day cleanup events.

Quincy Quarries Reservation Cleanup

The Clean Wave hosted a park cleanup at the Quincy Quarries Reservation on Saturday, April 23. The event was planned and organized by Tess Laffer, a NEWEA young professional, who has been an ambassador for The Clean Wave since 2018 and is a representative of their Greater Boston Area Chapter. Members of NEWEA attended the event and even brought along many peers, friends, and family to celebrate Earth Day.

The event consisted of an hour of cleanup and then an hour of sorting out recyclables from the trash. Gloves, trash bags, buckets, and light snacks and beverages were provided. The event had around 25 volunteers. Five large trash bags of recycling and three large bags of trash were collected during the two-hour event. The event was a huge success and there will be plenty more cleanups to come!

The Clean Wave is a non-profit organization that originated in Tamarindo, Costa Rica, in 2017 and has now spread around the world to encourage everyone to care for and clean up their communities. *The Clean Wave* has hosted and participated in over 100 beach cleanups and various zero waste community projects and has made a significant impact in the environments it has reached.

Charles River Cleanup

For more than 10 years, the Society of American Military Engineers (SAME) has volunteered with the Waltham Land Trust during its annual Earth Day Charles River Cleanup. The Waltham Land Trust was founded to promote, protect, and restore open space as well as assist with the conservation of the Charles River in Waltham. For Earth Day 2022, SAME was joined by young professionals from the Licensed Site Professionals Association (LSPA), Engineering Business Council (EBC), and NEWEA, along with their friends and families.

The event took place on Saturday, April 23, and was well attended with around 35 volunteers, some as young as four! The cleanup occurs in the same location every year, near the Moody Street Bridge, and usually results in 10 to 20 bags of trash. Over the years volunteers have collected various items, such as bicycles, shopping carts, rubber tires, and numerous plastic bottles and aluminum cans. After the hour-long cleanup, volunteers met at the Mighty Squirrel Brewery for informal networking. Jaimie Payne, NEWEA YP Committee, helped coordinate the event with Anne MacMillan, SAME Young Members chair.

WEF Delegate Report

This year began with focused activity for your NEWEA delegates to WEF, and it is only going to get busier. The roster of NEWEA delegates for this year is Jim Barsanti (the senior delegate), Peter Garvey, Ray Vermette, and Janine Burke-Wells (incoming delegate). We are thrilled to have Ms. Burke-Wells join the team to represent NEWEA nationally as she continues her dedication to NEWEA, having served as president in 2018. Matt Formica also remains a WEF delegate-at-large.

The 2022 WEFMAX conferences have mostly returned to in-person attendance. At these events delegates from all the Member Associations (MAs) across WEF get together to "X"-change information, ideas, and initiatives. After a two-year hiatus thanks to Covid-19, delegates were able to participate at each of three in-person WEMAX events this year.

Each delegate participates on various committees and workgroups associated with WEF's House of Delegates (HOD): Budget, Nominating, and Diversity, Equity, and Inclusion (DE&I) committees; Communications, Emerging Professionals, and Federal Advocacy are just some of the workgroup discussion topics, as you will see in each of the following delegate reports.

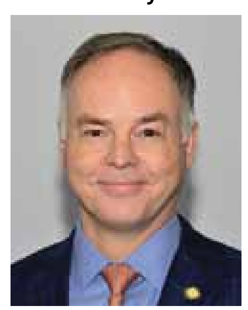
Jim Barsanti, senior delegate

Since last October's WEFTEC meeting in Chicago, I have been busy with several interesting and challenging WEF activities. As a member of the HOD Nominating Committee, I have helped review and update the nomination criteria for the HOD DE&I, Steering, Budget, WEFMAX, and Nominating standing committees, and for the positions of delegate-at-large and HOD speaker-elect. Nominations will be submitted for committee review in June with anticipated nominations for the 2022–2023 year confirmed with nominees in August.

I am secretary for the Emerging Professionals to Leadership workgroup. Our workgroup is coordinating with the Students and Young Professionals Committee leadership and WEF committee chairs to identify roadblocks to leadership transitions and identify actions for enhancing engagement. We have conducted several surveys across WEF to determine the top three to five barriers to leadership. Our objective is to create awareness of the various pathways into WEF leadership roles and to develop resources that better enhance emerging professional WEF transitions. In addition, the Water Environment Association of South Carolina hosted a WEFMAX in May that focused on emerging leaders and included workshops, panel discussions, and breakouts. WEFMAX also provides attendees with the opportunity to develop relationships with WEF colleagues from across the country. They share successes and lessons learned to enhance and develop existing or new MA activities.

As senior WEF delegate and NEWEA Bylaws Committee chair, I have been our liaison with WEF on the implementation of its code of conduct. The code documentation was developed by WEF to provide best practices and guidelines that members agree they will abide by as part of joining and maintaining a WEF membership. The WEF code of conduct extends to MA membership and its programs and activities in addition to any additional code of conduct adopted by the MA. WEF anticipates that the code of conduct will be adopted for all WEF/MA members and that MAs will develop a related code of conduct for any MA-only (non-WEF) members to abide by. WEF has provided a tool kit for MAs to use, and the NEWEA Bylaws Committee and Assessment and Development Committee will incorporate and implement the code of conduct during 2022.

Peter Garvey



It has been an active year for this NEWEA delegate. Two ongoing activities have been my involvement in the HOD Budget Committee and the Federal Advocacy workgroup.

Budget Committee

Did you know that WEF makes available $100,000 each year for grants to MAs like NEWEA? Applications, review, and award are conducted in two cycles and eligible grant activities can be anything that leads to MA advancement. As a committee member I reviewed 15 grant requests as part of the first cycle. The deadline for the second cycle of applications is June 24, so if you have any great ideas for use of such funds, please contact Mary Barry to see if NEWEA will consider preparing an application to support your suggestion.

Federal Advocacy Workgroup

This workgroup focuses on outreach to lawmakers in support of legislation affecting water topics. WEF developed an online platform on its Water Advocates webpage to make it easy to reach out to local legislators to inform them and to encourage them to vote in support of our water industry needs. In just a few clicks you can achieve the outreach—WEF has done all the hard work. I encourage all NEWEA members to sign up at wef.org/advocacy/water-advocates.

Finally, I had the honor in April to represent NEWEA at the WEFMAX conference in Hawaii. WEFMAX conferences bring together delegates like me from MAs across WEF to exchange ideas and plans. This conference focused on communications. It was interesting to see the materials, ideas, and challenges of other MAs. I also reported to the conference on progress of the Federal Advocacy workgroup. It was a great experience to meet with all the other delegates. As a first-time visitor to Hawaii, I also enjoyed the beauty and culture of the state.

Ray Vermette

As I continue my first year as a WEF delegate, I cannot help but be amazed at the interwoven workings of WEF. Since October's WEFTEC meeting in Chicago, I have been a member of the HOD Nominating Committee. We have been evaluating and updating the current nomination forms and criteria as well as presentations for upcoming WEFMAX events. I serve on this committee with Mr. Barsanti, and as he noted, we will be busy reviewing, discussing, and confirming nominations from June through August.

I am also on the Water Communications workgroup. Each month we hear different speakers describe the role they play in communicating for their organization. So far, we have heard from Kelley Dearing-Smith, vice president of strategic communications and marketing for the Louisville Water Company, who spoke on building a communications team and branding, and Samantha Villegas, director of strategic communication services at a consulting firm, who presented on effective use of WEF's biosolids tool kit. Our workgroup has split into two subgroups—social media research and messaging methods evaluation, the latter of which I am a member.

I was not able to attend an in-person WEFMAX event this year. In pre-Covid-19 2020, I was excited to be arranging the trip to beautiful Honolulu to attend my second WEFMAX; there is no need to explain what happened to those plans, but I am glad to see Mr. Garvey made it to the makeup event this year. I am looking forward to participating in the safe 2022 virtual WEFMAX slated for this July.

QR code bringing you directly to WEF's Water Advocates signup page. Reach out to Peter Garvey with any questions.

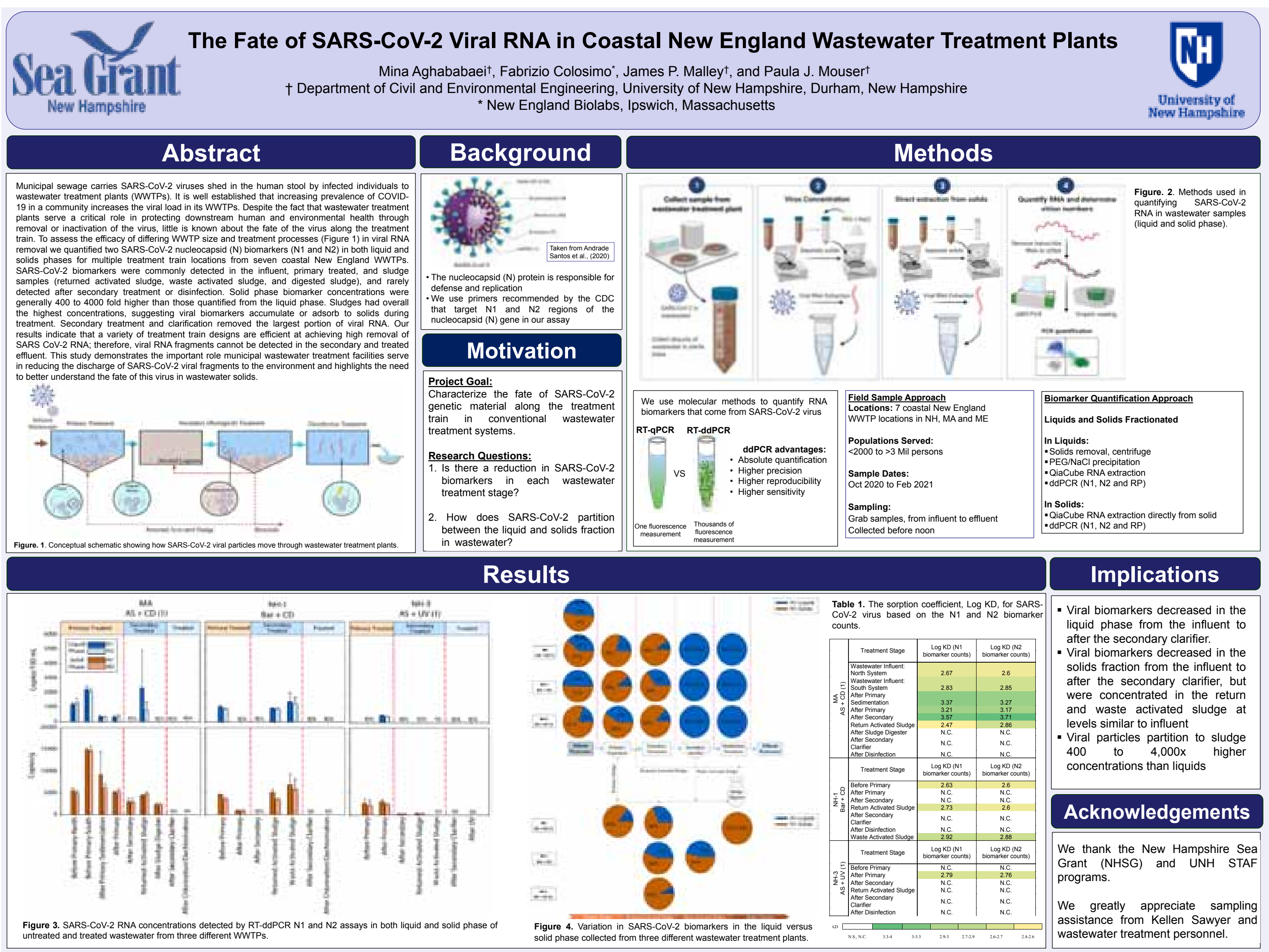
2022 Student Poster Board Competition

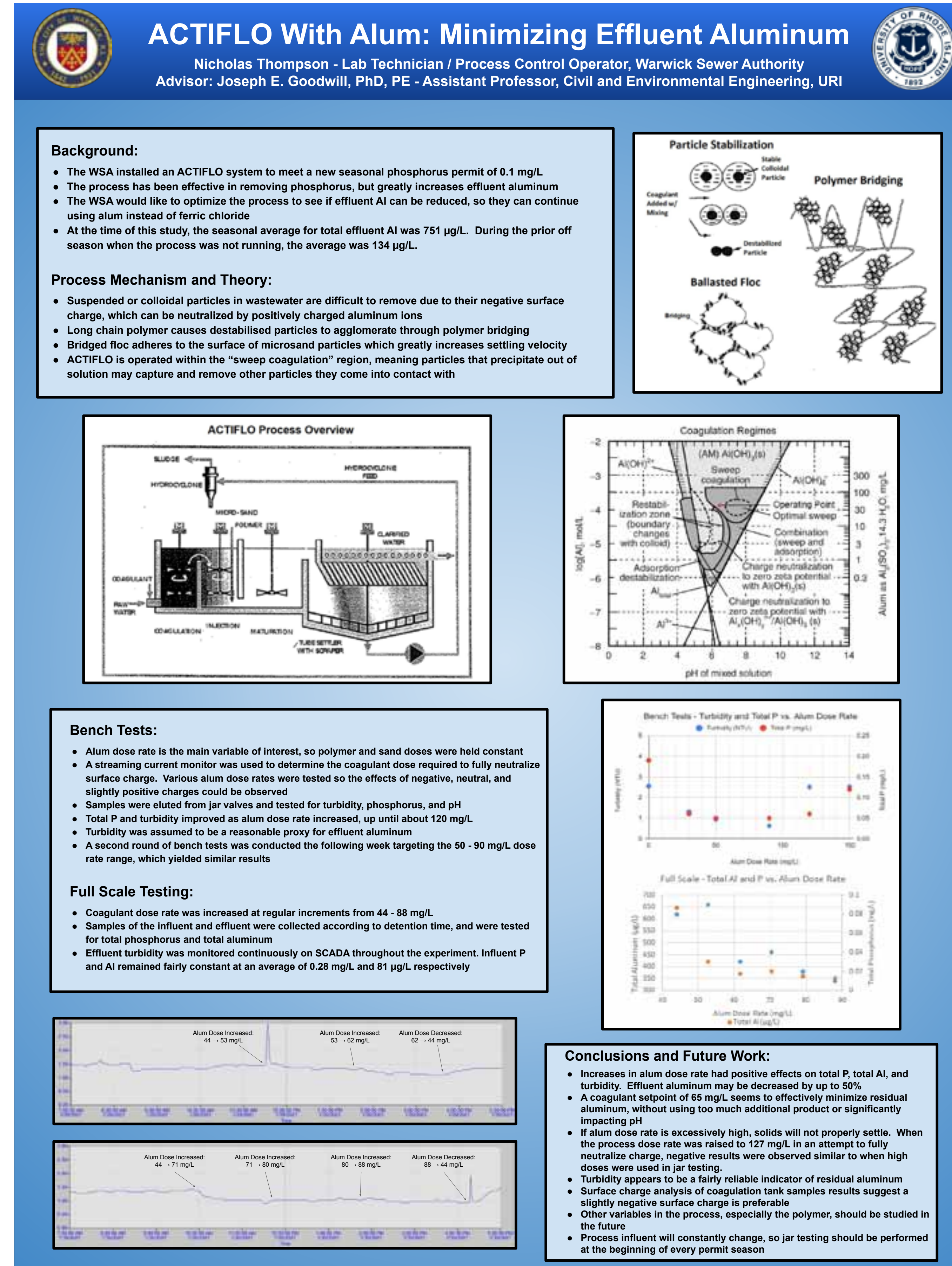
The NEWEA Student Activities Committee hosted the annual Student Poster Competition during this year's Annual Conference in Boston. Students from four universities participated: Northeastern University, University of Massachusetts Amherst, University of New Hampshire, and University of Rhode Island. Five undergraduate and four graduate poster entries were presented during the session and were judged by a panel of industry professionals. The competition was held with the Innovation Pavilion and enabled students to network and receive feedback from industry professionals and entrepreneurs.

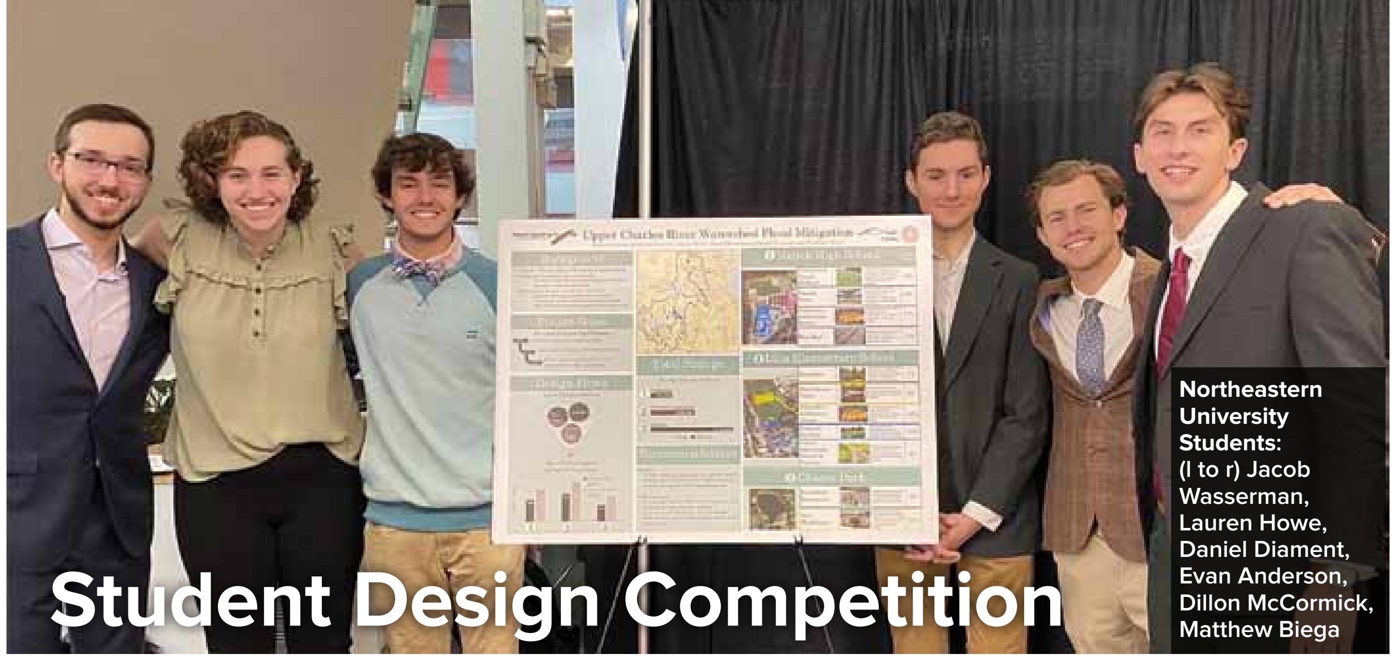
The winning posters were presented by undergraduate student Nicholas Thompson of the University of Rhode Island for "ACTIFLO with Alum: Minimizing Effluent Aluminum" and by graduate student Mina Aghababaei of the University of New Hampshire for "The Fate of SARS-CoV-2 Viral RNA in Coastal New England Wastewater Treatment Plants." The winning posters are included here.

The Student Activities Committee thanks all the participating students for their hard work and enthusiasm. We also extend our sincere gratitude to all the professionals who volunteered to judge the competition. We are delighted to have brought students and professionals together again in person at this year's event. As always, the student posters were of tremendous quality. If you missed the event this year, you should certainly stop by the posters on Tuesday during the 2023 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 Student Activities Committee chair for more information about sponsoring this event.







Student Design Competition

Northeastern University Students: (l to r) Jacob Wasserman, Lauren Howe, Daniel Diament, Evan Anderson, Dillon McCormick, Matthew Biega

This year's NEWEA Student Design Competition (SDC) was held virtually on May 2. The SDC is organized by the Student Activities Committee and promotes real-world design experience for students interested in an education and/or career in water engineering and sciences.

The SDC features two categories: (1) wastewater, which includes treatment facility design, and (2) water environment, which includes just about anything else related to water in the environment. This year's competing team was from Northeastern University (NU), entering the water environment category. The student team was invited to submit written reports and present their findings in front of judges during the SDC reception and presentation.

The team presented a plan for climate change resiliency within the Upper Charles River watershed, using green infrastructure for stormwater management and flood mitigation. Judges evaluated the project's technical aspects, the appearance and structure of the written submittal, and the content organization and effectiveness of the presentation. Following the evaluation, the NU team was selected to represent NEWEA at WEFTEC 2022.

The team created a prioritization method for selecting sites within the watershed with the greatest potential to store runoff at the sub-watershed scale. The team then selected the three highest priority sites and designed green infrastructure systems at each site sized to store the increase in peak runoff volumes associated with the 2070 100-year 24-hour storm. The sites included Lilja Elementary School and Natick High School in Natick, Massachusetts, and Choate Park in Medway, Massachusetts. The team used stormwater management systems such as blue roofs, subsurface infiltration chambers, planter boxes, and subsurface gravel wetlands.

The team will receive a $200 prize and allowance of up to $2,000 to travel to WEFTEC 2022 in New Orleans where the team will present its project at the WEF SDC. Congratulations to these bright students and best of luck in your future endeavors, at WEFTEC and beyond!

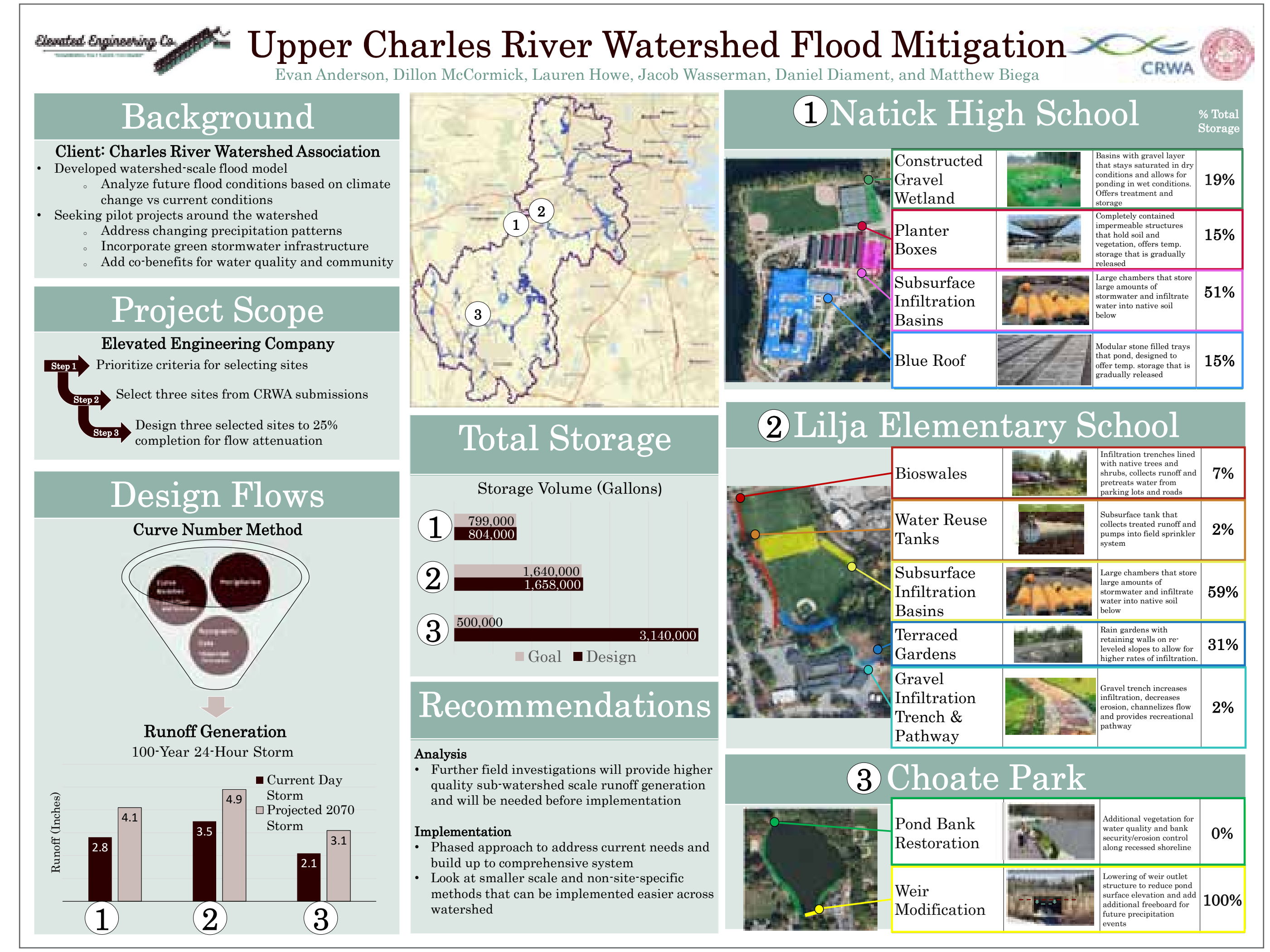
A big thanks goes to our volunteer judges who always provide thoughtful insight to the student teams: Caitlin Spence (Kleinfelder), Kyle Johnson (Kleinfelder), Caitlin Cervello (RH White), and Fred McNeill (City of Manchester). Also thanks to faculty advisor Annalisa Onnis-Hayden and professional mentor Indrani Gosh (Weston & Sampson).

We recognize and extend our appreciation to the companies that sponsored this event

AECOM	Environmental Partners	Jacobs
Aqua Solutions, Inc.	EST Associates, Inc.	Kleinfelder
Arcadis	F.R. Mahony & Associates	MWH
Brown and Caldwell	Flow Assessment Services	Stantec
Carlsen Systems, LLC	GHD, Inc.	The MAHER Corporation
CDM Smith	INVENT Environmental Technologies, Inc.	Tighe & Bond, Inc.
Dewberry		Weston & Sampson

For more information about sponsoring our NEWEA student design teams in preparing and presenting their projects at WEFTEC, please contact Joanna Sullivan (joannasullivan@vhb.com) or Jordan Gosselin (jgosselin@newea.org).

Next page: (top) poster, (bottom) four slides from presentation



2022 Spring Meeting & Exhibit Proceedings

Mt. Washington Resort, Bretton Woods, NH • May 22–25, 2022

The New England Water Environment Association held its Annual Spring Meeting on May 22–25, 2022, at the Mount Washington Resort in Bretton Woods, New Hampshire. Meeting registrants totaled 289. Registrants included 20 Operations Challenge participants and six guests. The meeting also featured 12 exhibit booths.

A full NEWEA Executive Committee meeting with committee chairs was held on Sunday, May 22, 2022, with NEWEA President Fred McNeill presiding. In addition to the Opening Session, there were eight technical sessions.

BREAKFAST & GENERAL OPENING SESSION

Moderator:
- Lauren Hertel, NEWEA Program Committee Chair, Woodard & Curran

Welcome
- Frederick McNeill, NEWEA President, City of Manchester, NH

The Keynote Panel Discussion featured industry leaders from New Hampshire discussing key water quality issues affecting our region:
- Shelagh Connelly, President, Resource Management
- Tracy Wood, Administrator, NHDES
- Rene Pelletier, Water Division Director, NHDES
- Ray Vermette, WWTF Supervisor, City of Dover, NH, NEWEA Past President

SESSION 1
CELEBRATING 50 YEARS OF CLEAN WATER—SUCCESS STORIES THROUGH TREATMENT OPTIMIZATION AND INNOVATION

Moderators:
- Miles Moffatt, Tighe & Bond
- John Adie, NH DES

50 Years of the Clean Water Act—A Parallel Journey
- Paul Hogan, Woodard & Curran

Clean Water Act Success Story—The Merrimack River
- Frederick McNeill, City of Manchester, NH

Interesting Journey—40 Year History of Working with Wastewater Personnel to Optimize the Performance of Our Wastewater Treatment Investment
- Charles Conway, Retired

Collaboration and Innovation Leads to Great Changes in Sewer Conveyance
- Timothy DeGuglielmo, Weston & Sampson
- Daniel Rowley, Town of Shrewsbury, MA
- Joseph Kenney, Town of Shrewsbury, MA
- Patrick Yeo, Weston & Sampson

SESSION 2
ADDRESSING CLIMATE CONCERNS WITH INNOVATIVE WASTEWATER AND SOLIDS HANDLING SOLUTIONS

Moderators:
- Scott Lander, Retain-It
- Faye DeMoura, Wright-Pierce

The New Net Zero: Dialing Up Sustainability Trends in Solid Streams
- Vanessa Borkowski, Stantec

A Passive Thermal Biosolids Management System—The Making of Our Carbon
- Valentino Villa, Bioforcetech Corporation

Climate Change Impacts to Wastewater Infrastructure
- Amy Sowitcky, Tighe & Bond
- Daniel Roop, Tighe & Bond

Blue-Green Infrastructure for Climate Resilience
- Andrea Braga, Jacobs

SESSION 3
FINDING THE PATH TOWARDS A RESILIENT FUTURE

Moderators:
- Brian Olsen, Carlsen Systems
- Vonnie Reis, City of Melrose, MA

Accelerating the Fortification of Coastal Pump Stations with Grant Funding in Marion, MA
- William Chandler, Weston & Sampson

Opposite page: Ops Challenge teams pose with event coordinators and judges at the Mt. Washington Hotel **1.** Doug Martin, Paul P. Casey, Scott Haynes, Charles Ryan, and Dennis Vigliotte at the Monday Reception **2.** Fred McNeill, Evan Karsberg, and James Plummer at the Monday Reception **3.** Vanessa Borkowski, Garrett Bergey, and David VanHoven socialize at the Monday reception **4.** Emily Cole-Prescott, Dep. Mayor Jodi MacPhail, and Howard Carter, all from Saco, Maine

Mitigating Sunshine Flooding in the City by the Sea
- Andrew Smith, Wright-Pierce

Resilience and Efficiency in Interconnected Infrastructure
- Andrew Jin, US Army Corps of Engineers

Sanitary Collection System Resiliency Through Comprehensive CMOM Program
- Karina Massey, Jacobs
- Nicole Petrozza, Jacobs

SESSION 4
GET SET, GO! FUNDING INFRASTRUCTURE

Moderators:
- James Barsanti, MassDEP
- Garrett Bergey, SDE

Federal Funding Update: What's New, What to Expect, and How to Prepare
- Jessica Richard, Woodard & Curran
- Dee Winterburn, Woodard & Curran

Where Do We Begin to Spend All This Money? Prioritizing Capital Expenditures with Asset Management
- Daniel Roop, Tighe & Bond
- Victoria Hawkes, Tighe & Bond

The Goldilocks Question—Finding the Right Asset Management Software
- Rachel Osborn, Woodard & Curran
- Bradley Hayes, Woodard & Curran

Improving Project Delivery Using Online GIS & BI at Nashua, NH
- Devon Jones, Hazen and Sawyer
- Kenneth Camacho, Hazen and Sawyer

SESSION 5
INNOVATING FOR TOMORROW'S TREATMENT CHALLENGES

Moderators:
- Ian Catlow, Tighe & Bond
- Laurie Perkins, Wright-Pierce

Decoding the Fate and Transport of PFAS Compounds in Sludge Undergoing Thermal Oxidation
- Sudhakar Viswanathan, Veolia Water Technologies

Navigating Low Nutrient Limits—Right-sizing Nutrient Reduction Strategies Through Uncertainty-based Evaluations
- Thomas Johnson, Jacobs

OxyPower HTC—Innovative Thermal Technology Based on Hydrothermal Carbonization
- John Ellersick, Next Rung Technology

Funding Options for Decentralized Systems
- Brian Baumgaertel, MASSTC

SESSION 6
FROM THE CLASSROOM TO THE CONSTRUCTION SITE—CULTIVATING DE&I IN THE WATER INDUSTRY

Moderators:
- Adam Yanulis, Tighe & Bond
- Vanessa McPherson, Arcadis

Incorporating DEI into an Intro Environmental Engineering Course
- Nick Tooker, University of Massachusetts
- Janice Weldon, University of Massachusetts
- Hannah Wharton, University of Massachusetts

1. Zach Henderson takes in the Merrimack River history narrative 2. Ko Ishikura discusses inclusion methods 3. Rysaiah Jones shares his internship experience 4. Russell Parkman addresses dealing with recent stormwater regulations 5. Whislaine Mesidor describes her success with X-Cel Conservation Corps 6. Victoria Hawkes offers ideas on asset funding priorities

1. Andrea Braga speaks on Blue-Green Infrastructure 2. Sudhakar Viswanathan decodes PFAS fate in sludge 3. Dee Winterburn shares federal funding information 4. Ken Sansone predicts impacts of PFAS regulations 5. Devon Jones relates Nashua's success using online data resources 6. Andrew Jin promotes the resiliency of interconnected infrastructure

Opening the Door to a Wastewater Career: Training & Internship Offers Alternative Path
- Don Sands, X-Cel Conservation Corps
- Whislaine Mesidor, Woodard & Curran
- Rysaiah Jones, Woodard & Curran
- Tom Connelly, Woodard & Curran

Bridging Differences for Inclusion
- Jasmine Strout, Green International Affiliates
- Ko Ishikura, Green International Affiliates

Harnessing the Power of Infrastructure Investment to Address Equity and Inclusion
- Erica Lotz, Stantec

SESSION 7
SOLUTIONS TO POLLUTANTS OF CONCERN

Moderators:
- Daniel Bisson, Tighe & Bond
- Garrett Bergey, SDE

Responsible Management Entities for Decentralized Wastewater Treatment Infrastructure
- Brian Baumgaertel, MASSTC

Planning for Low Effluent Nutrient Limits—Case Studies for Meeting Nutrient Limits in New England through Model Based Evaluation
- Edwin Castilla-Rodriguez, Jacobs

PFAS Regulations & Roadmap—How These Will Impact New England Water Suppliers
- Ken Sansone, SL Environmental Law Group

Addressing the Impacts of Recent Industrial Stormwater Regulations and Compliance
- Russell Parkman, Ramboll
- Courtney Messer, Ramboll

SESSION 8
RESILIENCY SOLUTIONS: INCORPORATING INNOVATION, COLLABORATION, AND AFFORDABILITY

Moderators:
- Jennifer Lawrence, CDM Smith
- Fred McNeill, City of Manchester, NH

How to Pass a Successful Infrastructure Bond Measure by Incorporating Your Community's Values into a Successful Triple Bottom Line Project Analysis!
- Howard Carter, City of Saco, ME
- Jodi MacPhail, City of Saco, ME
- Daniel Bisson, Tighe & Bond
- Leslie Corcelli, US EPA
- Michelle Madeley, US EPA

Innovation and Resiliency—Montague, MA Upgrades Sludge Dewatering to Meet New Demands
- Chelsey Little, Town of Montague, MA

From Asset Management to Asset Protection
- William Patenaude, Rhode Island Department of Environmental Management

National Grid Resources Available for NEWEA Wastewater Treatment Facilities
- Dan Sancomb, National Grid

Energy from Wastewater Solutions for NEWEA Members to Reduce Carbon and Energy Spend
- Jeff Hammer, UHRIG Energy

OPERATIONS CHALLENGE

Operations Challenge Committee:
- Jason Swain, Chair
- Rick Hartenstein, Vice Chair

Operations Challenge was held on May 23 and 24. Four teams participated in the competition:

Force Main (Maine)
- Jeff Warden
- Daniel Munsey
- Andrew Whitaker
- Jeremy Court

Mass Chaos (Massachusetts)
- Scott Urban
- Roel Figueroa
- Kelly Olanyk
- Mike Williams
- Paul Russell

RIsing Sludge (Rhode Island)
- Edward Davies
- Max Maher
- Kevin Gardner
- Rob Norton
- Riley Greene
- Dave Bruno

U-Connect-I-Cut (Connecticut)
- Jason Nenninger
- Ryan Harrold
- Bradford Vasseur
- Nicole Laboy

The Operations Challenge Awards Reception was on Tuesday, May 24. Committee Chair Jason Swain and each event coordinator, assisted by NEWEA President Fred McNeill, presented trophies to the winning teams of each event and to the overall first-, second-, and third-place winning teams. The results of the competition are reported as follows:

First Place Individual Events
- Collection Systems: Connecticut
- Laboratory: Rhode Island
- Maintenance: Rhode Island
- Process Control: Rhode Island
- Safety: Rhode Island

Overall Competition
- First: Rhode Island
- Second: Connecticut
- Third: Massachusetts

During the reception, it was announced that NEWEA would support the first-, second-, and third-place teams in the 2022 WEF National Operations Challenge competition to be held October in New Orleans.

Event Coordinators
- Safety – Rick Hartenstein
- Maintenance – Alex King
- Process Control – Alex Buechner
- Collection Systems – Mike Armes
- Laboratory – Nora Lough
- Trophies – Joe Kruzel

Judges
- Collection Systems: Eliza Morrison, Mike Smith
- Laboratory: Claudia Buchard, Dennis Palumbo, Marylee Santoro, Jeanette Brown, Danielle Morrison
- Maintenance: Patty Chesebrough, Dan LaFlamme, Scott Lausier
- Process Control: Patty Chesebrough, Dan LaFlamme, Claudia Buchard, Paul Dombrowski
- Safety: Evan Karsberg, Kim Sandbach




1. Amy Anderson George and Kim Sandbach offer raffle tickets to Rob Norton, Riley Greene, and Dave Bruno 2. Larry Sullivan, Sean Cohen, and Larry Murphy of the golf tournament winning team hoist their trophies 3. Kim Sandbach, Nora Lough, Dustin Price, and Tim Vadney clown on the golf course 4. Justin Skelly stands forward for 5S induction as Charles Tyler presents "just the facts"

OPERATIONS CHALLENGE SPONSORS

Woodard & Curran
Crooker Construction
KSB
Lenox
Veolia

SELECT SOCIETY OF SANITARY SLUDGE SHOVELERS

During the Monday evening reception, Influent Integrator Charles W. Tyler inducted eight new members into the Select Society of Sanitary Sludge Shovelers:

- Shelagh Connelly
- John Digiacomo
- Peter Garvey
- Zach Henderson
- Colin O'Brien
- Tom Sgroi
- Justin Skelly
- Nick Tooker

MISCELLANEOUS

A variety of committee meetings were held throughout the Spring Meeting. The Annual Spring Meeting Golf Tournament was held at the Mount Washington Golf Course.

MEETING MANAGEMENT

- Director – Amy Anderson George
- Sponsors – Brian Olsen

MEETING PLANNERS

- Conference Arrangements – Ron Tiberi
- Program – Lauren Hertel
- Registration – Meg Tabacsko, Scott Neesen, and NEWEA Staff
- Operations Challenge – Jason Swain
- Golf Tournament – Fred McNeill

EXHIBITORS

ADS Environmental Services-Idex
Champlin Associates
Cityworks
CUES
DN Tanks
Flow Assessment Services
Green Mountain Pipeline Services
Hayes Group
Noresco
Russell Resources
UHRIG Energy from Wastewater
Water Industries




1. Coach Mike Williams leads the Massachusetts team to the awards stage 2. Jeff Warden and Andrew Whitaker of Force Maine Ops team compete in the pump event 3. Paul Russell and Kelly Olanyk of the Mass Chaos team during the Lab event 4. RIsing Sludge Ops Challenge team with trophies: Rob Norton, Dave Bruno, Riley Greene, Max Maher, Eddie Davies

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INVENT Environmental Technologies, Inc.
Jacobs
Kleinfelder
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Tech Sales NE
The MAHER Corporation
Ti-SALES
Tighe & Bond, Inc.
Vaughan Company, Inc.
Weston & Sampson
Woodard & Curran
Wright-Pierce

New Members March – May 2022

Karlen Aleno
Fall River, MA (STU)

Gail Aloisio
City of Portland Public Works
Portland, ME (PRO)

Evan Anderson
Needham, MA (STU)

Matthew Biega
Boston, MA (STU)

Kareem Bonugli
Boston Water & Sewer Commission
Roxbury, MA (YP)

Patrick Boutin
Village of Essex Junction
Essex Junction, VT (UPP)

Simon Brooks
Fair Lawn, NJ (STU)

Katelyn Burke
Concord, ME (YP)

Emma Burleson
Tighe & Bond Inc
Worcester, MA (YP)

Kevin Cafferty
Town of Scituate
Scituate, MA (PRO)

Stephanie Carlisle
Town of Medway
Medway, MA (YP)

Caitlin Cervello
R.H. White Construction Co., Inc.
Worcester, MA (YP)

William Chandler
Weston & Sampson Engineers Inc
Reading, MA (PRO)

Elisabeth Christ
Hadley, MA (YP)

Amanda Coffuire
Douglas, MA (YP)

Christina Colarusso
Vineyard Haven, MA (YP)

Jacqueline Collins
Massachusetts Water Resources Authority
Chelsea, ME (UPP)

Michael Courtenay
Warren, ME (PWO)

Amanda Craver
Somerville, MA (YP)

Evan Dalton
Longmeadow, MA (YP)

Daniel Diament
Ocean, NJ (STU)

Bruce Fathers
North Andover, MA (PRO)

Nick Ganzon
North Andover, MA (PRO)

Keith Gardner
Stantec
Boston, MA (PRO)

Brett Gonsalves
Town of Stoneham
Stoneham, MA (PRO)

Ian Graham
Tighe & Bond Inc
Westfield, MA (YP)

Andrew Greenlaw
Boston Water & Sewer Commission
Boston, MA (YP)

Regina Hanson
Varec Biogas, a division of Ovivo USA LLC
Huntington Beach, CA (PRO)

Brad Hitselberger
Industrial Flow Solutions
Charlotte, NC (YP)

Grace Houghton
CDM Smith
Boston, MA (PRO)

Lauren Howe
Boston, MA (STU)

Steven Huang
Kleinfelder
Boston, MA (PRO)

Rishabh Iyer
Kleinfelder
Boston, MA (YP)

Erik Jensen
Leicester Water Supply District
Leicester, MA (PWO)

Andrew Jin
Los Angeles, CA (STU

Rebecca Kammerer
Stacey DePasquale Engineering
Lawrence, MA (PRO)

Alex King
Sanford Sewerage District
Biddeford, ME (YP)

Jim Konatsotis
Sherwood-Logan & Associates
Wilton, CT (PRO)

Sierra Kuun
Portland Water District
Yarmouth, ME (YP)

Scott LaJoy
Village of Essex Junction
Essex Junction, VT (UPP)

Kevin Leroux
CDM Smith
Amherst, NH (PRO)

Sydney Lewis Hernandez
Westwood, NJ (STU)

Max Maher
Providence, RI (YP)

Joseph Marcinkus
Town of Upton
Upton, MA (YP)

Charles Marsden
Nashua, NH (PRO)

Sean McCarthy
Scituate WWTP
Scituate, MA (PRO)

Dillon McCormick
Boston, MA (STU)

Michael McDonald
Concord, MA (PRO)

Eric Melanson
Groton Utilities
Groton, MA (PWO)

Alison Miner
Newington, CT (STU)

Jeffrey Moulton
Stoneham, MA (PWO)

Jessica Nekowitsch
Brown and Caldwell
Wilton, NH (YP)

Elyse Noll
Kleinfelder
Allston, MA (YP)

Gokhan Ozemet
Veolia North America
Carver, MA (PRO)

Joseph Parker
Millbury, MA (PRO)

Justin Pellerin
Portland Water District
Portland, ME (PRO)

Chris Prue
Town of Orono
Orono, ME (PWO)

Nazli Rafei Dehkordi
Northeastern University
Boston, MA (STU)

Mark Raumikaitis
Manchester, NH (PRO)

Amara Regehr
CDM Smith Inc
Boston, MA (YP)

Steve Reichert
Fuss & O'Neill Inc
Manchester, NH (PRO)

Jessica Richard
Woodard & Curran Inc
Lowell, MA (PRO)

Frank Rodrigues
Narragansett Bay Commission
Providence, RI (PRO)

Christian Rodriguez
Weston & Sampson Engineers Inc
Portsmouth, NH (YP)

Nick Rossi
CDM Smith
East Hartford, CT (PRO)

Ryan Shea
Boston Water & Sewer Commission
Boston, MA (YP)

Brady Steinbach
Minneapolis, MN (PRO)

Lee Tharps
Jacobs
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Ryan Trongone
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Nitsch Engineering Inc
Boston, MA (PRO)

Jacob Wasserman
Northeastern University
Boston, MA (STU)

Ruth Wilson
Kleinfelder
Brighton, MA (YP)

Academic (ACAD)
Affiliate (AFF)
Complimentary (COMP)
Corporate (COR)
Dual (DUAL)
Executive (EXEC)
Honorary (HON)
Life (LIFE)
Public Official (POFF)
Professional (PRO)
Wastewater Treatment Plant Operators (PWO)
Student (STU)
Utility Partnership Program (UPP)
Young Professional (YP)

Upcoming Meetings & Events

COMMITTEE MEMBER APPRECIATION EVENT & HOMEBREW COMPETITION
Kimball Farms, Westford, MA
July 28, 2022

PLANT OPS/ENERGY TECHNICAL PRESENTATIONS & TOUR
South Essex Sewerage District
Salem, MA
September 15, 2022

NEWEA GOLF CLASSIC
Derryfield Country Club
Manchester, NH
September 30, 2022

WEFTEC
New Orleans, LA
October 8–12, 2022

NORTHEAST RESIDUALS & BIOSOLIDS CONFERENCE & EXHIBIT
The Venue, Portsmouth, NH
November 1–2, 2022

NEWEA ANNUAL CONFERENCE & EXHIBIT
Boston Marriott Copley Place Hotel
Boston, MA
January 22–25, 2023

AFFILIATED STATE ASSOCIATIONS AND OTHER EVENTS

NHWPCA ANNUAL GOLF TOURNAMENT
Beaver Meadow Golf Course
Concord, NH
August 4, 2022

MWUA SUMMER OUTING
Cumberland Fairgrounds, ME
August 11, 2022

GMWEA—GEORGE DOW MEMORIAL GOLF TOURNAMENT
Cedar Knoll Country Club, Hinesburg, VT
August 19, 2022

RICWA FALL ANNUAL CLAMBAKE AND EXHIBITION
Crowne Plaza, Warwick, RI
September 9, 2022

GSRWA FALL TRADE SHOW
Mt Sunapee Mt., Newbury, NH
September 13, 2022

NEWWA ANNUAL CONFERENCE
Newport Marriott, Newport, RI
September 18–21, 2022

MEWEA FALL CONFERENCE & GOLF TOURNAMENT
Sunday River, Newry, ME
September 21–23, 2022

NHWPCA FALL MEETING
Keene, NH
September 23, 2022

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

U.S.	International System of Units (SI)	U.S.	International System of Units (SI)
Liquid volume		**Length**	
gallon (gal)	liter (L)	inches (in.)	centimeters (cm)
cubic feet (ft^3)	cubic meters (m^3)	feet (ft)	meters (m)
cubic yards (yd^3)	cubic meters (m^3)	miles (mi)	kilometers (km)
acre-feet (ac ft)	cubic meters (m^3)	**Area**	
Flow		square feet (ft^2) or yards (yd^2)	square meters (m^2)
million gallons per day (mgd)	million liters per day (ML/d)	acre (ac)	hectare (ha)
for larger flows (over 264 mgd)	cubic meters per day (m^3/d)	square miles (mi^2)	square kilometers (km^2)
gallons per minute (gpm)	liters per minute (L/min)	**Weight**	
Power		pounds (lb)	kilograms (kg)
horsepower (hp)	kilowatts (kW)	pounds per day (lb/d)	kilograms per day (kg/d)
British Thermal Units (BTUs)	kilojoules (kJ) / watt-hours (Wh)	ton – aka short ton (tn)	metric ton or tonne (MT)
Velocity		**Pressure**	
feet per second (fps)	meters per second (m/s)	pounds/square inch (psi)	kiloPascals (kPa)
miles per hour (mph)	kilometers per hour (km/h)	Inches water column (in wc)	kiloPascals (kPa)
Gas		**Head**	
cubic feet per minute (ft^3/min)	cubic meters per minute (m^3/min)	feet of head (ft of head)	meters of head (m of head)

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Upcoming 2022 *Journal* Themes

Fall—**Instrumentation & Controls**

Winter—**Funding the Work**

NEWEA/WEF* Membership Application

Water Environment Federation — the water quality people

NEWEA — WORKING FOR WATER QUALITY

Personal Information (please print clearly)

First Name | M.I. | Last Name | (jr. sr. etc)

Business Name (if applicable)

Street or P.O. Box | (☐ Business Address ☐ Home Address)

City, State, Zip, Country

Home Phone | Cell Phone | Business Phone

Email Address | Date of Birth (mm/yyyy)

☐ Check here if renewing, please provide current member I.D.

☐ Check here if you do NOT wish to receive information on special offers, discounts, training and educational events, and new product information to enhance your career.

***NEWEA is a member association of WEF (Water Environment Federation). By joining NEWEA, you also become a member of WEF.**

ACQ. Code (for WEF use only) | WEF 22

Membership Categories (select one only)

Category	Description	Member Benefit Subscription	Dues
☐ **Professional**	Individuals involved in or interested in water quality	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$190
☐ **Young Professional**	Water quality professionals, with fewer than five years working experience and under the age of 35, are eligible to join. This program is available for new member applicants and Student Members and is available for 3 years..	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$75
☐ **Professional Operator**	Individuals in the day-to-day operation of wastewater collection, treatment or laboratory facility, or for facilities with a daily flow of < 1 mgd or 40 L/sec. License # ____________	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$110
☐ **Academic**	Instructors/Professors interested in subjects related to water quality.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$190
☐ **Student**	Students enrolled for a minimum of six credit hours in an accredited college or university. Must provide written documentation on school letterhead verifying status, signed by an advisor or faculty member.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$15
☐ **Executive**	Upper level managers interested in an expanded suite of WEF products/services.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online) ■ *WEF SmartBrief* ■ Complimentary WEF Webcasts and more	$360
☐ **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

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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

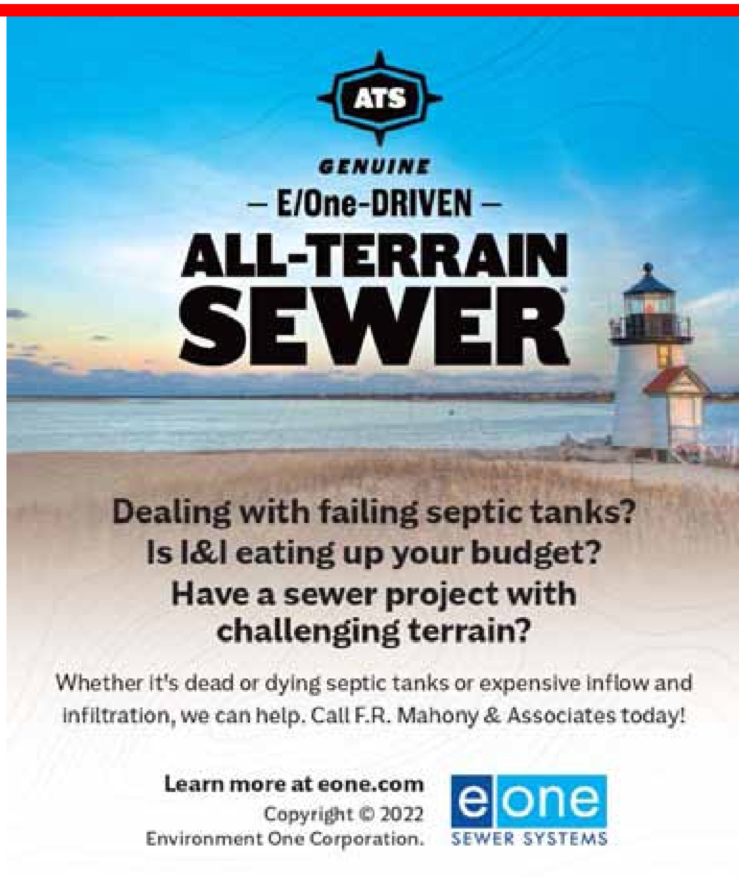
Education: ☐ Doctorate ☐ MA/MBA/MS ☐ BA/BS ☐ AA/AAS ☐ Technical School ☐ High School

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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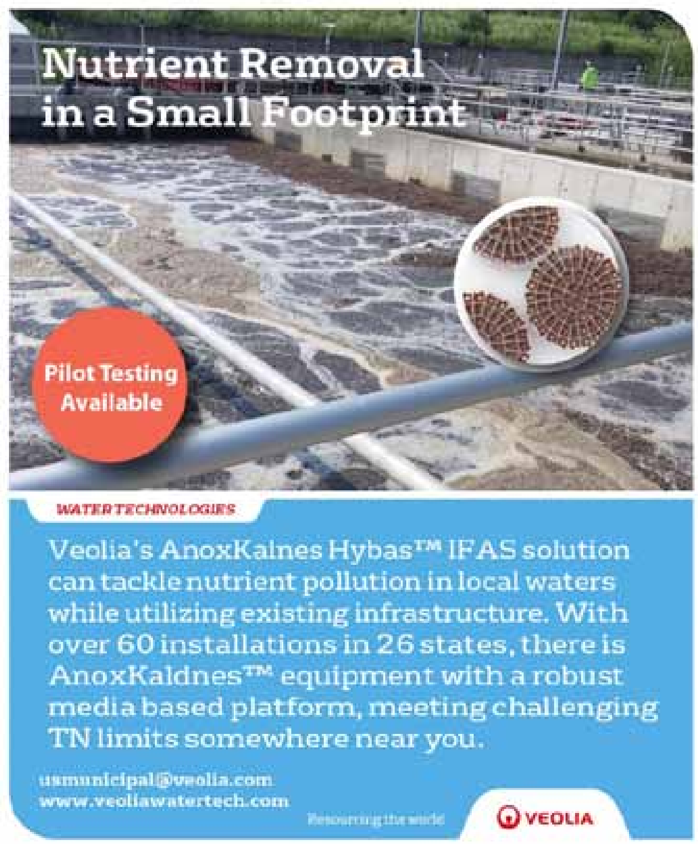
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