JOURNAL

OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

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STORMWATER

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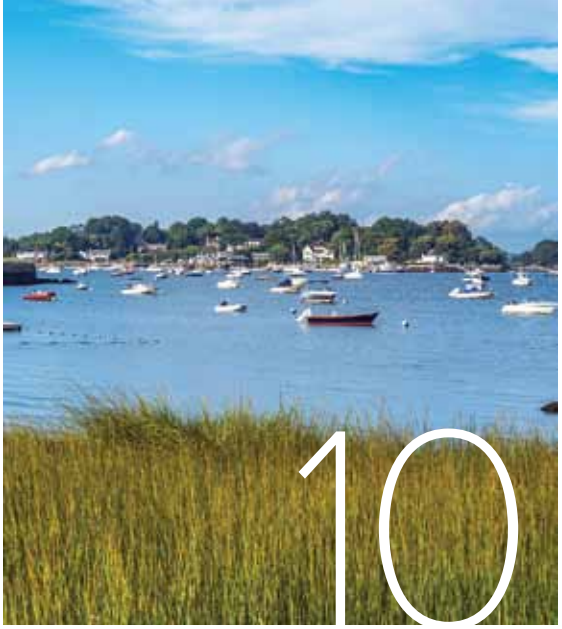

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NEWEA
WORKING FOR WATER QUALITY

OUR ASSOCIATION WAS ORGANIZED NINETY-SIX 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.

Executive Member—shall be an upper level manager interested in water quality and who is interested in receiving an expanded suite of WEF products and services.

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.

Regulatory Member—this membership category is a NEWEA only membership reserved for New England Environmental Regulatory Agencies, including: USEPA Region 1, Connecticut Department of Energy and Environmental Protection, Maine Department of Environmental Protection, Massachusetts Department of Environmental Protection, New Hampshire Department of Environmental Services, Vermont Department of Environmental Conservation, and Rhode Island Department of Environmental Management.

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- Complete and mail the membership application form on pages 63–64
- Download a membership application from **newea.org** by selecting—*Join Us/Become a NEWEA Member*
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2025 RATES ($)

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Young Professional	88
PWO	129
Dual	50
Student	28.50

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President's Message

Strategic Planning Update

Each NEWEA president is tasked with executing an initiative that aligns with the organization's mission and values. My presidential initiative is to develop NEWEA's next strategic plan.

Deborah S. Mahoney
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The last such effort took place nearly a decade ago (before the challenges of the Covid pandemic), and selecting this task as my initiative took much effort and relied on contributions from the Strategic Planning task force, NEWEA senior management and staff, and WEF's director of community engagement–associations, Kelsey Hurst, all of whom have continued to engage in advancing the initiative. Thank you, also, to all who participated in the recent membership survey, providing information that will continue to help guide NEWEA's strategic direction.

On September 4 and 5, the Strategic Planning task force, together with Executive Committee leaders and several former officers and notable committee chairs, held a two-day in-person strategic planning session, facilitated by Ms. Hurst, who has extensive experience in leading and assisting with planning sessions for WEF member associations across the country. During the session, the group discussed and consolidated data from an earlier SWOT (strengths, weaknesses, opportunities, and threats) analysis, ongoing committee outreach, and the recent membership-wide survey to identify key target areas and corresponding actions.

The group took a fresh look at current NEWEA mission and vision statements in comparison with WEF's recently revised statements and considering NEWEA's needs, and smaller work groups were appointed to update versions of NEWEA's mission (defined as the association's reason for existence) and vision (defined as the purpose that the association aspires to affirm) to best reflect NEWEA's present culture. For the rest of the session the group developed a short list of priorities for NEWEA over the next three to five years, including goals (based on perceived needs from the SWOT and survey results), and proposed activities to achieve them in the allotted time. Task teams were assigned to further define each focal path and its related activity proposals.

Strategic planning session participants

This work session was a significant step in formulating a workable, living (that is, subject to ongoing adjustments and revisions) strategic plan. Task team efforts over the next few months will focus on implementation planning, intending to present the results at the NEWEA Annual Conference in January to inform the membership of the proposed plan and to gauge reaction and solicit member input.

In the meantime, I offer heartfelt thanks and appreciation for the hard work of the planning task force and the session task team participants, and once again I encourage all NEWEA members to share ideas or questions with me at Dmahoney@brwncald.com. All useful input is welcomed and will help shape the direction of the association and the industry.

From the Editor

Welcome, NEWEA friends, to our fall edition of the *Journal*. In this edition, we highlight stormwater. As many of us know, stormwater management presents significant challenges, especially in our highly urbanized areas where stormwater runoff can overwhelm under-designed drainage systems, causing street flooding, property damage, and transport of pollutants and sediments to our receiving waters. Compounding these issues, with our changing New England weather patterns over the last several decades, we have experienced more frequent and intense rainfall and flooding in the spring, summer, and fall. In some cases, these events have had devastating consequences, such as the historic rainfall and river flooding in Montpelier, Vermont, and surrounding areas in July 2023, when over 5 in. (13 cm) of rain caused the Winooski River to overtop resulting in roadway collapses and widespread flood damage to businesses and residential areas. Events such as this have heightened the public's awareness of the need to advocate for effective stormwater management systems and to address gaps in funding to construct, operate, and maintain resilient and sustainable stormwater systems.

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But we New Englanders are a hardy lot—we embrace challenges with a steadfast desire to find solutions—and we are excited to present in this *Journal* issue four feature articles that have addressed the challenges of planning and implementing effective stormwater programs.

Our first feature highlights the town of Westford's long-term strategic vision and leadership in transforming its stormwater system into a sustainable stormwater utility prepared for the future. Westford's plan included preparing a comprehensive inventory of its stormwater assets, prioritizing plans to address critical drainage infrastructure and culvert replacement projects, and developing a successful public outreach approach to gain stakeholder support for the program.

Effective stormwater management starts with collection of runoff and capture of the associated urban pollutants, and our second feature highlights the town of Brookline's innovative program to evaluate its catch basin cleaning program to attain increased phosphorus credits under its MS4 permit. Brookline used a methodology patterned after the Chesapeake Bay Total Maximum Daily Load, the largest nutrient reduction program in the country. That program bases phosphorus removal credits on the actual mass of sediment removed by its cleaning program and applies an empirical formula to calculate the quantity of phosphorus removed.

Our third feature spotlights the Boston Water and Sewer Commission's work to evaluate the impacts of extreme rainfall in Boston while developing an adaptive plan for its drainage infrastructure to address increasingly intense rain events and high sea levels. The Commission has built a citywide inundation model and created a website that shows users the consequences of flooding with interactive location-specific 360-degree imagery, organized a dashboard that tabulates impacts on critical facilities during extreme storm events, and developed conceptual designs to adapt its stormwater infrastructure to account for concurrent heavy storms and high sea levels.

Finally, we are excited to present research by Dr. Harry Zhang of The Water Research Foundation that highlights the One Water approach to consider the water cycle as an integrated system recognizing all water flows as potential resources. His article includes case studies that illustrate the importance of a holistic stormwater management approach with three important interconnected elements to support robust decision-making: performing Best Management Practices, applying life cycle cost analytics, and sharing the multi-benefits at a watershed scale.

In addition, this issue includes the latest NEBRA highlights, reports from our six New England state directors highlighting this summer's activities and concerns, and a Young Professional spotlight featuring Anna Ropes, a project engineer in CDM Smith's Manchester, New Hampshire office, who is an active member of our Young Professional Committee. We are also thrilled to present the state winners of the Stockholm Junior Water Prize. The work of these six young people is inspiring and confirms that the future of our water industry is bright.

As always, we offer our heartfelt thanks and appreciation to our *Journal* advertisers and event sponsors whom we recognize for their vital role in supporting our NEWEA programs. On behalf of the Journal Committee, I wish you all a happy fall season,.

Industry News

Long Island Sound
Rowayton, Connecticut

Celebration of 40 years of protecting and restoring Long Island Sound

– EPA Press Office

Senior officials from EPA, Connecticut, and New York, along with many partners, met in June in Rye, New York, to celebrate 40 years of progress in restoring and protecting the Long Island Sound, and announced a new plan that sets a 10-year road map to revitalize the Sound as an ecological, economic, and recreational resource.

At the event, EPA and state leadership affirmed support for the Long Island Sound Partnership's new Comprehensive Conservation and Management Plan (CCMP), the program's third such plan since 1994. The new plan includes updated metrics to improve water quality, restore and protect habitats and wildlife, support community resilience and sustainability, and inspire people to value and protect Long Island Sound. The Long Island Sound Partnership is the new name for the Long Island Sound Study, which was created in 1985 when Congress enacted legislation to conduct a single study to research, monitor, and assess the water quality of the Sound.

"This celebration highlights decades of progress in protecting the Long Island Sound," said EPA Region 2 Administrator Michael Martucci. "This work showcases what we can achieve when federal, state, and local partners work together to safeguard clean water and healthy ecosystems for a prosperous community."

"Over the last 40 years, this partnership has been essential to Connecticut DEEP's efforts to restore and maintain the health of the Sound," said Katie Dykes, commissioner of Connecticut's Department of Energy and Environmental Protection (DEEP). "Connecticut's collaboration with New York State, EPA, and other federal agencies, education and research institutions, non-governmental organizations, and dedicated advocates and residents has led to successful reductions of nitrogen in the Sound."

Since its founding, the partnership has—through implementation of a CCMP—decreased the area of unhealthy levels of dissolved oxygen by half, restored 2,400 ac (970 ha) of coastal habitat, protected an additional 8,000 ac (3,200 ha), and reconnected 448 mi (720 km) of rivers and streams.

Long Island Sound and its coast and watersheds are home to thousands of plants and animal species, and are a recreational treasure for boaters, fishers, birders, and more. Through the decades, the partnership has launched many programs to protect the Sound and its shoreline. These include a habitat restoration initiative, a Long Island Sound stewardship initiative to help manage critical recreational and ecological areas around the Sound, and a seafloor mapping program to better understand the Sound's underwater habitats. The partnership also oversees the Long Island Sound Futures Fund, which has provided millions of dollars in grants to organizations and communities across the Sound's watershed in Connecticut, New York, Massachusetts, New Hampshire, and Vermont.

Stormwater permit to protect watershed

– Rhode Island DEM press release

The Rhode Island Department of Environmental Management (DEM) has developed a new draft permit aimed to improve water quality in the Mashapaug Pond watershed. The draft Mashapaug Watershed Stormwater General Permit would apply to certain properties within the Mashapaug watershed, which also includes Spectacle and Tongue ponds in Cranston, with one ac (0.4 ha) or more of impervious surface (e.g., rooftops, pavement) not already permitted. Once issued, the draft permit will require that property owners affected prevent, manage, and treat stormwater pollution through routine maintenance and stormwater management plans.

DEM hosted two public workshops on the draft permit to share information and gather feedback. The sessions covered the permit's impact on property owners and water quality improvements, and included a question and answer session. The workshops were not affiliated with the cities of Providence or Cranston. After gathering stakeholder input at these workshops, DEM will finalize the draft permit and initiate a formal public notice in the late summer or early fall of 2025.

The draft permit responds to petitions filed by Attorney General Peter F. Neronha and the Conservation Law Foundation, urging DEM to act under the federal Clean Water Act to reduce toxic algae blooms, high bacteria, and frequent pond closures in the Mashapaug watershed. Stormwater runoff, rain that does not evaporate or soak into the ground, carries harmful pollutants like fertilizer, pet waste, pesticides, oil, and litter into waterways, fueling harmful algae blooms. The watershed lies in a heavily paved area identified as an environmental justice focus zone disproportionately affected by stormwater pollution.

"This draft permit marks an innovative new approach toward improving long-standing water quality pollution in the Mashapaug watershed," said DEM Director Terry Gray. "DEM is taking action to protect this important urban watershed and supporting nearby environmental justice communities by working collaboratively with property owners to reduce stormwater pollution."

"This is a first step of many toward curbing extensive stormwater pollution, which causes toxic algae blooms in not only these urban freshwater bodies in Cranston and Providence, but also the ponds in Roger Williams Park and ultimately Narragansett Bay," said Mr. Neronha. "At its core, this permitting system will prioritize protecting our natural resources from further unmitigated contamination, thereby protecting the health and safety of Rhode Islanders and our precious natural resources."

WEF research reveals $47 billion opportunity in circular water economy

– WEF.org press release

Water demand is rising, and fast. With the population in the United States projected to grow by 40 million people by 2050, expanding industries and the digital economy are placing unprecedented pressure on our freshwater supplies. Climate change and aging infrastructure are compounding the challenge.

Today, 20 percent of treated drinking water is lost before it reaches customers, representing billions in wasted resources. Meanwhile, wastewater contains 5 times more energy than is needed to treat it, yet fewer than 10 percent of U.S. facilities recover biogas.

The solution? A shift from a linear to a circular approach to water. A circular water economy reimagines how we manage water, focusing on the following:

- Reducing waste and inefficiency
- Recovering nutrients, energy, and water
- Regenerating natural ecosystems

This approach treats water as a renewable resource, using advanced technologies to reduce pollution and close water loops across industrial, agricultural, and municipal systems.

But circularity is more than just being environmentally responsible, it's smart economics. According to research from WEF, a national shift to circular water practices could unlock up to $47 billion annually in direct economic value for U.S. water utilities and municipalities:

- $28 billion from leak detection, water reuse, and efficiency upgrades
- $12 billion from capturing nutrients, biogas, and biosolids
- $6.5 billion from managed aquifer recharge and green infrastructure

"This is a critical moment for rethinking how we manage water," said Ralph Erik Exton, executive director of WEF. "Circular water systems are already proving effective in places like Loudoun Water, East Bay Municipal Utility District, and Orange County. There's more economic value to realize, and we're committed to leading this transformation with our industry partners."

Innovative generative AI research project

– WEF.org press release

The American Water Works Association (AWWA), in collaboration with WEF, The Water Research Foundation (WRF), and Karmous Edwards Consulting (KEC), launched a project earlier this year on the role of generative AI (GenAI) for the global water sector.

The research will establish a foundational understanding of GenAI's role for water utilities, develop and share best practices and case studies for GenAI applications in water, and establish a research road map for advancing future applications of this innovative technology in the water sector.

"Generative AI is a game changer that will transform the water community in ways we cannot yet fully imagine," said AWWA CEO David LaFrance. "The project team will lay the foundation to bring unimagined possibilities into our daily strategic operations."

Including a diverse group of global water utilities—including utilities from South Korea and the United Kingdom—the project will explore the application of GenAI to address critical water sector challenges, such as infrastructure management, water resource and environmental resilience, and public engagement and understanding of the value of water.

"While digital transformation of the water sector has been underway for several years, the emergence of GenAI technologies represents a significant opportunity to further transform the water sector by providing powerful, accessible solutions for utilities of all sizes," said WEF Executive Director Ralph Exton.

The ability of GenAI to analyze and generate insights from vast datasets—both structured and unstructured—can help utilities uncover trends, optimize resource allocation, and support data-driven decision-making at all levels and in all roles. Significantly, GenAI could augment human resources rather than replace them, enabling water sector professionals to focus on higher-value tasks, make more informed decisions, and drive innovation.

Project outcomes will define new approaches to leverage GenAI technologies, mitigate risks, and advance digital transformation in the water sector to enhance utility capacity to address current and future water challenges.

"This exciting project will gather insights and lessons learned from utilities who already have experience implementing GenAI strategies," said WRF CEO Dr. Peter Grevatt. "These case studies will help others across the water sector see the potential associated with the use of these new tools, while demonstrating how to pursue secure experimentation, thereby mitigating the cybersecurity concerns sometimes associated with GenAI." Project results will be available in late 2025.

Strategic vision, lasting impact: Westford's holistic approach to stormwater success

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PAUL STARRATT, PE, Town of Westford, Massachusetts
JEREMY DOWNS, PE, Town of Westford, Massachusetts

ABSTRACT | A suburban, MetroWest town in the Boston area made its long-term strategic vision for stormwater a reality. Westford did so by making the most of a 2013 Stormwater Management Master Plan appropriation and other grants to transform its minimalist stormwater program into a sustainable stormwater utility prepared for the future. The town took advantage of the respite between the 2003 and 2016 EPA stormwater permits to build an inventory of stormwater assets, prioritize critical drainage infrastructure and culvert replacement projects, and develop a plan to fund improvements. Other municipalities can follow this model to adopt a more sustainable, holistic approach to stormwater management with community support.

KEYWORDS | MS4, public outreach, stormwater utility, water quality, asset management, capital planning

Westford, Massachusetts, is a picturesque New England town in Middlesex County about 35 miles (56 km) northwest of Boston. With a population of nearly 25,000, Westford is known for its family-friendly character, access to nature and outdoor open spaces, excellent public schools, and blend of rural charm and thriving commercial corridors. Westford has abundant water resources and wetlands and lies within two watersheds—Stony Brook (part of the Merrimack River watershed) and Nashoba Brook (part of the Sudbury River watershed).

Watershed stewardship has long been a priority for Westford, and at the 2013 Annual Town Meeting, the town engineer and highway superintendent made the case to residents for a Stormwater Management Master Plan (SWMMP). At the time, Westford was 10 years into implementing EPA's National Pollutant Discharge Elimination System (NPDES) Small Municipal Separate Storm Sewer Systems (MS4) General Permit. EPA was in the long process of reissuing this permit, which expired in 2008 but was administratively continued. Initial drafts of the new permit and communications from EPA made it clear that the reissued permit would include enhanced requirements to advance Clean Water Act goals that would require much more municipal funding and staff time.

Whereas some communities scaled back municipal stormwater activities and expenditures while they waited for the reissued permit, Westford's Engineering Department redoubled its efforts and began planning to transform the town's future stormwater program. Water resources protection is important to Westford's residents for quality of life and the character of the town. Residents value the water-rich scenic landscape and appreciate the abundant wildlife in the local lakes and streams and the surrounding area. In 2013, there was an increasing awareness in the town that nonpoint source pollution is a threat to local waterbodies, and closures at the swimming beach for bacteria and algal blooms had further brought attention to human contributions to water pollution. Additionally, Westford provides residents and businesses with public water supplied from their groundwater wells, so aquifer protection in the Stony Brook watershed is important to the stormwater program. Through public outreach and the cooperation of multiple town departments, residents voted to move forward with the $300,000 appropriation for an SWMMP that would integrate Small MS4 program compliance, drainage capital improvements, and operation and maintenance of drainage infrastructure.

Most important, the Engineering Department recognized that without sustainable, dedicated funding, SWMMP goals could never be achieved. The SWMMP's education and outreach program would pave the way to a stormwater utility and support for a more sustainable stormwater program.

Stormwater Management Master Plan Volumes 1–4

ELEMENTS OF THE MASTER PLAN

The SWMMP aimed to address various challenges with stormwater management. Its goals included the following:

- Preserve the water quality of lakes and streams for public health, recreation, and wildlife habitat
- Provide a sustainable high-quality drinking water source for residents and businesses
- Operate and maintain Westford's drainage system, which comprises 59 mi (95 km) of drainpipes, approximately 5,100 drainage structures (like catch basins and maintenance holes), 530 outfalls, 150 miles (241 km) of publicly maintained roadways, and almost 200 culverts, as well as dams, stormwater treatment facilities, and natural drainage conveyances
- Comply with federal and state environmental regulations, such as the NPDES permits, Massachusetts Stormwater Management Standards, Massachusetts Wetlands Protection Act, Total Maximum Daily Load (TMDL) provisions of the Clean Water Act, and the Safe Drinking Water Act
- Implement a program that aligns with the town's natural and financial resources
- Identify a long-term funding strategy

The SWMMP is organized into four volumes.

Volume 1, the **Stormwater Assessment**, summarizes current and future conditions (e.g., demographics, land use, water resources) in Westford, the current and anticipated future MS4 program, infrastructure needs, and operations and maintenance. This volume also describes Westford's drivers for an enhanced stormwater program.

Volume 2, the **Long-term Capital Improvement Plan** (CIP), includes prioritization of capital projects to address identified drainage and/or water quality needs, recommendations for additional investigation of stormwater infrastructure, and recommendations for buying equipment and hiring additional staff. This plan incorporates projects and priorities in Westford (such as roadway projects, water system projects, and facilities upgrades) that may enable strategic and cost-effective add-on drainage improvements. A menu of stormwater treatment practices that best meet water quality challenges is presented, which can inform future town projects and also be used to advise local developers during design and permitting for private projects. The Long-Term CIP includes an implementation schedule and an opinion of probable costs.

Volume 3, the **Operation & Maintenance (O&M) Plan**, includes an inventory of municipal facilities and operations. For the town's routine activities, this plan includes town-wide and site-specific standard operating procedures (SOPs) consistent with Massachusetts Department of Environmental Protection (MassDEP) and EPA guidelines for town staff to follow. The goal is to reduce pollutants in stormwater runoff. SOPs are presented in fact sheets that can be easily accessed or carried by staff responsible for operations, in some cases at various facilities.

Volume 4, the **NPDES Stormwater Program Compliance Plan**, is equivalent to the written Stormwater Management Program required to satisfy EPA's 2016 Massachusetts Small MS4 General Permit. This plan documents the Best Management Practices the town will implement to comply with the six minimum control measures (MCMs) within the timeline specified in the reissued General Permit.

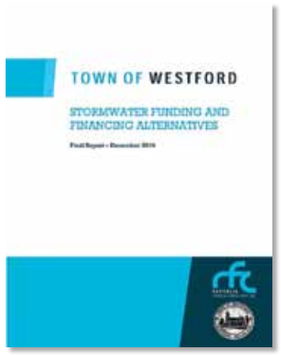
MAKING THE CASE FOR STORMWATER: PUBLIC EDUCATION AND OUTREACH

Master planning process provided an opportunity for timely and meaningful public outreach to residents, businesses, town boards, and committees, key opinion leaders and decision-makers, and other stakeholders. The SWMMP had to reflect the community's goals, opportunities, and challenges. Likewise, the public had to understand the value and

The SWMMP logo. An engaged audience at the 2014 Westford Strategic Planning Retreat. Retreat educational materials.

benefits of improved stormwater management and the cost to implement the SWMMP.

Much of the plan development was driven by the stormwater advisory group (SwAG), comprising 11 members of the community and town staff, selected to oversee the project from various perspectives. The group initially met to review and comment on the project scope and met at project milestones to discuss progress, review work products, and provide guidance before presenting information to the select board or public. A logo and branding were developed for the SWMMP and for use on other stormwater outreach materials to unify the stormwater messaging. This resulted in a straightforward message that connects with Westford residents: "Clean water begins with YOU."



The full SWMMP, educational materials, and funding and financial alternatives can be found at westfordma.gov/339/Managing-Our-Stormwater

A public involvement and education program is essential to engage stakeholders from the start. Transparency builds trust and leads to public support. One of the most important functions of the SWMMP is to provide the public with the data and information needed to appreciate the value of protecting natural resources. Public outreach for the SWMMP included the following:

- Messages targeted to key audiences compelling calls to action that resonate with each audience
- Outreach at strategic project milestones to stakeholders and participants who expressed interest in the planning process
- A project webpage on the town website, which allowed questions or comments, and included SWMMP and stormwater management educational materials
- Customized print materials for distribution at meetings and community gathering places
- Updates at public meetings, including the 2014 Strategic Planning Retreat, which included a workshop to facilitate feedback on the SWMMP and protecting and improving Westford's water resources
- Press outreach, including town newsletters and coordination with Westford Community Access Television (WestfordCAT) to record public meetings and provide educational information about the SWMMP and stormwater fee, as well as emphasizing why stormwater and drainage infrastructure matters

The outreach throughout the SWMMP laid the foundation for additional communication necessary to win support for a stormwater utility.

REVEALING THE UNSEEN COSTS OF STORMWATER MANAGEMENT

As part of the SWMMP, Westford explored current costs and future scenarios for the stormwater program. An assessment of the town's current spending on stormwater, including drainage system O&M, capital improvement projects, staff time, and program administration and compliance, revealed that the town spent an average of about $600,000 annually. When an enterprise fund is not in place, stormwater expenditures are woven into many line items under multiple departments' operations and capital budgets and, when the expenditures were compiled as part of this exercise, people were surprised by the amount being spent on stormwater. Over $500,000 felt like an "invisible cost" for a service that many considered free.

Projected revenue needed to support the town's program goals and compliance with the reissued Small MS4 General Permit was also evaluated and determined to be closer to $1.5 million. The choice between supplementing existing funding (e.g., General Fund supported by property taxes) or changing to a new funding methodology (e.g., stormwater fee) was evaluated.

It was determined that creation of a stormwater fee would help Westford meet the increased financial demands of all aspects of the program while being the most fair, transparent, and flexible. Stormwater fees are tied directly to a property's characteristics, most commonly impervious area (e.g., driveways, parking lots, and roofs where rainfall and snowmelt cannot infiltrate into the soil and aquifers), which drive stormwater management impacts and costs. The SwAG and town leadership understood the advantages of a system where properties with more impervious area are assessed a higher fee. Likewise, a credit policy was compelling to allow customers to reduce their fee by improving their property in ways that reduce stormwater runoff and pollution.

Westford's drainage infrastructure was in good condition except the oldest areas and corrugated metal pipe

EXPANDING THE SWMMP WITH GRANTS

During the multi-year SWMMP process, two grant-funded supplemental projects were identified that strengthened and supported the SWMMP, backed by a Massachusetts Water Infrastructure Planning and Technical Assistance Grant and a federal Section 319 Nonpoint Source Grant.

Water Infrastructure Planning and Technical Assistance Grant

Early in developing the drainage system long-term CIP and O&M elements of the SWMMP, unmapped drainage infrastructure (largely for subdivisions), and a lack of drainage system attributes (i.e., age, material, size, condition) in the town's geodatabase were discovered, making a true asset management approach impossible at that time.

Leveraging part of the original SWMMP appropriation as cash match, Westford was awarded $30,000 of additional funds in 2015 through the MassDEP Water Infrastructure Planning and Technical Assistance Grant program to enhance the SWMMP scope of work and budget to align the SWMMP with Good Engineering Practices for Asset Management. The grant allowed the town to add drain system mapping and attributes from record plans from representative areas and decades. A cost-effective rapid assessment approach was used to correlate field observations of drainage structure and pipe conditions, using zoom camera pipe inspection, to mapped attributes (e.g., age, material, size). This allowed drainage system condition, O&M needs, and risk of failure to be characterized. Zoom camera inspections revealed that the condition of Westford's drainage infrastructure was good except for the oldest drainage areas and corrugated metal pipe; these areas needed additional assessment.

Westford improved the SWMMP, particularly the CIP and budget forecast, by extrapolating condition information to town-wide drainage infrastructure and prioritizing improvements to critical assets.

Section 319 Nonpoint Source Grant

When the stormwater funding and financing alternatives were presented to the stormwater advisory group and the select board in 2016, there was support to continue with the outreach and analysis to pursue a stormwater utility. In 2018, Westford received an EPA 319 grant for $99,982 that allowed the following: the refinement of the program revenue needs; development of a rate structure, rates, and billing mechanics; continued input from town leadership; expansion of the SWMMP's public education and outreach; and preparation for billing once the utility was approved.

FUNDING THE SWMMP: "FAILURE IS NOT FATAL"

At the beginning of the SWMMP in 2014, only a handful of stormwater utilities in New England existed. By the time the Section 319 Nonpoint Source Grant began, this concept was slowly gaining traction with Massachusetts communities subject to the reissued Small MS4 General Permit that went into effect in 2017.

With the same SwAG, Westford forged ahead with the SWMMP recommendation to pursue a stormwater utility. To advance the stormwater utility, the town significantly increased public outreach, particularly with select board and Finance Committee public meetings to develop and refine a stormwater rate structure and detailed budget for the 2019 Annual Town Meeting.

Despite the five-year educational campaign, stakeholder workshops, and public discussions, the initial attempt to adopt a stormwater enterprise fund narrowly failed at Town Meeting. Typically, if a stormwater utility is voted down, it takes years before it is possible to try to convince the public again.

This was not the case for Westford. The select board and Engineering Department tried again at Special Town Meeting that same year. The select board chair championed the issue, and she worked with WestfordCAT to create a video that addressed public concerns. She explained the stormwater utility and related articles in easy-to-understand terms that resonated with voters. This video ran on local cable and was played at Special Town Meeting. Engineering, Highway, and the Tax Collector's office created a long-form video for local cable. This video offered a hands-on visual tour of the stormwater management program and some of the impacts that

WestfordCAT produced and aired two videos that were instrumental in educating residents about stormwater management and its impacts on the environment and the town budget. Pictured above: Paul Starratt, town engineer, in the Stormwater Matters video and Elizabeth Almeida, select board chair, in a review of stormwater articles 6 and 7 for the 2019 Special Town Meeting.

it has to the environment and the town budget, all explained by familiar town employees. Concurrently, the select board settled on a rate structure and rates and published a web application so all property owners could look up their properties and stormwater fees before credits.

The stormwater enterprise fund was adopted at the 2019 Special Town Meeting. The success of this initiative can be attributed to the increased communication and transparency, as well as the recommendation of a trusted champion on the select board and a revised message that resonated with the community.

FROM PLANNING TO PROGRESS

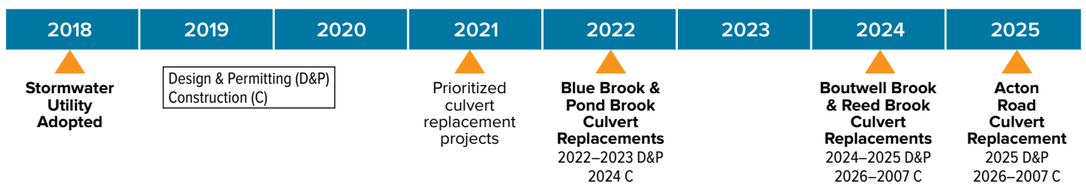
Once the stormwater enterprise and rates were adopted, Westford had the revenue to implement the SWMMP recommendations.

Culvert Assessment a Priority

The SWMMP revealed an obvious lack of usable information about the town's culverts. Yet with this limited information, more than half of the projected cost increases in the five-year SWMMP plan were due to the need to proactively fund and implement capital improvements of drainage infrastructure, particularly culverts. Immediately following the SWMMP and prior to the stormwater utility, the town secured capital funding for a town-wide culvert assessment to map and inspect culverts and then prioritize repairs and replacements. This work began in 2020.

Westford is not alone in seeking an affordable way to manage a vast network of aging culverts. In fiscal year 2019 the Commonwealth of Massachusetts convened the culverts and small bridges working group and prepared a report to the Massachusetts Legislature in September 2020. Many of the state's culverts and bridges have reached, or will soon reach, the end of their designed service life. To compound the issue, many of the state's culverts and small bridges were constructed in the 1950s and 1960s using the stream flow data of the time and before modern environmental regulations. Not only are many of the state's culverts and small bridges undersized and/or failing, but they also do not meet the Massachusetts River and Stream Crossing Standards. Likewise, climate change predictions include increases in both the frequency of severe weather and the amount of precipitation; New England is already experiencing these changes, putting many culverts and small bridges at risk.

While the SWMMP included recommendations to address culverts known to be in poor condition or prone to flooding, more work was needed to understand the characteristics of the mapped culverts in Westford to account for maintaining this vital part of the drainage infrastructure. The work included the following objectives:



Westford took immediate action to address critical culverts throughout town that were identified in the Culvert Inventory and Asset Management Program and has replaced two culverts in the past five years, with another three currently being designed. Using the annual stormwater utility operating budget, the town also replaced other smaller pipe culverts in poor condition.

Pond Brook culvert, pre-construction (April 2022) and post-construction (August 2024)

- Improve the inventory of all culverts, including location, size, material, condition, ownership, and other attributes, and complete a desktop assessment to identify potential locations of unmapped culverts that should be added to the inventory
- Complete an initial inspection of nearly 200 town-owned culverts while establishing a consistent methodology and evaluation criteria for future inspections, and update the inventory with field observations using online geographic information system (GIS) software, providing the town with an updated GIS geodatabase at the end of the project
- Prepare a risk-based culvert asset management program with criticality ratings (i.e., potential for failure, including beaver activity and other maintenance issues, and the risk of failure) to protect public health, safety, and personal property
- Provide an opinion of probable cost for replacement and/or repair of high-priority culverts and conceptual recommendations as well as recommendations for maintenance and ongoing inspections

The Culvert Inventory and Asset Management Program report provided Westford with a road map for ongoing inspections, maintenance, replacement, and repair of stream crossings in town. This study has afforded the town the following capabilities:

- Respond to public complaints about flooding related to stream crossings with accurate location, condition, and ownership information
- Work more closely with the Conservation Commission on culvert replacements, since they may not always approve emergency work
- Understand high-priority culverts for replacement, repair, enhanced monitoring, and maintenance as well as work that the Highway Department could complete in-house
- Present a more detailed budget to the Capital Planning Committee, select board, and residents justifying annual culvert-related expenditures

Since the stormwater utility went live in fiscal year 2021, Westford has built sufficient reserves to fund larger capital projects, including the prioritized culvert and drainage replacement projects identified throughout the SWMMP and culvert assessment planning. Proactively replacing culverts, and sizing them to meet the Massachusetts River and Stream Crossing Standards, enables the new culverts to pass large storm events that are more severe due to climate change and reduce local inland flooding. The town has phased funding design, permitting, and construction of five culvert replacement projects from 2021 through today. This phased approach to culvert replacement projects allows Westford to strategically construct a replacement project each year while completing design and permitting of the next. Completing these large, expensive projects every year is only possible due to the planning completed as part of the SWMMP and the revenue from the stormwater fee.

Staff Capacity

Integral to implementing an SWMMP is having staff to support it. With the stormwater utility, the town increased the annual budget available for stormwater; it can be challenging to immediately ramp up project execution and oversight without additional staff capacity. The SWMMP recommended hiring additional Engineering Department staff, which was added to the annual stormwater utility budget. The town also hired a new staff engineer in 2024. The engineer helps implement the stormwater program, including completing field inspections, maintaining the asset inventories and GIS mapping, reviewing plans and applications for stormwater management permits, and assisting with SWPPP compliance and the MS4 permit.

Capital Purchases and Projects

Funding is always a roadblock to capital improvements, but the stormwater utility has provided Westford with a funding source that reduces the need for some of the capital required for typical projects and purchases. When designing a sidewalk project, for example, the cost of drainage infrastructure can be paid for through

the stormwater utility to reduce the capital request for the project. Westford is also building money into the stormwater budget for larger purchases like a vacuum truck or sweeper.

Focus on Improved Data Management

Since 2013, Westford has invested significant time and resources into a stormwater asset management program and associated systems. As policies and practices are refined through execution, the town is using the data to update asset prioritization and identify upcoming projects to maintain the stormwater system. GIS tools such as dashboards and online field survey forms provide user-friendly data and can be used during daily operations for Engineering and Highway Department staff. Maintaining a complete stormwater geodatabase is a work in progress and will continue to be a priority for the Engineering Department.

The data collected throughout the Stormwater Management Master Plan process has allowed the town to make informed decisions about capital investments and maintenance strategies. The dashboard and online field forms have allowed field crews to maintain the database and keep infrastructure information up to date.

CONCLUSION

Westford's Stormwater Management Master Plan can be a blueprint for other communities. Town leadership and a long-range vision for this plan transformed Westford's stormwater program into a proactive, sustainable, and cost-effective program that addresses the community's expectations for water quality, environmental stewardship, and public safety. The biggest challenge was not technical; it was building consensus and political support for the future of the stormwater program that required a dedicated source of revenue. Communities can learn from Westford's approach to education, outreach, and public engagement as well as its patience and perseverance to stay the course. The town is well on its way to putting the SWMMP into action and ready for the next phase of EPA's Small MS4 General Permit and a more resilient drainage system.

ACKNOWLEDGMENTS

The authors acknowledge Westford's stormwater advisory group and our project partners, Keith Readling and Jennifer Tavantzis from Raftelis and Kate Barrett previously from Regina Villa Associates. Synergy Systems & Services was also instrumental during the 319 grant project to refine the impervious area and associated fee per parcel.

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Paul and Jeremy were recognized with a New England Stormy Award in 2016 for more than a decade of the Living Labs program in which they educated all Day Elementary School fifth-grade students about stormwater management.

Recommendations for an alternative phosphorus credit method for catch basin cleaning

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MAX ROME, Charles River Watershed Association, Boston, Massachusetts

ABSTRACT | Catch basin cleaning is a vital non-structural strategy for reducing nutrient pollution from municipal stormwater discharges to natural water bodies. Massachusetts communities with phosphorus reduction requirements in their MS4 permits depend on phosphorus credits to meet regulatory requirements, but existing credits for this work are small. Data collected by the Town of Brookline revealed that the current crediting method—based on desktop modeling—underestimates phosphorus removal. In response, a 2025 study evaluated an alternative, measurement-based crediting approach that aligns with the methodology used in the Chesapeake Bay TMDL (total maximum daily load), the largest nutrient reduction program in the country. This measured approach, which credits phosphorus mitigation based on the mass of sediment removed, could significantly increase the credit available to communities and incentivize municipal focus on consistent catch basin maintenance.

KEYWORDS | Stormwater, MS4 permit, phosphorus TMDL, phosphorus control plans, catch basin cleaning

Phosphorus total maximum daily loads (TMDLs) have been developed for several waterbodies in Massachusetts, including the Charles River and numerous lakes and ponds. The Massachusetts 2016 General MS4 Permit requires that permittees that discharge to these waterbodies develop phosphorus control plans to reduce the phosphorus load in their stormwater discharges. To track compliance with the reduction targets, the permit established credits for different structural and non-structural Best Management Practices (BMPs), including catch basin cleaning.

Catch basin cleaning credits in Massachusetts are calculated through a desktop analysis based on modeling-derived factors. This method is referred to as a *modeled* approach. In contrast, other regions in the United States use a *measured* approach, which calculates credits based on quantifying the amount of catch basin sediments removed. One example is the Chesapeake Bay TMDL—the largest phosphorus TMDL in the country—which employs the measured approach to credit calculations.

In 2022, Brookline measured the phosphorus removed by its catch basin cleaning program and determined the credit available under the permit significantly underestimated phosphorus reduction (Brown and Caldwell, August 2024). The disparity may extend to other communities as well. Given the challenges with the permit's phosphorus control plan requirements, it is important that permittees receive credits that accurately reflect reductions in phosphorus entering receiving waters. Aligning credits with performance will enable permittees to design and implement the most cost-effective phosphorus control strategies.

A measured catch basin cleaning credit could improve compliance with the permit and incentivize permittees to further optimize their catch basin cleaning programs. In response, the Alternative Catch Basin Cleaning Phosphorus Reduction Credit Evaluation Study evaluated an alternative, measured phosphorus credit for catch basin cleaning in Massachusetts.

APPROACH

A Technical Advisory Committee (TAC) was assembled to guide the study. Similar to a mini-expert panel, the TAC comprised stormwater and engineering professionals with various backgrounds and perspectives. It included Jamie Houle, the director of the University of New Hampshire Stormwater Center (UNHSC); Mark Voorhees, a former EPA permit writer who developed the permit's phosphorus control plan requirements and currently works for the UNHSC; Max Rome, the Charles River watershed's stormwater program manager; Maria Rose, chair of the Massachusetts Statewide Municipal Stormwater Coalition and Brookline's stormwater engineer; and Bob Winn, Waltham's city engineer. EPA Region 1 staff were also invited to join the TAC, but the invitation was declined. The study was funded by a MassDEP MS4 Municipal Assistance Grant.

The study included a literature review, sampling of catch basin sediments from communities in the Charles River watershed, and a series of workshops. Four workshops were conducted with the TAC to evaluate the alternative catch basin cleaning credit and to review the study's catch basin sediment data. An additional workshop was held with Charles River watershed communities to discuss potential issues to implement an alternative catch basin cleaning credit.

The study's findings and the TACs recommendations were documented in a White Paper (Brown and Caldwell, June 2025).

Catch basin cleaning

REGULATIONS

The 2016 Massachusetts MS4 General Permit established phosphorus control requirements for permittees that discharge stormwater to waterbodies with a phosphorus TMDL. These permittees include communities within the Charles River watershed and communities that discharge stormwater to 78 lakes and ponds in Massachusetts. Each permittee was assigned a phosphorus reduction target. To achieve the necessary phosphorus reductions, each permittee must develop a phosphorous control plan (PCP) and fully implement the PCP within 20 years of the permit effective date.

The PCP outlines the permittee's strategy to implement BMPs for reducing phosphorus loads and holds the permittee accountable to a three-phase schedule for design and implementation. Appendix F of the permit provides phosphorus removal credits for specific structural and non-structural BMPs. Structural BMPs are permanent installations or physical alterations to the landscape (e.g., disconnection of impervious cover) that remove phosphorus through processes such as infiltration, sedimentation, or filtration. Examples include bioretention cells, constructed wetlands, infiltration basins, green roofs, and detention ponds. Nonstructural BMPs reduce phosphorus discharges through operational or planning changes rather than physical infrastructure. Examples include street sweeping and catch basin cleaning.

The permit established a phosphorus reduction credit for catch basin cleaning based on a "modeled" approach. To qualify for the credit, permittees must remove enough sediment from catch basins semi-annually to maintain at least 50 percent of full sump capacity throughout the year. Under this credit, communities with qualifying catch basin cleaning programs are eligible for a phosphorus reduction credit equal to 2 percent of the phosphorus load received by the catch basins.

The permit includes a provision that allows permittees to seek an alternative method for calculating credits as described in Appendix F, Attachment 2 of the permit:

> EPA will consider alternative methods and/or nutrient reduction factors, provided that the permittee submits adequate supporting documentation to EPA. At a minimum, supporting documentation shall consist of a description of the proposed method, the technical basis of the method, identification of alternative nutrient reduction factors, supporting calculations, and identification of references and sources of information that support the use of the alternative method and/or factors in the Watershed. If EPA determines that the alternative methods and/or factors are not adequately supported, EPA will notify the permittee and the permittee may receive no nutrient reduction credit other than a reduction credit calculated by the permittee following the methods in this attachment for the identified practices.

Table 1. Catch basin sediment data summary

Parameter	Mean	Standard Deviation	Coefficient of Variation[1]
Total solids (percentage of wet sediments)	67.8	9.2	13%
Total phosphorus (percentage of dry sediments)	0.053	0.018	33%
Total phosphorus[2] (lb TP/ton wet sediment)	0.72	0.24	33%
Bulk density (lb dry sediment/ft^3 wet sediment)	45.1	11.0	24%

1. Standard deviation/mean.
2. (Total solids [percentage of wet sediments] / 100 x Total phosphorus [percentage dry sediments] / 100) /2,000.

NATIONAL CATCH BASIN CLEANING PHOSPHORUS CREDIT PROGRAMS

This study reviewed national catch basin cleaning phosphorus credit programs. It benefited from previous literature reviews by Tetra Tech in 2020 (Tetra Tech, March 2020) and the UNHSC in 2024 (UNHSC, March 2024). These reviews identified and summarized catch basin cleaning credit programs across the country.

The reviews identified four states in New England with catch basin cleaning credit programs: Massachusetts, New Hampshire, Vermont, and Rhode Island. Except for Rhode Island, these states use a model-based approach to calculate catch basin cleaning credits. The reviews also identified catch basin cleaning credit systems in other states, including those subject to the Chesapeake Bay TMDL (Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia), North Carolina, and Florida. All these states use a measured approach.

The measured approach bases the phosphorus credit on the amount of catch basin sediments physically removed annually. The method typically requires weighing the removed material to determine the credit amount. In some crediting systems, however, volume-based measurements may be accepted as alternative to weight-based calculations.

The Chesapeake Bay TMDL credit system illustrates a measured credit system. An expert panel developed it through a rigorous evaluation process. The credit system is documented in the report, entitled Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices (Donner et al, 2016).

The Chesapeake Bay catch basin cleaning credit is calculated as follows:

1. Measure the mass of solids/organic matter that is effectively captured and properly disposed by the catch basin/storm drain cleaning practice annually.
2. Convert the initial wet mass captured into dry weight. The following default factors can be used to convert wet mass to dry weight in the absence of local data. The conversion factors are 0.7 for wet catch basin sediments and 0.2 for organic matter.
3. Multiply the dry weight mass by the default nutrient enrichment factor 0.0006 or 0.0012, depending on whether the material captured is catch basin sediment or organic, respectively.

For example, the phosphorus contained in 2,000 lbs (907.2 kg) of catch basin sediments would be calculated as follows: 2,000 lb (907.2 kg) x 0.7 x 0.0006 = 0.84 lb (0.38 kg).

The catch basin cleaning credit in other states with measured approaches are similar, though some allow the credit to be based on volumes, too (the volumes are multiplied by a bulk density factor to convert the wet volume of sediments to a dry mass).

SAMPLING PROGRAM

The measured approach relies on two conversion factors to estimate phosphorus content from wet catch basin sediments (or volumes), as discussed above. One factor converts the wet sediment weight to dry sediment weight, and the second conversion factor converts the dry sediment weight to the weight of the phosphorus. The Chesapeake Bay TMDL credit system developed its conversion factors by reviewing catch basin sediment measurements in the literature. This study performed measurements to determine appropriate conversion factors for catch basin sediments in Massachusetts.

The sampling program collected four rounds of samples from five communities in the Charles River watershed. Samples were collected from catch basin sediment stockpiles. The following measurements were performed:

- Total solids (percentage of wet sediments)
- Total phosphorus (percentage of dry sediments)
- Bulk density (lb dry sediment/ft^3 wet sediment)

In addition, total phosphorus (lb TP/ton wet sediment) was calculated by multiplying total solids (percentage of wet sediments) by TP (percentage of dry sediments) and dividing by 2,000.

Figure 1 provides plots of the data collected by the sampling program. The mean is shown as the dashed lines in the boxes. The boxes represent the interquartile range, which contains 50 percent of the data. The whiskers extend to the most extreme data points that are not considered outliers. Table 1 provides a statistical summary of the measured (and calculated) quantities.

The catch basin sediment data collected by this study was compared to the source data used to develop the Chesapeake Bay TMDL credit as shown in Table 2. This comparison was to understand the consistency of local data with the well-established Chesapeake Bay TMDL credit system conversion factors.

This study measured a mean total solids value of 68 percent, which is close to the 70 percent value used by the Chesapeake Bay TMDL credit program for BMP and catch basin sediments. The mean TP (percentage of dry sediments) measured by this study was 0.053, close to the value of 0.06 used by the Chesapeake Bay TMDL credit. Figure 2 *(next page)* compares TP source data to develop the Chesapeake Bay TMDL credit and the data collected in this study. An analysis of variance (ANOVA) on the two datasets found no statistically significant difference between their mean values. The results suggest that the phosphorus content measured in Massachusetts catch basin sediments is consistent with the values in the Chesapeake Bay TMDL crediting framework.

The wet sediment to phosphorus conversion factors (lb TP/ton wet sediment) were calculated using the source data from the Chesapeake Bay TMDL. Those values were then compared to the ones from this study. Measurements of total solids were not available for the set of samples that the Chesapeake Bay TMDL used to develop its TP content (percentage of dry sediments) factor, so a value of 70 percent total solids was assumed for the samples. The two datasets are compared in Figure 3 *(next page)*. An ANOVA test found no statistically significant difference in the means between the two datasets.

In summary, the catch basin data collected by this study data is consistent with the BMP and catch basin sediment data used to develop the Chesapeake Bay credit. This is true for both total solids and TP. These results demonstrate the compatibility of the Chesapeake Bay credit system for permittees in Massachusetts.

CONSIDERATIONS

Throughout the study, the TAC discussed many issues related to catch basin cleaning credits. The following are the results of some of these discussions.

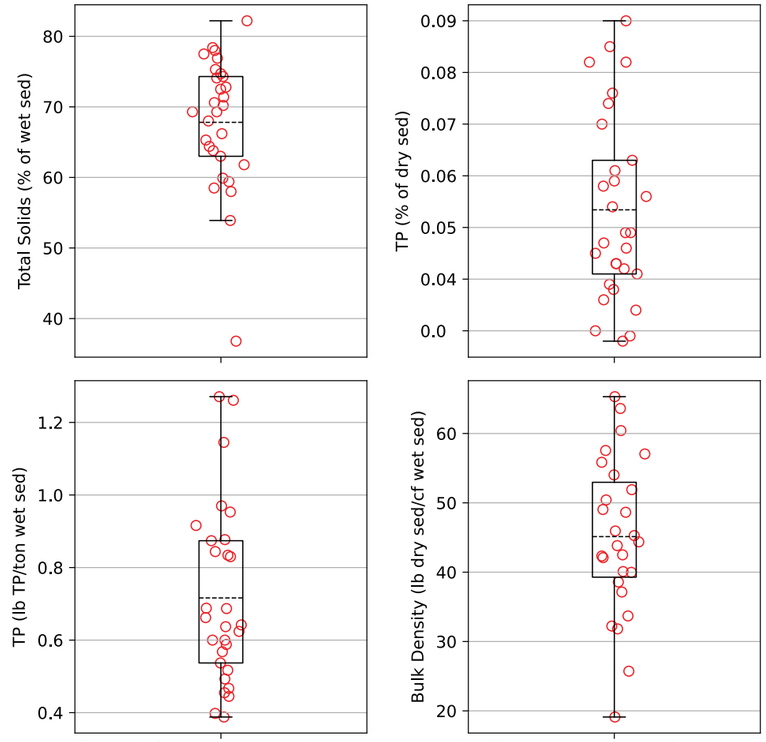

Figure 1. Catch basin sampling program data for 29 samples collected from December 2024 to June 2025 (Dashed line indicates mean)

Table 2. Comparison of catch basin sediment data

Parameter	Chesapeake Bay TMDL[1]	This Study[2]	Percent Difference
Total solids (percentage of wet sediments)	70	68	3%
Total phosphorus (percentage of dry sediments)	0.06	0.053	12%
Total phosphorus[3] (lb TP/ton wet sediment)	0.84	0.72	15%

1. Conversion factors from the Chesapeake Bay TMDL for BMP and catch basin sediments (Donner et al., Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices, Table 19, 2016).
2. Mean values from this study. See Technical Memorandum 1: Catch Basin Sampling Program (Brown and Caldwell, June 2025) for more information.
3. (Total solids [percentage of wet sediments]/100 x Total phosphorus [percentage dry sediments]/100)/2,000.

Accuracy

The TAC concluded that the measured approach adopted by the Chesapeake Bay TMDL (and others like it) accurately estimates the phosphorus removed by catch basin cleaning programs. The TAC found the findings of the expert panel that developed the Chesapeake Bay TMDL credit system credible and defensible. In contrast, the TAC concluded that the permit's modeled approach underestimates the phosphorus removed by permittee programs.

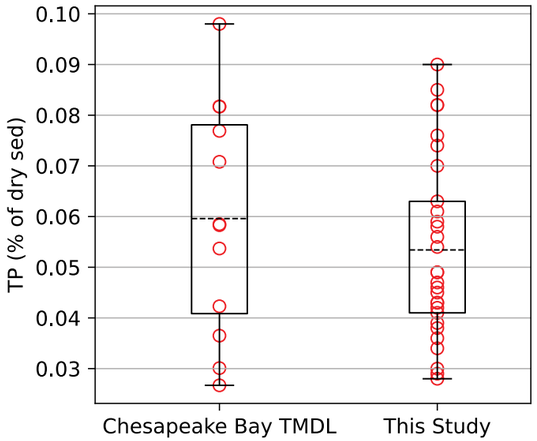

Figure 2. Comparison of percent total phosphorus data
Sources of Chesapeake Bay data: SPU et al, 2009; Law et al, 2008; MWCOG, 1993; Sansalone et al, 2011; Schueler, 1994; Pitt et al, 1984.

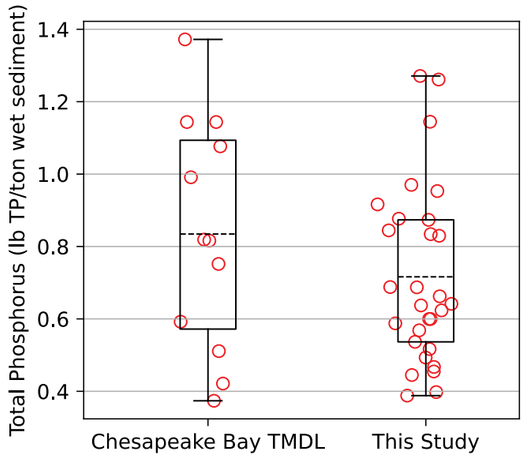

Figure 3. Comparison of wet phosphorus to total phosphorus conversion factors

Appropriateness of Chesapeake Bay TMDL Credit

An expert panel developed the Chesapeake Bay TMDL catch basin cleaning credit. The TAC found the work sound and defensible. The catch basin sediment sampling data from this study aligns well with the data used to develop the Chesapeake Bay TMDL credit. As a result, the TAC concluded that the factors used to calculate the Chesapeake Bay credit would be appropriate for a measured credit in Massachusetts.

Cost-Effectiveness of Phosphorus Removal through Catch Basin Cleaning

Removing phosphorous through catch basin cleaning is cost-effective, especially compared to structural controls. Table 3 shows the costs of Brookline and Waltham's catch basin cleaning programs, and Table 4 shows the cost-effectiveness of their programs. In 2024, the cost of removing a pound of phosphorus through catch basin cleaning was $488 and $535 for Brookline and Waltham, respectively. By comparison, the cost of phosphorus removal through structural BMPs is typically much higher. Table 5 compares the average annual phosphorus removal costs of catch basin cleaning and a typical green infrastructure practice. Assuming that the green infrastructure construction cost is $100,000 to remove 1 lb ($220,500/kg) of phosphorus a year, an annual operation and maintenance cost of 2 percent of the construction cost and useful life of 20 years, the average annual cost of the green infrastructure practice is $7,000/lb TP per year. ($15,435/kg TP per year.). This is about 14 times more expensive than catch basin cleaning. The cost of catch basin cleaning and green infrastructure varies widely, but the conclusion is clear: Catch basin cleaning is cost-effective at removing phosphorus compared to typical structural BMPs.

Table 3. 2024 cost of catch basin cleaning programs (U.S. dollars)

Cost Type	Brookline[1, 3]	Waltham[2, 3]
Labor	100,000	210,000
Equipment	15,667	13,333
Disposal	34,354	34,510
Other	8,000	10,000
Total	158,021	267,843

1. Source: May 29, 2025 Email from Maria Rose to Matt Davis.
2. Source: May 28, 2025 Email from Bob Winn to Matt Davis.
3. Average useful life of trucks assumed to be 15 years.

Table 4. Cost-effectiveness of catch basin cleaning programs

	Brookline	Waltham
Annual Catch Basin Cleaning Cost	$158,021/yr	$267,843/yr
Tons of Catch Basin Sediment Removed[1]	386 tons	596 tons
Phosphorus Removed by Catch Basin Cleaning Program[2]	324 lb TP	535 lb TP
Annual Cost of Phosphorus Removal	$488/lb TP-yr	$535/lb TP-yr

1. Weight of catch basin sediments removed in 2024.
2. Used Chesapeake Bay TMDL credit to estimate phosphorus removal. Pounds of phosphorus removed = tons catch basin sediments x 0.7 x 0.0006 x 2000.

Table 5. Comparing average annual cost of phosphorus removal

Type of Best Management Practice	Annual Cost/lb TP Removed
Catch Basin Cleaning	$511[1]
Green Infrastructure	$7,000[2]

1. Average annual cost of removing a pound of phosphorus through catch basin cleaning in Brookline and Waltham in 2024.
2. Assumptions: Construction cost of $100,000 for a structural stormwater practice that removes 1 lb TP/yr. Annual operation and maintenance cost is 2 percent of the construction cost. 20-year useful life for the stormwater practice. The average annual cost was calculated by dividing the 20-year life cycle cost by 20. Green infrastructure construction costs vary widely but $100,000/lb TP is accepted as a typical value in the Charles River Watershed.

Table 6. Catch basin cleaning credit compared with phosphorus reduction targets for selected communities

Massachusetts Community	Modeled Credit Claimed in Phase 1 Phosphorus Control Plan	Catch Basin Sediments Removed[1] (Reporting Year)	Measured Phosphorus Credit using Chesapeake Bay Credit System	Phosphorus Reduction Requirement[2] (lb/yr)	Measured Phosphorus Credit as Percent of Reduction Requirement
Newton	0.1	539 tons (2024)	453 lb	5,214	9%
Brookline	24	386 tons (2024)	324 lb	2,134	15%
Waltham	43	596 tons (2024)	535 lb	3,869	14%

1. Source: Community Stormwater Annual Reports. The year the reports were submitted is shown in parenthesis.
2. Source: 2016 MA MS4 General permit, Appendix F, Table F-2. Values have been converted from kg/yr to lb/yr.

Incentivization of Additional Catch Basin Cleaning

The TAC believes a measured credit would provide a strong incentive for permittees to further optimize catch basin cleaning programs. This was confirmed in the community outreach workshop facilitated by the study, where 83 percent of the attendees responded that a measured approach would either strongly or very strongly encourage them to further optimize catch basin cleaning programs.

In contrast, the permit credit does not reward permittees for additional cleaning beyond a base threshold. To be eligible for the credit, permittees must maintain a minimum sump storage capacity of 50 percent throughout the year. Permittees that meet this requirement receive a flat credit equal to 2 percent of the phosphorus load (calculated through a desktop analysis) entering the catch basins. There is no incentive in the credit system for permittees to go beyond the minimum cleaning requirements. Removing more catch basin sediments (beyond the minimum threshold) does not translate into more credit.

The measured approach provides a strong incentive for further optimizing catch basin cleaning programs. First, it provides a direct connection between materials removed and the credit: More sediments removed equals more credit received. Second, cost is an important consideration as permittees evaluate strategies to meet phosphorus reduction requirements, and removing phosphorus through catch basin cleaning is much more cost-effective than constructing structural BMPs. The combination of these factors would encourage permittees to further optimize catch basin cleaning programs.

Near-Term Improvements

Permittees have existing catch basin cleaning programs. They (or their contracted service providers) have the staff and equipment to perform catch basin cleaning. With incentives built into a measured credit approach, permittees could quickly scale up their programs. This would reduce phosphorus entering impaired waterbodies in the near term. In contrast, structural BMPs require more time for design and construction, delaying implementation.

Co-Benefits

Selecting stormwater BMPs with multiple benefits, or "co-benefits," offers advantages to the community that go beyond water quality improvements. An important co-benefit of catch basin cleaning is that it can capture sediments that might otherwise deposit in pipes. Buildup of sediments in pipes can reduce stormwater drainage system capacity and increase the risk of localized nuisance flooding. Thus, a catch basin cleaning program not only improves water quality, but it also prevents flooding.

Concerns over Less Focus on Structural BMPs

The TAC discussed the concern that if permittees receive a larger credit for their existing catch basin cleaning programs this could reduce their implementation of structural BMPs. While this may be the case, focusing on a manageable number of structural BMPs, while optimizing and enhancing non-structural control measures, is practical in an era of constrained municipal budgets, Moreover, the measured approach to catch basin cleaning more accurately represents the phosphorus removal achieved by permittees through their investments in these programs.

Table 6 illustrates the size of the modeled and measured credit relative to the phosphorus reduction requirements of several communities. The catch basin sediment removal values were taken from annual stormwater reports submitted by the communities to EPA. The measured credits were calculated using the Chesapeake Bay method. The amount of catch basin sediments removed will vary from year to year, and the measured credit will vary accordingly. For the years shown, the measured credit ranges from 9 to 15 percent of the reduction targets. While the measured credit is much larger

CATCH BASIN CLEANING

than the modeled credit, the communities would still need to pursue other reduction measures to satisfy most of their reduction requirements.

A measured credit is not going to inhibit permittees from pursuing structural BMPs that are cost-effective and implementable; permittees need these structural BMPs to meet their targets. What a measured credit will do, however, is reduce the number of structural BMPs needed that are not cost-effective or are difficult to implement. In addition to retrofits, communities will also continue to reduce phosphorus loads through BMPs implemented through development and redevelopment projects.

RECOMMENDATIONS

Based on the study, the TAC recommended that Massachusetts permittees be allowed to claim a measured credit for their catch basin cleaning programs. The TAC recommends that the credit be calculated using a methodology that borrows from the Chesapeake Bay and Florida credit programs. The study recommendations are documented in its White Paper.

The recommended process for calculating the credit is as follows:

1. Measure the weight of the catch basin sediments that are captured effectively and properly disposed of by the catch basin cleaning practice annually. If weight cannot be measured, volumes can be measured instead.
2. Convert the initial wet weight or volume captured to a dry weight.
3. For weight measurements, multiply the wet weight by 0.7 to calculate the dry weight.
4. For volumetric measurements, multiply the volume by the bulk density of 45 lbs dry sediments/ft^3 (721 kg dry sediments/m^3) of wet sediments.
5. Multiply the dry weight (in pounds) by 0.0006 to calculate the phosphorus credit (in pounds).

When possible, permittees should base their credit calculation on catch basin sediment weight. However, some permittees may not be able to measure weight. In these cases, it is recommended the permittees be allowed to use volumetric measurements instead.

The origin of the conversion factors used in the calculations is discussed below:

- The factor of 0.7 used to convert wet sediment weights to dry sediment weight is the same value used by the Chesapeake Bay credit.
- The bulk density conversion factor of 45 lbs dry sediments/ft^3 (721 kg dry sediments/m^3) is mean value measured by this study (Table 1).
- The factor of 0.0006 used to convert dry sediment weight to phosphorus content is the value used by the Chesapeake Bay credit for BMP and catch basin sediments.

Since measured credits will vary from year to year, the TAC recommended that the credit for a given year be equal to the average credit over the five preceding years. This will help to even out the annual variations in the credit, providing stability to the credit so permittees can plan accordingly to meet reduction requirements. If five preceding years of data are not available, the average should be calculated from the preceding years for which the measured credit was requested.

The TAC recommended EPA incorporate these recommendations into the next Massachusetts MS4 permit. Until the measured catch basin credit is incorporated into the MS4 permit, permittees who want to claim measured credit should do so through the alternative credit process described in the Appendix F, Attachment 2 of the permit. It is recommended that permittees reference the study's White Paper when making the request.

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Boston and Water Sewer Commission's innovative inundation modeling and climate adaptation efforts

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ABSTRACT | Since 2018, when the mayor of Boston asked the Boston Water and Sewer Commission to evaluate the impacts of extreme rainfall in Boston, the Commission has set out not only to perform this analysis, but also to adapt its drainage infrastructure for increasingly intense rain events and high sea levels. During this time, the Commission has built a citywide Inundation Model, created a website that shows users the consequences of flooding with interactive 360 imagery (bwscstormviewer.com), created a dashboard that tabulates critical facilities and residents affected during extreme storm events, and developed conceptual designs to adapt its stormwater infrastructure and residents for higher sea levels. The Commission is now working with the City of Boston and the U.S. Army Corps of Engineers as it continues its stormwater adaptation, updating and expanding its Inundation Model, and building emergency planning tools that will provide near real-time insights based on weather forecasts.

KEYWORDS | Boston, flooding, climate, sea level rise, adaptation, rainfall, modeling, inundation

In 2017, Hurricane Harvey highlighted the severe impacts that extreme storm events can have on coastal urban areas. At that time, the Boston Water and Sewer Commission, which owns and operates the storm drainage system in Boston, had undertaken previous studies to evaluate risks and vulnerabilities due to climate change. It had not, however, evaluated where, when, and how flooding would occur if intense rainfall occurred coincidentally with higher sea levels. Similarly, other agencies had conducted analyses to characterize coastal flooding in Boston, but they did not consider rainfall or the interaction of the Commission's storm drainage system.

Therefore, in the wake of the Hurricane Harvey disaster, the Commission sought to develop a citywide 2D model (the Inundation Model) that would predict inundation from both coastal events *and* from intense rain events occurring at the same time. Developing such a model would allow the Commission not only to characterize how its system performed under extreme conditions, but also to answer a key question posed by the mayor: "What would happen if a storm like Hurricane Harvey hit Boston?"

The Inundation Model advanced previous modeling in Boston as follows:

- Instead of using "off the shelf" design storms for rainfall, the Commission analyzed over 80 years of rainfall data from Logan Airport along with radar data to develop four Gauge Adjusted Radar Rainfall (GARR) events that accurately represent Boston-specific rainfall patterns, including distribution of rain over time as well as speed and direction. As a result, the Commission was able to conduct simulations with events representing cloudburst-type storms (those which have recently wrought havoc in New York City and throughout the Northeast), nor'easters, tropical storms (hurricanes), and slower moving "frontal" events. Each of these storm types results in different patterns of flooding and stresses on different parts of the Commission's system. For example, a tropical storm event, as shown in Figure 1, represents a worst-case flood scenario with peak rainfall intensity occurring at the end of the storm, after nearly 48 hours of rainfall and coastal flooding.
- While previous studies estimated coastal inundation in the city based solely on topography (i.e., "bathtub models"), none had considered the dynamic aspect of the Commission's underground sewer and storm drains. By including this critical subsurface infrastructure, the Inundation Model characterized the impact of rainfall (in the form of the GARR events) along with coastal flooding (incorporating predictions from Woods Hole Group's Massachusetts Coast Flood Risk Model) at the same time. As such, the model predictions could estimate the impact of tide level on interior flooding duration and locations.
- With the intent of capturing a wide spectrum of scenarios, the Commission completed simulations of more than 30 storm events and analyzed impacts to critical facilities, such as hospitals, fire stations, and Massachusetts Bay Transportation Authority stations, throughout the city for each simulation. To ensure rapid accessibility of the vast data generated by these efforts, the Commission developed a dashboard to quickly analyze the impacts predicted by the Inundation Model for a given storm event. Figure 2 shows how the dashboard could be used to determine the number of residents impacted (by street flooding above 6 in. [15 cm]) in Dorchester, along with a list of which MBTA stations would be flooded (including depth and duration) during a 500-year tropical storm event.

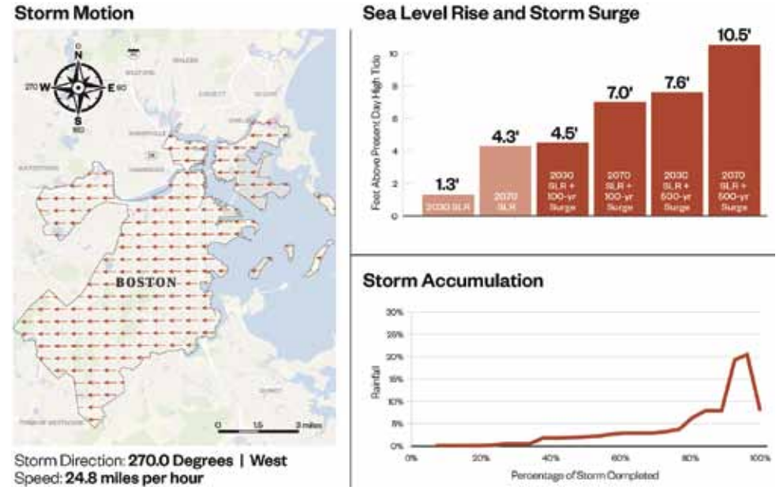

Figure 1. Tropical Gauge Adjusted Radar Rainfall event from Inundation Model

Figure 2. Inundation Model emergency planning dashboard

- At the outset of the project, the Commission wanted the ability to intuitively "show" predictions of the Inundation Model to non-technical audiences. The project included creation of the Inundation Model viewer, which allows users to select and view model predictions for various storm events in a map interface. Furthermore, users can view 360-degree interactive renderings of floodings at recognizable locations throughout Boston in an experience similar to Google Streetview to understand the scale and impact of flooding throughout the city, as shown in Figure 3 *(next page)*. Combined with the emergency planning dashboard, the viewer and website set a new standard for accessibility and communication of complex 2D model predictions.

At the conclusion of the Inundation Model project, which outlined risks and vulnerabilities throughout the city, the Commission was already thinking about the next step: how to adapt its infrastructure to these predicted vulnerabilities. In Boston, storm drains operate exclusively by gravity and discharge via outfalls to a receiving water such as the Boston Harbor. As sea levels continue to rise, gravity discharge of stormwater is reduced, or even impossible, in some locations. This can lead to flooding throughout the city, even if flood walls are constructed, if stormwater "backs up" when tide levels are high. To identify where this vulnerability existed throughout its system, the Commission undertook the next phase of work, the Coastal Stormwater Discharge Analysis.

This analysis builds on the citywide flood modeling that the Commission completed during the Inundation Model project. Model predictions were used to identify outfalls with the greatest coastal flood vulnerability. Design concepts to address these vulnerabilities were developed, and the Inundation Model was then used to quantify the flood reduction benefits in each concept developed as part of this project.

Figure 3. Inundation Model viewer with 360-degree interactive rendering

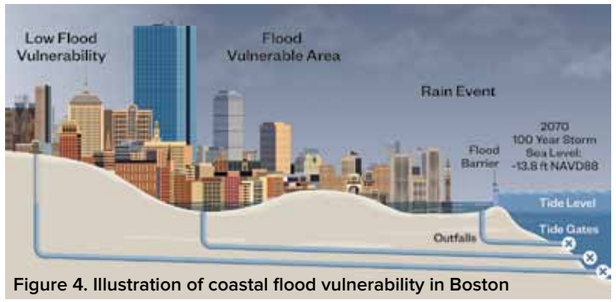

Figure 4. Illustration of coastal flood vulnerability in Boston

The Coastal Stormwater Discharge Analysis was undertaken within the context of Boston's ongoing Climate Ready Boston (CRB) program. The CRB program was established to evaluate climate-related vulnerabilities throughout the city, including those related to sea-level rise (SLR) and storm surge, and is developing concepts for shoreline protection for each neighborhood. As shown in Table 1, shoreline protection (implemented via the CRB program) provides coastal flood protection of land surfaces from SLR and storm surge, while the concepts developed as part of the Coastal Stormwater Discharge Analysis facilitate stormwater discharge from outfalls during these conditions. The Commission's proposed concepts were designed for consistency (i.e., considering timing and location) with planned CRB shoreline adaptations where possible.

Table 1.
Benefits of CRB Shoreline Protection and Coastal Stormwater Adaptations

	ADAPTATION PROGRAM	
	Climate Ready Boston	Coastal Stormwater Discharge Analysis
SHORELINE PROTECTION (for SLR and Storm Surge)		
Sunny Day Flooding (SLR Only)	✓	
Overland Coastal Flooding (Storm Surge)	✓	✓
STORMWATER DISCHARGE		
Rainfall + SLR + Storm Surge		✓

For this project, "coastal flood vulnerable areas" were defined as areas at an elevation of 13.8 ft (4.2 m) NAVD88 (20.3 ft [6.2 m] Boston City Base) or less; this elevation is the approximate peak flood elevation during a 100-year tropical storm event in Boston in 2070, based on projections from the Massachusetts Coast Flood Risk Model. Figure 4 illustrates a coastal flood vulnerable area in Boston, along with a low flood vulnerability area.

Throughout the project, the Commission developed conceptual solutions for 31 outfalls that provide drainage to 71 percent of the coastal flood vulnerable area in Boston. For each conceptual design location, conveyance, storage, and pumping alternatives were evaluated to improve the discharge of stormwater (and reduce upstream flooding), with the most feasible alternative(s), for each site, selected based on site characteristics and system configuration.

Each concept design was summarized in a package that includes an overview of the proposed concept, basis of design summary and assumptions, flood reduction benefits (2D model results), economic benefits (damage analysis), project cost estimate, conceptual design drawings and schematics, as well as considerations for implementation and adaptability. Detailed information on each concept and the project can be found on the Resilience Hub, a public information website created by the Commission to summarize the project (bwsc-stormviewer.com).

The Commission prioritized development of concepts that could serve as "regional" solutions by adapting numerous outfalls (and the associated drainage areas) with one project. Two examples of this approach include the Fort Point Channel storm surge barrier and Dorchester Bay basin storage. These concepts use storm surge barriers (SSBs) to create "natural" detention basins (based on existing features) along the city's coastline that could be used for stormwater discharge during high-tide events. During dry weather conditions, the SSBs are kept in the "open" position, allowing for unimpeded tidal exchange and flow. However, if high-tide levels and rainfall were predicted, the storm surge barriers could be closed during low tide, effectively creating enormous detention basins into which stormwater could be discharged. Together, these two locations could hold up to 320 MG (1.21 Mm^3) of stormwater. Figure 5 contains 2D model predictions comparing flooding with only shoreline elevation implemented (on the left) with flooding with the shoreline elevation and the Fort Point Channel SSB and tide gates implemented during a 100-year tropical storm in 2070. As shown in Figure 5, the Fort Point Channel SSB concept would significantly reduce flooding in the city.

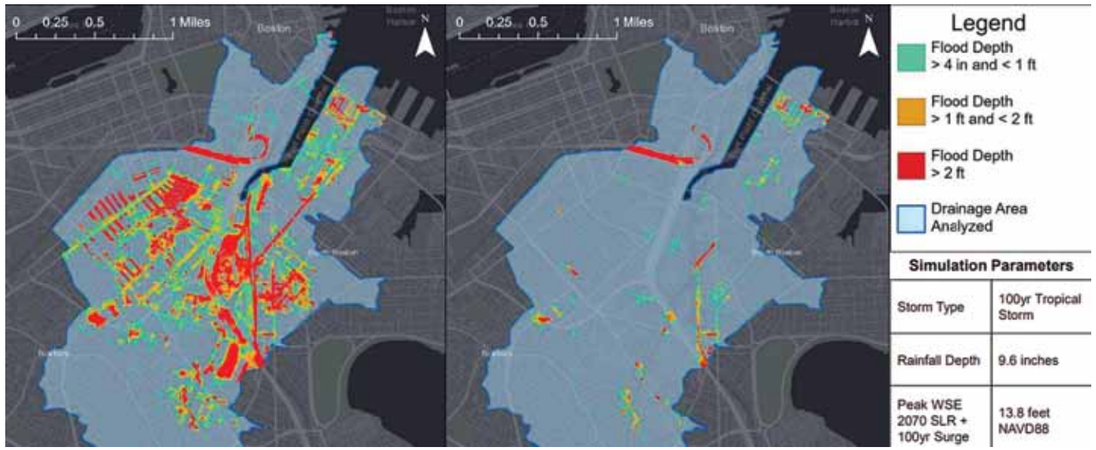

Figure 5. Model predicted flooding during a 100-year tropical storm in 2070—
with shoreline elevation only (left) and shoreline elevation + Fort Point Channel storm surge barriers (right)

The Inundation Model did not include non-Commission-owned infrastructure, such as any drainage and pumping facilities owned by Massachusetts Department of Transportation. Some flooding shown in Figure 5 (e.g., along the Massachusetts Turnpike) may therefore be overrepresented.

The Commission is in the midst of the next phase of its work, the Inundation Model update. This project has several objectives:

- Identify solutions and conceptual adaptations for the remaining coastal flood vulnerable outfalls not addressed in prior work
- Advance development of interior flooding adaptations in areas prone to flooding due to intense rainfall
- Construct an updated 2D Inundation Model that takes advantage of new computer technologies and detailed elevation mapping made available after the original model was developed in 2018
- Develop an even more comprehensive suite of emergency planning tools and Inundation Model Viewer that can display predictions and information based on up-to-date weather forecasts

This ambitious project involves continued coordination with the City of Boston (and the Climate Ready Boston team) to facilitate consistency between coastal and stormwater adaptations, as well as with the U.S. Army Corps of Engineers, which is undertaking a Coastal Storm Risk Management Feasibility Study for the city.

Over the past seven years, the Commission has prioritized collaboration with other agencies, innovation, and practical application of up-to-date climate science and technology. When the Inundation Model Update project concludes around 2027, the Commission's efforts, together with those of the Climate Ready Boston team, will result in a clear road map to manage stormwater as climate risks continue to intensify, as well as tools for emergency planning and response during extreme flooding events.

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- John Sullivan has 53 years of water and wastewater experience, and has been the Commission's chief engineer since 1989, overseeing all major water, sewer, and drainage projects in Boston. John is excited to develop solutions for the climate adaptation challenges facing the coastal capital city and work on cost-effective solutions for future generations.

Holistic stormwater management by integrating performance, life cycle cost, and benefits: an overview of research from The Water Research Foundation

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ABSTRACT | The One Water approach considers the water cycle as an integrated system in which all water flows are recognized as potential resources. Similarly, a holistic stormwater management approach takes a comprehensive view of stormwater and wet weather flows throughout the full hydrologic cycle, from the source all the way to the receiving water. Holistic stormwater management includes three important inter-connected elements necessary to support robust decision-making: performance of Best Management Practices, life cycle cost, and benefits. In this paper, an overview of research portfolios on stormwater and wet weather management by The Water Research Foundation is covered with examples and considerations of evolving digital transformation. In summary, rigorous research on integrating hydrologic and water quality performance, life cycle cost, and triple bottom line benefits has advanced holistic solutions to stormwater and wet weather challenges facing utilities and municipalities.

KEYWORDS | Holistic stormwater management, life cycle cost, benefits, digital transformation

Stormwater management requirements are integral to the Clean Water Act. The Water Quality Act of 1987 enhanced stormwater management by requiring permits under the National Pollutant Discharge Elimination System (NPDES) for stormwater discharges from large and medium municipal separate storm sewer systems (MS4s) and industrial activities. This was a crucial step in addressing stormwater as a point source of pollution. Since then, the stormwater sector has grown significantly, incorporating science and technology for Best Management Practices (BMPs), also called stormwater control measures, and related compliance approaches. After more than three decades of collaboration, stormwater and wet weather flows remain as one of the biggest challenges to achieving the Clean Water Act's goals for "fishable and swimmable waters" nationally.

As the water sector has increasingly embraced the One Water approach, a holistic approach to stormwater management has gradually gained momentum over the past 10 years. While the traditional approach to stormwater management emphasizes the performance of BMPs with different pollutants and associated costs (still important), a new paradigm incorporates the life cycle benefits of BMPs at watershed and community scales. In addition, reframing the traditional view of stormwater, from a problem as pollution to a valuable resource, is a growing trend which helps advance stormwater harvesting and reuse. Holistic stormwater management includes three important inter-connected elements necessary to support robust decision-making: performance of BMPs, life cycle cost, and multi-benefits (e.g., at a watershed scale).

HOLISTIC STORMWATER MANAGEMENT: APPROACHES AND TOOLS

The approaches and tools to manage stormwater holistically are discussed below.

Performance Summary through International Stormwater BMP Database

By collaborating with national partners such as the American Society of Civil Engineers (ASCE), The Water Research Foundation (WRF) over the past 20 years has been advancing the International Stormwater BMP Database (bmpdatabase.org), a publicly accessible repository for BMP performance study and cost information. The database provides scientifically sound information on the performance of 800 BMPs after peer review and rigorous statistical analysis. It provides categorical BMP performance summaries, tools for extracting BMP performance data, monitoring guidance, and other study-related publications that can be used by stormwater managers, consultants, researchers, and others to assess the statistical performance of BMPs in the field. Approximately 400,000 stormwater quality records are also now accessible in the BMP Database. Additionally, the project website provides access to the National Stormwater Quality Database, an urban stormwater runoff characterization database. The National Stormwater Quality Database contains data from over 9,000 events from around 200 municipalities throughout the United States, serving as a resource for municipal stormwater managers and researchers seeking urban runoff characterization data.

Furthermore, the BMP Database project has expanded its focus to collect BMP cost data. Improved tracking of BMP operation and maintenance (O&M) and costs is much needed by local governments. To address this need, WRF and the Environmental and Water Resources Institute (EWRI) of ASCE developed a recommended cost reporting protocol for stormwater BMPs. The long-term objective is to improve the basis for recommended BMP maintenance and frequencies, as well as support life cycle cost estimation. Through standardized parameters forming a reporting protocol, practitioners have a common basis for cost estimation and maintenance planning (Clary et al. 2018). An initial version of the new urban BMP O&M cost database module (bmpdatabase.org/urban-bmp-cost) was developed, with the aim to advance the national practice regarding the costs to maintain stormwater BMPs across municipalities (Clary 2023).

Life Cycle Cost Analysis through CLASIC Tool

To further advance holistic stormwater management, the decision support system Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC) was developed with EPA funding and through a six-year collaboration by a multidisciplinary research team and national partners such as WEF and ASCE. The CLASIC tool applies to a variety of users, including managers and operators of regulated stormwater systems (e.g., municipalities, counties, and utilities), consultants, academics, and others interested in integrated water management.

The three components in the web-based CLASIC tool are as follows (also see Table 1):

Table 1. Functionality of CLASIC Life Cycle Cost Tool

Output	Included in CLASIC Life Cycle Cost Tool
Pollutant Load Reduction	• TSS (Total Suspended Solids) • TN (Total Nitrogen) • TP (Total Phosphorus) • FIB (Fecal Indicator Bacteria)
Hydrologic Performance	• Runoff volume • Volume infiltrated • Volume evapo-transpired • Number of runoff events
Life Cycle Cost	• Net Present Value – Construction – Maintenance – Replacement • Average annual cost over design life • Unit cost for scenario comparison
Co-Benefits	Score of economic, environmental, social benefits based on user-selected importance factors

Source: WRF 2021, Zhang et. al. 2021.

1. Performance
   - Hydrologic performance, such as runoff volume reduction
   - Water quality performance, such as pollutant load reduction
2. Life cycle cost
   - Capital cost
   - Operation and maintenance cost
   - Other cost elements over the life cycle
3. Triple bottom line (TBL) benefits
   - Relative scores of benefits (e.g., financial, environmental, and social) based on performance and select characteristics of green infrastructures

The CLASIC tool uses a rigorous life cycle cost framework to support feasibility assessment and planning for stormwater infrastructure, which can assist users with regulatory objectives, funding and financing strategies, and programmatic objectives. The tool can assess the scenarios of green and gray infrastructure to inform decision-making based on preferences to estimate capital and maintenance costs over time (Zhang et al. 2021).

The TBL analysis assigns benefit scores from environmental, social, and financial aspects (Figure 1 *next page*). The user assigns weights according to a multi-criteria decision analysis process. This analysis provides quantitative outputs to compare benefits across technology scenarios. Outputs also provide the performance of hydrology (e.g., runoff volume reduction) and pollutant load reduction scenarios.

The CLASIC tool also allows users to build and compare stormwater infrastructure options and simulates climate scenarios. It incorporates a

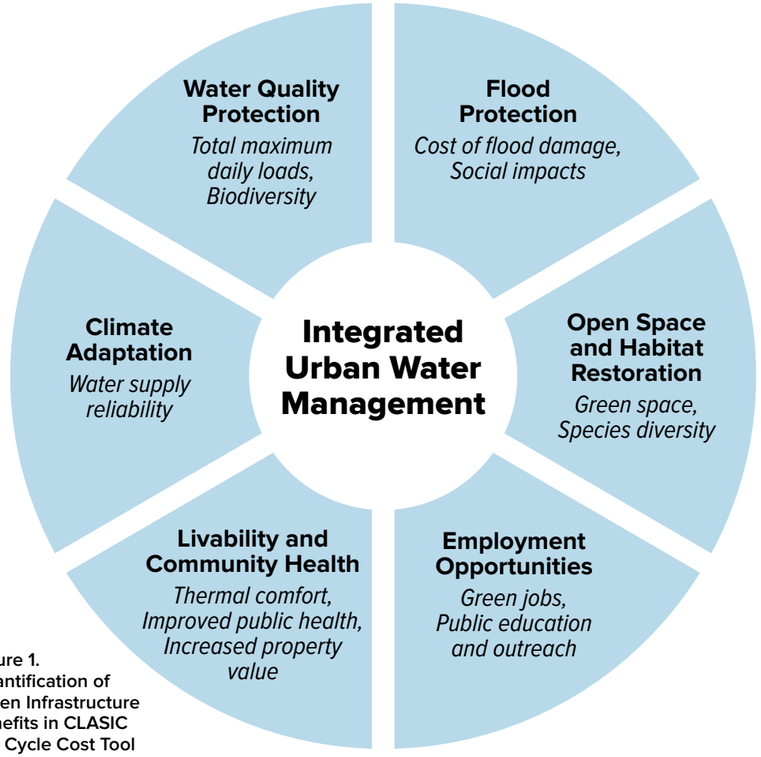

Figure 1. Quantification of Green Infrastructure Benefits in CLASIC Life Cycle Cost Tool
Source: WRF 2021, Zhang et al. 2021.

multivariate adaptive constructed analog method for downscaling global climate models and simulating climate scenarios.

The tool is hosted on a cloud-based modeling platform, is geographic information systems (GIS)-based, and interacts with national databases (Dell et al. 2021). Users can automatically upload data from national databases (e.g., U.S. census boundaries, the national land cover database, climate databases, and soil databases) or upload their own data with more site-specific or higher-resolution information.

With three integrated components (i.e., performance, life cycle cost, and TBL benefits), the CLASIC tool can help stormwater professionals, community planners, and local decision-makers understand and weigh the estimated costs, reductions in runoff and pollutant loads, and benefits of planning scenarios for stormwater management projects.

The tool has been applied in all nine climate regions in the United States. The 10 CLASIC case studies completed during the time of tool release cover communities of different sizes and climate regions. In the Ohio Valley region, two case studies demonstrated the tool's utility for both large and medium-size communities. These case studies represent the variety of hydrologic, performance, cost, and benefit comparisons along with climate scenarios that the tool provides to aid in decision-making about future stormwater projects.

For example, the case study from the Northeast region is entitled "Considerations of Progressive Greening in a Co-benefit Analysis – Philadelphia, Pennsylvania." Also, two other case studies incorporate climate scenario simulations to better accommodate variations in regions. These two are "Scenario Performance in Future Climate Scenarios – San Diego, California" and "Green Infrastructure Technology Scenarios and Climate Impacts – Dubuque, Iowa." For all case studies, CLASIC tool outputs are displayed in immersive charts, graphs, and tables that can be analyzed, printed, and shared to facilitate decision-making.

Triple Bottom Line Benefit Quantification and Monetization

Other WRF research on benefit quantification includes "Economic Framework and Tools for Quantifying and Monetizing the TBL Benefits of Green Stormwater Infrastructure (WRF No. 4852)." Green stormwater infrastructure (GSI) can provide many benefits beyond water quality, including flood risk reduction, improved air quality and related health benefits, energy savings, climate resilience, and enhanced community living conditions. Furthermore, the costs of pursuing GSI strategies may compare favorably to expanding or upgrading conventional stormwater treatment and conveyance facilities or other typical gray infrastructure solutions, especially by quantifying these benefits.

The GSI TBL Benefit Tool by WRF (Clements et al. 2021) is a companion to the CLASIC tool that allows stormwater practitioners to quantify and monetize the TBL benefits of GSI. These include financial benefits such as avoided gray infrastructure costs, environmental benefits such as improved water quality and associated habitat improvements, terrestrial ecosystem benefits, and carbon reduction and decreased greenhouse gas emissions, and social benefits such as the public health benefits with reduced urban heat stress and improved air quality, flood risk reduction, increased water supply through stormwater capture and harvesting, and improved urban aesthetics and livability (Zhang et al. 2021).

The rigorous quantification methodology for GSI benefits is analyzed together with a life cycle cost analysis of stormwater infrastructure (e.g., using CLASIC tool) to enable better community decision-making. The TBL benefit analysis can help communities identify stormwater management alternatives that maximize community value, compete for scarce funding, leverage private capital and alternative funding, support alternative project delivery, and gain community support.

In a follow-up comparison entitled "Advancing Benefits Quantification and Monetization for Green Stormwater Infrastructure: An Interactive Guidebook for Comparison Case Studies (WRF No. 5105)," six case studies of varying scales, geographies, and storm sewer typologies were selected and run through the CLASIC and the GSI TBL tools to compare the outputs. The studies are from the following locations: Philadelphia, Pennsylvania; Fort Collins, Colorado; New Orleans, Louisiana; Phoenix, Arizona; San Antonio, Texas; and Sun Valley, California. Four U.S. climate regions—Northeast, Southwest, South, and West—were covered. The report summarized model inputs and outputs, recommendations for tool improvements, and areas for future research. The study's approach ensures that holistic costs and benefits of each alternative are presented to the decision-makers and allows for better and more complete decisions with limited resources (Callahan and Bill 2023). Through this study, both the web-based CLASIC and the stand-alone GSI TBL tools showed they provide numerical estimates of benefits from green infrastructure. While the CLASIC tool uses normalized scores for qualitative evaluation of scenarios by connecting with GIS-based watershed analysis, the GSI TBL tool monetizes the benefits from green infrastructure practices using algorithms for each category based on available research. When a specific need is warranted (e.g., to evaluate both life cycle cost and benefits along with watershed-level modeling analysis) and resources are available, using both tools collectively to support more informed decision-making would be beneficial.

Stormwater Capture and Use and Stormwater Harvesting

With shifting populations and other uncertainties including a changing climate, urban stormwater capture and use can add flexibility and diversity to water supplies. Once seen as a nuisance, stormwater is now part of a modern-day shift that recognizes it as an asset. When captured and used, stormwater can supplement water supplies and provide environmental and community co-benefits (Spurlock et al. 2024).

Reframing the traditional view of stormwater from problem to valuable resource is a growing trend. By connecting stormwater harvesting to source water protection and resilience, WRF completed a study, "Diversifying Water Portfolios through Stormwater Capture and Use: Contributing to a Water-Resilient Future (WRF No. 5236)," which characterized and quantified the anticipated benefits of stormwater capture and use (SCU) into integrated water resource management.

This project benefits water utilities and water managers across the United States by providing adaptable and streamlined methodologies to navigate their unique geographical and regulatory landscapes when considering stormwater as a water resource development strategy (Spurlock et al. 2024). These tested methodologies support the integration of SCU projects at the local, state, and regional scales by integrating co-benefits into water management and investment decisions, creating enabling conditions that contribute to safer, more water resilient communities, and analyzing more thoroughly the factors that can affect co-benefits of SCU. These benefits provide utilities with a straightforward approach to better understand and estimate to what extent stormwater capture and use can address other challenges such as water quality, flooding, and urban heat island impact.

Digital Transformation: Using Digital Twin in Support of Wet Weather Management

With the advent of digital transformation across all sectors including the municipal sector, many recent WRF projects have applied advanced techniques such as artificial intelligence (AI) and machine learning (ML) into a holistic solution to stormwater and wet weather challenges. One example is the completed project, "Designing Sensor Networks and Locations on an Urban Sewershed Scale with Big Data Management and Analytics (WRF No. 4797)."

The goal of WRF project No. 4797 was to help utilities become digital utilities. The Digital Utility Maturity Assessment (DUMA) model developed through previous WRF research was applied in water, wastewater, or combined utilities, with over 60 DUMA assessments conducted virtually and/or in-person. The DUMA model helped utilities assess their level of digital maturity, creating strategies to improve in the seven defined areas and revisiting the DUMA to assess progress throughout the transformation (Thompson et al. 2025).

Through the project, a comprehensive framework provided a deep understanding of the complexities and processes inherent in an intelligent water system at a sewershed level. The project conducted demonstrations at utilities across North America to assess the effectiveness of sensor-based, real-time monitoring, and models and decision support systems on sewershed scales to support digital transformation. Furthermore, it presented the pros, cons, and complexity of AI and ML in applying them in water, wastewater, stormwater, and reuse utilities.

Below we summarize examples from two utilities that applied the technique of "digital twin," according to Thompson et al. (2025). Broadly, digital twin is a digital replica of physical assets. Within the water sector, digital twins combine models that digitally represent one part of the water system (e.g., water resource recovery facilities, sewers) and use real-time data from multiple sources to simulate expected or desired behavior of the physical system (Pedersen et al. 2021). The advantages of digital twins range from improved efficiency and productivity to increased benefits for society (e.g., stormwater management). For example, there could be economic savings (e.g., online energy optimization), more effective environmental protection (e.g., model predictive control for effective nutrient removal), and societal benefits (e.g., improved stormwater management to minimize risk of flooding in urban areas) (Valverde-Pérez et al. 2021).

Metropolitan Sewer District St. Louis

The Metropolitan Sewer District (MSD) St. Louis Wet Weather Optimization Project (WWOP) is a three-year effort that began in January 2021. The project aimed to identify opportunities to improve environmental water quality and reduce capital expenditures while meeting consent decrees through an innovative approach for managing complex wet-weather infrastructure via real-time sensors and advanced analytics.

This innovative approach included a pilot to implement and assess the value of operational analytics on MSD's wastewater and collection system. The pilot was one part of the WWOP that included long-term improvements in optimization modeling and a digital twin for real-time decision support of the combined sewage capture optimization in the service area. A digital twin was built and integrated into the dashboard to allow users to see system-wide effects of gate control strategies during actual rain events. Rainfall data are monitored through level/velocity/flow sensors. As soon as the system detects a rainfall event has occurred and concluded, simulations using the Stormwater Management Model (SWMM) are automatically run to identify opportunities to reduce combined sewer overflows. These simulations feed the actual rainfall data into a SWMM representation of the MSD sewer system and replay the rain event using different gate control strategies to determine the optimal strategy (Thompson et al. 2025).

Hampton Roads Sanitation District (HRSD)

The Sustainable Water Initiative for Tomorrow (SWIFT) program is a water management project in Eastern Virginia to further protect the region's environment, enhance the sustainability of the region's long-term groundwater supply, and help address environmental pressures such as Chesapeake Bay restoration, sea level rise, saltwater intrusion, land subsidence, abnormally high tides, and severe storms (HRSD 2025).

The SWIFT program has integrated building information modeling designs with GIS maps, workflows, and analytical tools. This combination has allowed HRSD to create a detailed digital twin. This digital twin enables planners to interact with design models using virtual and augmented reality, providing an immersive experience within the infrastructure. Utility operational teams and construction crews can use this technology to accurately position new pumps or assets, ensuring precise placement.

The digital twin affords a higher level of operational intelligence with 3D data for newly constructed facilities and plans to capture the same for older facilities. In the event of storms, HRSD works to minimize wet weather overflows and oversee the condition of infrastructure. With the increasing severity of storms, coupled with the factors of land subsidence and rising sea levels, there is a heightened sense of urgency in safeguarding wastewater drainage systems against potential spills. To address this concern, the district relies on its GIS and digital twin technology. In addition, HRSD is consistently improving a regional hydraulic model through commercial integrated urban water modeling software. This model is a dynamic tool, enabling the assessment of system capacity, the determination of facility dimensions, and the formulation of operational choices (Thompson et al. 2025).

HOLISTIC STORMWATER MANAGEMENT: ONGOING RESEARCH

Two areas of ongoing research are in smart stormwater systems and PFAS.

1, Smart Stormwater System

To support digital transformation, WRF has an ongoing project, "Implementing a Smart Sewer System to Optimize Capacity to Reduce Surface Flooding and Sewer Overflows" (WRF No. 5297). Smart sewer approaches can maximize the capacity of existing infrastructure and reduce capital expenditure using sensors, communications, and real-time controls. While smart sewer projects have been gaining more acceptance, and have lowered costs and improved management of overflows and flooding, there is a lack of industry-wide guidance to help utilities identify opportunities and implement smart sewer approaches in their systems, especially with the increasing number of AI and ML applications.

This project evaluates experiences, best practices, and costs of smart sewer approaches. The project team expects to develop a utility-facing practical guide to help utilities identify opportunities and implement smart sewers. By focusing on smart sewer systems, this project can be applied to utilities of any size. Both separate and combined systems can benefit from the outcome of this research. Utilities and municipalities can have information, strategies, and tactics to scope their capital and operations programs related to smart sewer systems, tailor their control strategies for sewer overflows, and meet regulatory requirements. These related efforts are expected to reduce treatment costs and protect human health and the environment.

2, PFAS in Stormwater

Based on peer-reviewed literature, the concern of per- and polyfluoroalkyl substances (PFAS) has expanded into additional water matrices beyond drinking water such as in stormwater and rainwater. In a review based on a national mapping of PFAS in municipal drinking waters in Sweden (Cousins et al. 2022), the levels of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in rainwater were significant and variable in urban, rural, and remote areas, indicating global risks in transmission and atmospheric deposition of rainwater contaminated with PFAS. Kim et al. (2023) found that concentrations of emerging PFAS in precipitation samples collected in the summer of 2019 at seven sites in the central United States were in the 10 to 1,000 ng/L range. Xia et al. (2024) reported that the median PFAS concentrations in precipitation across the five sites in the Great Lakes region ranged between 2.4 and 4.5 ng/L. Other literature (Goukeh and Alamdari 2024; Kali et al. 2025) discussed stormwater BMPs and impact of stormwater runoff relating to PFAS.

With the increased attention on PFAS and its sources from various water matrices, WRF's latest research helps address the PFAS challenge through a holistic watershed-based approach that integrates drinking water, wastewater, and stormwater management. One project is "One PFAS: A One Water Approach to Managing PFAS Pollution (WRF No. 5345). Built from experience and monitoring data from a drinking water reservoir for up to one million residents in Northern Virginia, this project develops generalizable modeling tools and analyzes data on PFAS sources and their relative contributions at a watershed scale, including those from stormwater and rainwater. One research objective is to identify, quantify, and control PFAS pollution in this and other One Water systems. The One Water framework in this study promotes collaboration among stakeholders responsible for various parts of the water cycle and facilitates a holistic watershed management and source water protection strategy that integrates monitoring, treatment, and source control. By adopting a comprehensive One Water approach to PFAS management, the watershed stakeholders can optimize mitigation across subsystems to minimize costs while maximizing public health and water quality benefits at a watershed scale.

SUMMARY AND CONCLUSIONS

With a holistic stormwater management principle in mind, the latest trend promotes comprehensive, community-wide approaches for managing stormwater and wet weather flows. The integrated planning framework, now part of the Clean Water Act amendments, expects to assist municipalities in achieving the act's human health and water quality objectives. The practices through integrated water management can also facilitate the use of sustainable solutions (e.g., green infrastructure and nature-based) that protect human health, improve water quality, manage stormwater as a resource, and support community-level benefits (Zhang et al. 2021). In addition, holistic stormwater management should consider climate resilience along with the impact of more frequent and intense storms and other extreme weather events on stormwater infrastructure and water quality (Zhang and Babbar-Sebens 2025).

Furthermore, stormwater capture and use have become more common. Stormwater harvesting and reuse can expand local water sources while providing additional benefits such as reduced water pollutant loads and a more sustainable water supply.

With the advent of AI and its broad applications, digital transformation has been growing in utilities and municipalities. As an example, digital twinning can leverage ML technology to create virtual models of physical systems (e.g., wet weather and stormwater systems) that can learn and adapt from real-time data, enhancing decision-making and optimizing performance.

From the One Water perspective, WRF is helping to develop next-generation decision support systems for integrated solutions to stormwater management and wet weather challenges, for example, the CLASIC life cycle cost tool. This integrated decision support tool enables municipalities to analyze risk tolerance for stormwater services and consider associated costs for holistic solutions while also addressing climate resilience at the community level. The related TBL approach and supporting tool holistically evaluate benefits to determine the most appropriate strategies that consider both costs and benefits. Quantifying benefits attributable to green infrastructure provides utilities and municipalities with a holistic view in evaluating future stormwater investments.

In summary, WRF has been at the forefront of research on stormwater and wet weather management by integrating hydrologic and water quality performance, life cycle cost, and TBL benefits for holistic solutions to stormwater challenges at utilities and municipalities. The holistic stormwater management approach will help create innovative solutions for addressing evolving wet weather challenges during the journey of digital transformation and the new era of One Water (Zhang 2023).

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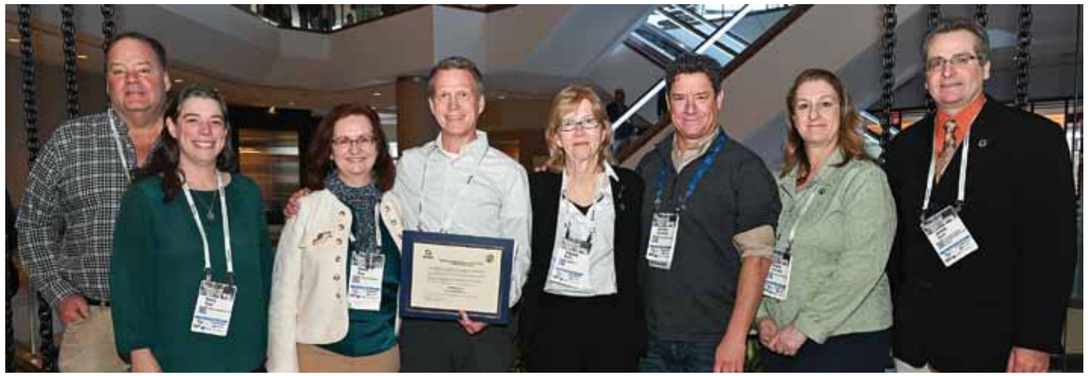
Committee Focus

Stormwater

Driving Innovation, Resilience, and Collaboration

Stormwater isn't just runoff—it's a challenge, an opportunity, and critical to creating healthier, more resilient communities. The NEWEA Stormwater Committee is at the forefront of stormwater management in the Northeast, uniting engineers, municipal leaders, researchers, and industry experts in solving complex problems through collaboration, innovation, and a shared purpose.



RECOGNIZING EXCELLENCE—Each year, we honor a standout contributor to the stormwater field with the **Golden Raindrop Award**—our way of spotlighting leadership, innovation, and impact. **Past award winners include (photo, l-r) Brutus Cantoreggi, Kerry Reed, Maria Rose, Matthew Davis, Virginia Roach, Zach Henderson, Angela Blanchette, and James Houle.**

Whether it's interpreting evolving regulations, advancing resilient infrastructure, or supporting greener, cleaner communities, our members are making real impacts across the region.

What We Do

Our committee is a collaborative "go-to resource" for stormwater professionals, focused on the following:

- Tracking key policy updates especially related to MS4 and NPDES compliance—and keeping our community informed
- Perfecting best practices in water quality, green infrastructure, and integrated stormwater planning through peer-to-peer knowledge sharing
- Championing climate resilience by supporting design strategies that help communities adapt to extreme storms, rising seas, and watershed-scale stressors

We're not just observers, we're active participants. From technical sessions and webinars to our popular annual Stormwater Panel at the NEWEA Annual Conference, we bring stormwater professionals together to learn, share, and lead.

2025 Committee Focus: Pushing Boundaries, Building Resilience

This year, we're focusing on two priorities—nutrient reduction strategies, and resilient infrastructure and flooding:

1. Nutrient Reduction Strategies. New England communities face stricter nutrient load limits under new MS4 permit conditions. That means innovation and collaboration are more critical than ever. We're working with municipalities, watershed groups, and regulators (e.g., Massachusetts Department of Environmental Protection and EPA Region 1) to share economical, practical solutions that meet these new standards.
2. Resilient Infrastructure & Flooding. With aging drainage systems and climate-fueled weather extremes, retrofitting infrastructure is essential. The committee is helping communities evaluate vulnerabilities, share lessons learned, and adopt smarter, stronger stormwater systems.

Be a Part of the Stormwater Solution

Whether you're new to the field or an experienced professional, the Stormwater Committee is a dynamic community where ideas are exchanged, mentors are met, and innovations are born. Our team is led by our chair, Natalie Pommersheim (Apex Companies), serving through 2027, and our vice chair, Maria Rose (Town of Brookline, Massachusetts), set to become chair in 2027.

With over 50 active members, we're always looking for passionate, forward-thinking professionals to get involved. Interested? Reach out to Natalie Pommersheim (Natalie.Pommersheim@apexcos.com) and join a committee that's shaping the future of stormwater management in New England.

Save the Date: Our next NEWEA stormwater webinar is scheduled for October 28 at 11 AM.

NEBRA Highlights

NEBRA continues to monitor federal and state legislative activity, specific to disposal and end uses for wastewater sludges in the Northeast. Below is a summary of activities from before the summer break. NEBRA's Reg-Leg Committee is tracking only a few of these activities. The legislatures will be back this fall, and we expect to see more legislative activity, especially at the state level, related to biosolids and sludge management.

119th Congress—hearing and key bills

Another congressional hearing on PFAS was held on June 18 with a mix of water resource and solid waste specialists, including Dr. Sally Brown of University of Washington, Chris Ball of Waste Management, Jason Dadakis of Orange County Water District (California), Amanda Waters of AlexRenew, and others. There were great discussions and materials. Federal legislation being watched by NEBRA's Reg-Leg Committee includes the following:

- **H.R.1267—Water Systems PFAS Liability Protection Act**. Other than the hearings, no action has occurred on this bill since February.
- **H.R.3991—Research for Healthy Soils Act**. This was introduced in June and referred to the House Committee on Agriculture to research the impact of biosolids on agricultural land. A companion bill in the Senate, S.2500, looks to amend the Food, Agriculture, Conservation, and Trade Act of 1990 to include, as a high priority, research on microplastics in land-applied biosolids on farmland.

Important state legislative updates

Despite all the studies and recommendations around biosolids management in Maine, the legislature still has not arrived at a permanent solution. In the 2025 legislative session, it passed LD297, An Act Regarding the Management of Oversized Bulky Waste from Wastewater Treatment Plants. This bill is a stopgap "emergency" measure that extends the allowance of bulky waste from out of state (needed to mix with wet sludges for safe landfill disposal) for another two years with certain limits. Maine continues to rely primarily on landfill disposal since 2022 when the legislature passed LD1911, the law that banned the "sale or distribution and use" of biosolids-based products on land, and LD1639, which prohibited the import of oversized bulky wastes from out of state. The resulting emergency situation at the state-owned Juniper Ridge Landfill led to wastewater sludges diverted to Canada and elsewhere for a while. Numerous studies have suggested solutions and provided the state with recommendations (including the Maine Bureau of General Services Bulky Waste Study, the Maine Solid Waste Materials Management Plan, and others), but though LD297 buys the state time, no immediate long-term resolutions are in sight for Maine.

There was a scramble at the end of the New York State legislative session. A bill (A6192B) that started out as comprehensive, looking at soil health and financial support for farmers impacted by PFAS, and that proposed to establish a New York State biosolids task force, was amended and passed out of the Senate, including a proposed five-year moratorium on land application of biosolids. The Mid-Atlantic Biosolids Association acted against this push that could have been harmful for the entire region. A coalition of clean water operators, biosolids managers, agricultural interests, and others recruited allies and contacted their local state legislators with their concerns. The coalition raised doubts with legislators about New York State's landfill capacity and the likelihood of large increases in the cost of disposal, as has happened in Maine.

Important federal and state regulatory updates

The comment period on EPA's Draft Risk Assessment for PFOA and PFOS in biosolids closed on August 14. By that time, EPA had received hundreds of comments including those from NEBRA and New England state operator associations. WEF also submitted a letter, and WEF's Residuals and Biosolids Community Biosolids Products Use and Communication focus group created a Fact Sheet that furnishes information about risk assessment/management and this draft risk assessment in particular. EPA's next steps are not known, other than responding to comments on the draft risk assessment for biosolids.

WEF biosolids risk assessment Fact Sheet

Two New England states are expected to publish studies on wastewater sludge management. Part 2 of the Massachusetts Department of Environmental Protection's PFAS in Residuals Technology and Management Study, as reported in our summer highlights, should be published (at Residuals & Biosolids | Mass.gov) by late September.

More recently, the Vermont Department of Environmental Conservation (VTDEC) has begun evaluating sludge management with an expected completion by the end of the year. Previously, VTDEC had studied the management of septage (from septic systems being used by 55 percent of residents and businesses in Vermont). The work will collect data from all of the publicly owned treatment facilities (POTWs) in the state as well as biosolids processors and managers and landfills both in and out of state. The study will look at current and future sludge management capacity and costs. It will include data visualizations (a key to helping policy makers understand the issues) as well as a "geospatial model mapping sludge flows." VTDEC will involve stakeholders to seek consensus on potential future scenarios to examine. Scenarios to discuss include new regional biosolids processing facilities, the installation of dryers at larger POTWs, no exports of sludge, a land application ban, and closure of the state landfill in Coventry.

The recent proposal by the New York State Legislature to place a moratorium on land application of biosolids could have impacts for Vermont, as the Grasslands facility in Chateaugay, New York (dba Casella Organics), is a major outlet for numerous POTWs in Vermont (and Massachusetts, too). VTDEC wants to wrap up this work by the end of 2025.

NEBRA collaborates on webinar on interim regulatory strategies for biosolids

In collaboration with the other regional biosolids associations, NEBRA helped organize a webinar for state regulators and by state regulators that was hosted by the Midwest Biosolids Association on July 15. The webinar featured presentations about the development of the original Part 503 regulations based on EPA's risk assessment and risk management work, and an update on activities around the states from the Environmental Council of the States (ECOS), which recently issued a compendium of state actions related to PFAS, ECOS Compendium of State PFAS Actions. ECOS was one of the signers of the Joint Principles for Preventing and Managing PFAS in Biosolids.

The rest of the speaking lineup consisted of regulators in states where PFAS in biosolids is regulated through interim limits. The states include Michigan, Minnesota, New York, Maryland, and Vermont. Although the webinar was by invitation only to regulators, the slide decks are available through NEBRA.

Gasification and pyrolysis for biosolids

NEBRA continues to study and share information about gasification and pyrolysis for biosolids. These processes could address contaminants such as PFAS in biosolids and still produce end products that can be beneficially used (e.g., biochar). However, few full-scale, continuously operating units exist. NEBRA recently came across a 1978 document, "State/EPA Regional Policy on Municipal Sludge Management," by NEIWPCC and EPA Region I – New England. At the time, there were more options for sludge management including the current ones (land application, landfill, incineration) as well as ocean dumping (finally phased out in 1991). The regulatory policy document also listed pyrolysis. So why are we still talking about pyrolysis for biosolids (and now gasification and torrefaction) almost 50 years later? The reason is that we need options more than ever, and there are more incentives to figure out how to make these high-temperature processes work consistently for biosolids.

NEBRA hosted back-to-back webinars over the summer to look at gasification in particular. In June, we heard about the recently completed "Water Research Foundation project No. 5107, Understanding Gasification for PFAS Removal." WRF studied the fate of PFAS through a full-scale gasification facility processing 30 wet tons (27 wet tonnes) per day at the Edmonds Wastewater Treatment Plant in Edmonds, Washington, over two days of normal operating conditions. In July, Earthcare Solutions, the operator of the Bethel, Pennsylvania gasification facility for processing municipal biosolids and other mixed organics, talked about that project and its startup issues.

NEBRA board updates and committee activities

The board held its annual in-person meeting on July 17. The Lowell Regional Wastewater Utility hosted a productive day of big picture discussions. The board continues to make progress on NEBRA's Strategic Plan (2024-2029) initiatives. It approved spending on a custom Association Management System (AMS) that will automate and improve membership services.

NEBRA, other biosolids associations contribute to finish biosolids risk calculator

The University of Cincinnati was working on a risk calculator for contaminants in biosolids under the EPA's National Priorities grant to evaluate pollutants in biosolids. EPA canceled funding for this project, "Unregulated Organic Chemicals in Biosolids: Fate and Risk Evaluation for Land Application," in May. The project was being led by The Water Research Foundation and included collaborators from Purdue University, University of California Riverside, and WEF in addition to the University of Cincinnati. Dr. Drew McAvoy from Cincinnati was leading the effort on developing the risk calculator and was about six months from completion when the grant was canceled.

The tool uses the same fate and transport model formulations as the EPA's Biosolids Risk Assessment Tool used for assessing PFOA and PFOS. The tool is being developed in Excel with Visual Basic for Applications (VBA) the programming language. Anyone would be able to use the tool, including regulators and utilities interested in their own biosolids risk assessments. The Mid-Atlantic Biosolids Foundation called for donations, and all the regional biosolids associations and other organizations have contributed enough to support the project. NEBRA donated $2,000, most coming from the Research Committee's budget. The risk calculator tool should be ready for use in the fall. The regional biosolids associations are planning to host a webinar with Dr. McAvoy to demonstrate its use.

The 2024-25 NEBRA Board at the July 17, 2025 meeting in Lowell, Massachusetts (l-r): Scott Firmin, Tracy Chouinard (Secretary), Eryka Clive (President-Elect), Deb Mahoney (Immediate Past President), Lise LeBlanc (President), Janine Burke-Wells (Executive Director), Phil Tucker (Vice President), Laura Marcolini, Mike Lannan, Tom Schwartz, Aaron Fox (Treasurer) Missing: Mike Carignan, Patrick Ellis, Chris Hubbard, and Art Simonian

The Research Committee has scheduled its Student Poster Contest for November 13. NEBRA plans to announce the winners at the Northeast Residuals & Biosolids Conference in Worcester, Massachusetts, the following week. The committee has a new initiative for sharing its library of published papers (online digital format) on research into sludge, biosolids, and residuals. The committee has organized this database using tags and creating collections for certain purposes. One use will be the regular (monthly) sharing of research curated by a committee member with easy access for NEBRA members. The first series of research papers (July) was about various end uses for biochar.

The Carbon Trading Committee had a guest speaker over the summer. Guanglong Tian, principal environmental scientist at the Metropolitan Water Reclamation District of Greater Chicago, spoke to NEBRA members about his research into carbon sequestration in soils where biosolids have been used. He is the main author on a paper recently published in *Soil Biology and Biochemistry,* "Intracellular carbon storage of microorganisms and resulting C sequestration in biosolids-amended agricultural soil." The Carbon Trading Committee oversees the Biosolids Emissions Assessment Model (www.BiosolidsGHGs.org) and is interested in carbon credits for biosolids land application projects.

Preview for fall conference—annual member meeting date set

NEBRA members mark your calendars for our annual membership meeting and election of officers. It will be held on November 18 as part of the Northeast Residuals & Biosolids Conference at the AC Hotel & Conference Center in Worcester, Massachusetts. The theme for this year's annual conference in collaboration with NEWEA's Residuals Management Committee is "Managing Residuals and Biosolids in a Time of Uncertainty." We will have a full panel of regulators for a roundtable discussion on the theme.

The Residuals Committee is eyeing potential projects for NEBRA. In addition to being a clearinghouse for non-biosolids residuals regulations, the committee has discussed a regional waste exchange and marketplace based on the successful Iowa Waste Exchange model, and a recent residuals manager-focused member drive has attracted new members who manage residuals other than biosolids.

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

YP Spotlight

Anna Ropes is an environmental engineer for CDM Smith. She works in the firm's Manchester, New Hampshire office in the water services group. Anna has broad experience in water treatment facility design, conveyance, regulatory compliance, and water quality analysis. She enjoys working on projects at any scale from Maine to Florida. Anna holds a Bachelor of Science in Environmental Engineering from Clarkson University.

Journal *How did your childhood/community shape your understanding of the environment/water/wastewater/etc.?*

Growing up, every summer, before I could walk, my family would travel to our remote cabin in Down East Maine. No electricity, no Wi-Fi, and more interaction with wildlife than with other humans. Just me and nature—the vast lake and rolling hills with eagles soaring high in the sky and moose walking along the banks of the water. I was lucky enough to learn and appreciate all that the natural world has to offer at an early age which drove me into the field of environmental engineering. I attended Clarkson University just north of the Adirondacks in New York where my love for the mountains continued to flourish. I wanted to share all my experiences of how amazing this planet is with others through conversation and education and, ultimately, my job. We can often forget and take advantage of these natural resources, so I strive to continue to improve how these resources are used as well as protect them and replenish when we can through our work as civil and environmental engineers and scientists.

Anna Ropes

■ *What have been the most exciting parts of your job and your involvement with NEWEA?*

The most exciting part of my job is the direct impact we have on society no matter how big or small the project. I have been with CDM Smith for three years and have enjoyed the various projects I have worked on which include water treatment plant upgrades to treat PFAS, water quality analysis, sewer separation design, permitting, and sampling in the field. I enjoy getting to touch all aspects of the environment and solving dynamic and unique problems for our clients.

With NEWEA, I enjoy coordinating and participating in NEWEA's mentoring program. I am lucky enough to have amazing NEWEA mentors. I believe that mentoring is vital to the success of our industry, to help the new generation of engineers grow in our technical skills and foster a collaborative environment. Mentoring is not only top down but down up; we can all learn from one another.

■ *When did you first get involved with NEWEA? (Note: How did you hear about it?)*

I first got involved with NEWEA after hearing my colleague and mentor, Emily Korot (YP Committee chair), talk about it one day at work. It piqued my interest when she was explaining what the YP Committee was and how to get involved. It sounded fun to get together with other young professionals in the industry. She sent me an email invitation to a monthly meeting one year ago, and I have been involved ever since.

■ *What's your favorite thing about the YP Committee?*

My favorite thing about the YP Committee is getting to know all my colleagues and to share our passion for the environment. We exchange ideas, establish relationships, and build our little community together that will carry us through our careers. I also enjoy the YP Summit; it is such an amazing experience to be a part of!

■ *Tell us a fun fact about yourself.*

After I graduated college in 2022, I spent a week backpacking in northern Sweden. I hiked 60 miles on the Kungsleden (the King's Trail) stopping at huts along the way and encountering herds of reindeer. Next year I hope to go back and climb the tallest mountain in Sweden—Kebnekaise.

The Stockholm Junior Water Prize

This year's state winners from New England

The Stockholm Junior Water Prize (SJWP) is the world's most prestigious youth award for a water-related science project. National and international competitions are open to young people between the ages of 15 and 20 who have conducted water-related projects of proven environmental, scientific, social, or technological significance. The projects aim to increase students' interest in water-related issues and research, raise awareness about global water challenges, and improve water quality, water resources management, water protection, and drinking water and wastewater treatment.

The Water Environment Federation (WEF) organizes the national SJWP competition and solicits electronic research paper entries for each state competition and returns New England entries to NEWEA following the announced deadline. By having applicants apply directly through WEF's website, project presentations can be ranked fairly by local volunteer judges. This year, applications were received from all six New England states.

Fifty-six students representing 37 WEF Member Associations and 47 states/territories convened for the national competition June 19–22 at Washington University in St. Louis, Missouri. Catherine Chen from New York was named the winner of the national competition.

Thank you to the state associations for their continued support and our NEWEA judges for volunteering their time and expertise to review papers: Carina Hart, Amy Mueller, Tracy Chouinard, Matthew Buck, Megan Ambrose, and NEWEA SJWP Coordinator: Annalisa Onnis-Hayden.

Rhode Island

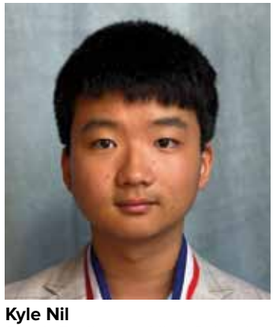
Ethan Kang
Portsmouth Abbey School
Portsmouth, RI

Environmental Factors of AMR in Rhode Island Waters

Antimicrobial resistance (AMR) is an urgent global public health threat, attributed to millions of deaths per year with a substantial economic burden. The impacts of these selective pressures in freshwater ecosystems, often exacerbated by anthropogenic activities such as pollution and nutrient runoff, lead to an increase in the occurrence and persistence of resistant bacteria in these environments.

This study examines the prevalence of AMR in Rhode Island's water bodies, where AMR was measured in terms of bacterial resistance to the antibiotics Ampicillin and Tetracycline in regard to environmental variables, including nitrate levels, pH, and temperature. Water samples were taken from Long Pond, Buckmaster Pond, Massasoit State Park, and Big Alum Lake. The bacteria were isolated, cultured, and tested for antibiotic susceptibility using antibiotic disk. Results showed that increased nitrate levels correlated with greater resistance, as sites with higher nitrate concentrations had smaller zones of inhibition. These results highlight the important and growing pressures from poor environmental management and antibiotic regulation that will need to be strengthened to limit AMR spread.

Vermont



Kyle Nil
South Burlington High School
Burlington. VT

Will Zebra Mussels Consume Cyanobacteria if they are Left with No Other Food Source?

Zebra Mussels (ZMs) are invasive species from Europe. They lack significant natural predators and selectively favor consuming green algae over cyanobacteria, potentially contributing to harmful cyanobacterial bloom. This study will test whether ZMs would consume cyanobacteria in the absences of all other food sources. The experimental plan was to set up five experimental and control groups: ZMs with green algae, Zebra Mussels with cyanobacteria, and a control group with no food sources. Additional control groups containing only the food source (no ZMs) were included to test for sedimentation of algae. Zebra mussel foraging was measured using a spectrophotometer to determine the density of algae over a 24-hour period. A decrease in absorbance over the 24-hours would indicate consumption. After accounting for a ~0.044 increase in absorbance over the 24-hour period in the mussel-only control group, we found a -0.034 absorbance change in the green algae group and a -0.008 change of absorbance in the cyanobacteria group. Our finding suggests that ZMs prefer green algae and even in a situation where there is little to no amount of green algae present, their effect on cyanobacterial blooms are likely very minimal. In further studies, we should use longer time intervals to account for whether hunger will have a heavy influence on the feeding behavior.

Massachusetts

Yuxuan Zhang
Boston Latin School
Boston, MA

Heavy Metal Analysis of Lichen at a Massachusetts Superfund River Reveals Previously Overlooked Contamination

Heavy metals are toxic pollutants that persist in ecosystems and bioaccumulate, causing serious health risks. Along the Lower Neponset River in Eastern Massachusetts, now an EPA Superfund site, centuries of industrial activity have left behind significant contamination. Despite cleanup efforts since 2023, heavy metal pollution remains under-addressed. This study uses Flavoparmelia caperata (L.) Hale, an epiphytic lichen species and cost-effective bioindicator, to assess contamination. We collected 88 lichen and 25 soil samples from the site, along with 3 lichen controls from suburban Massachusetts. Using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), we measured concentrations of 19 trace metals. Lichen samples exhibited significantly elevated levels of Al, Ba, Cr, Cu, Fe, Mg, Mn, Ni, Pb, V, Zn ($p<0.01$), with particularly severe Pb contamination. Soil samples showed primarily Pb contamination. Enrichment factor analysis confirmed that lichen, compared to soil, monitors effectively air quality and modern environmental contamination more effectively. Spearman rank correlation analysis further suggests distinct distribution patterns within site and different pollution sources for lichen and soil contamination. We conclude that lichens serve as a modern air pollution indicator, while soils reflect long-term, localized contamination. Given that current remediation efforts focus on polychlorinated biphenyls (PCBs), we recommend a revision of strategies to address heavy metals and their associated health risks.

Connecticut

Dongeun Rhee
The Taft School
Watertown, CT

Biomimetic Filtration: Applying the Voronoi Pattern of Sea Urchin Shells to Remove Lead from Connecticut's Water Supply and Combat Marine Desertification

Children in Connecticut have higher blood lead levels than those in other states, and children from low-income households face an even greater risk of exposure; this problem is related to aging sewage and water systems that contain lead. To develop a natural solution, this study explored sea urchins, a species attributed to coastal desertification, and how their pattern resembling the Voronoi structure contributed to their lead adsorption capabilities. Along with sea urchins, shrimp and crab shells were also examined since they contain chitosan, which is an antimicrobial polymer. Due to their unique patterns and porosities, raw sea urchin shells and raw or heat-treated shrimp shells were the most effective absorbents. Beyond lead adsorption, both shells were also able to inhibit bacterial growth and ammonia-based odors that emerge when eutrophication increases nitrogen levels in lead-contaminated waters. The Urchin-Shrimp Purifier (USP) was developed based on these findings, integrating the most optimal qualities of sea urchin and shrimp shells for enhancing water quality. By repurposing shell wastes from nearby oceans, the USP provides a cost-effective, eco-friendly solution that benefits both the ecosystem and nearby inhabitants, simultaneously addressing two environmental concerns of Connecticut.

Maine

Sungbeen Lee (photo) **and Dhana Park**
Fryeburg Academy, Fryeburg, ME

Synthesis and Application of Iron Oxide Nanoparticle-Loaded Chitosan Composites for Phosphate Removal

This study investigates the effectiveness of chitosan and iron-based compounds in removing phosphate ions from water. Phosphate contamination contributes to eutrophication and harmful algal blooms, posing risks to aquatic ecosystems. By preparing a phosphate solution and treating it with chitosan, ferric chloride, and ferrous ammonium sulfate, we measured changes in phosphate concentration using a DR300 Pocket Colorimeter. Results showed that chitosan alone reduced phosphate levels, while the addition of iron compounds further enhanced removal efficiency. This research highlights the potential of combining biodegradable materials with accessible chemical treatments for eco-friendly water purification.

New Hampshire

Aadi Kulkarni
Nashua High School
Nashua, NH

Economical and Novel Microplastic Detection Using a Arduino-Based Turbidity Sensor: A Comprehensive Investigation

Microplastics—generally defined as plastic particles ranging from 1 µm to 5 mm—have emerged as a critical environmental contaminant worldwide. Although they are ubiquitous in rivers, lakes, and oceans, their presence in smaller waterways is often undetected. Traditional analytical methods, such as Fourier Transform Infrared spectroscopy or Raman microscopy, provide specific identification of polymer types but are prohibitively expensive, technically demanding, and inaccessible to many communities, especially in low-resource regions. This paper presents a novel, low-cost solution for microplastic detection based on a custom-built turbidity sensor integrated with an Arduino microcontroller system. By exploiting the slower settling rates and unique scattering characteristics of microplastics relative to natural sediments, this sensor can accurately classify water samples into four categories: clear water, sediment-laden, microplastic-laden, and mixed (i.e., both sediment and microplastics). Laboratory tests spanned multiple microplastic polymers—polyethylene, polypropylene, and nylon—at concentrations ranging from 10 to 100 mg/L, as well as common sediments (river silt, decomposed leaf matter, and fine sand) in the 50 to 200 mg/L range. Using a rigorous experimental protocol (n=3 replicate samples per condition) and advanced data analysis (ANOVA, Principal Component Analysis, and Support Vector Machine classification), I demonstrated that the sensor can achieve up to 95 percent classification accuracy, with near 100 percent sensitivity to the presence of microplastics. This method, which costs under $50 to assemble, offers a significant advancement in making microplastic detection accessible to students, local communities, and resource-constrained regions worldwide. Furthermore, the device's reliance on turbidity decay over time—an otherwise overlooked metric—offers a powerful, distinctive fingerprint for identifying buoyant or slow-sinking plastic particles.

Massachusetts State Director Report

by John Digiacomo
jdigiacomo@natickma.org

I can't believe that this will be my final submission to the *Journal* as the NEWEA state director from Massachusetts. I am honored to have had this privilege and responsibility for the past three years. I am excited that I will continue to support Massachusetts as a member of the Massachusetts Water Environment Association (MAWEA) Board of Directors as well as work with the incoming Massachusetts NEWEA director to continue to advocate for the clean water industry and support our operators and members.

This spring, I was privileged to represent Massachusetts for the third year in a row at the 2025 National Water Policy Fly-In with numerous other NEWEA leaders and members. This is the nation's largest annual grassroots advocacy event for water policy issues. Effectively engaging and educating our representatives is essential to showcasing the impactful work we do, advocating for the necessary funding to support both current and future initiatives, and building momentum for legislation that will positively shape the future of our industry.

Our Massachusetts delegation included 14 attendees from both clean water (NEWEA/MAWEA) and drinking water (New England Water Works Association and Massachusetts Water Works Association). This group met with staff from 10 of the 11 Massachusetts national representatives, who are addressing so many issues that it is difficult for them to be versed on all of them. They appreciated our group spending time away from our jobs and families, traveling to Washington, D.C., to share our feedback and expertise. We were especially excited to have one-on-one time with Representatives Jim McGovern and Jake Auchincloss.

Issues discussed included workforce development, PFAS, CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) liability, biosolids management, and non-flushable wipes. With the uncertainty in Washington under the new administration in its first 100 days in office, the delegations could not give assurances about future funding, but noted it was a priority for them to continue the remarkable work our industry has been doing and ensure it continues. Of note, the flushable wipes legislation that NEWEA has advocated for years was passed through the House of Representatives in early summer and it awaits passage by the Senate. NEWEA and MAWEA will continue to advocate for this important legislation on both the federal and state level. The Massachusetts State Legislature has been meeting in committee on this issue over the last year, with MAWEA providing expert testimony.

Attending the Fly-In has clearly shown me that even one person can make a difference. If you would like to "make a difference" and attend the 2026 National Water Policy Fly-In, please reach out to me or the NEWEA Government Affairs Committee chair Jeff McBurnie.

For the Young Professional (YP) members of NEWEA reading this, if you think that the Fly-In is just for experienced professionals, that's not the case. This year WEF provided 15 $1,000 scholarships for YPs to attend the event, helping to cover transportation, lodging, and food. New England had three YPs who received the scholarship: Ryan Buckley (Massachusetts), Megan Simonian (Connecticut), and Meghan Abbey (New Hampshire). Many other YPs from New England attended. At the upcoming NEWEA Annual Conference in January 2026, I will present about the Fly-In alongside WEF Delegate-at-Large Peter Garvey during the conference, beginning with the YP Summit. Please stop by one of these presentations to introduce yourself and learn more about the YP scholarship and how you can get involved.

MAWEA Events

The MAWEA Spring Operators Trade Show and Barbeque was held at Wachusett Mountain Resort on May 28. The event has been growing post-Covid, and this was our best-attended trade show in years. Thank you to all the exhibitors and presenters. Members of the Massachusetts Operations Challenge team (Mass Chaos) attended, performed a pipe cutting demonstration, and then let attendees test their skills. The trade show was one of the major aspects of this year's Operator Exchange visit from New Hampshire. The New Hampshire Water Pollution Control Association (NHWPCA) sent Cody Daigneault from the Wolfeboro wastewater treatment facility (WWTF) to visit the Lowell Regional WWTF, the Greater Lawrence Sanitary District, and the Upper Blackstone Clean Water plant. Thank you, NHWPCA, Cody, and the three plants that hosted our visits.

For the second year in a row, MAWEA presented awards at the trade show as part of our re-invigorated Awards Program. Congratulations to Carl Thurston (Operator of the Year), Patricia Sullivan (Laboratory Analyst Excellence Award), and Jennifer Lichtensteiger (Charles W. Tyler Service Award) for your distinguished service to Massachusetts. In particular, MAWEA acknowledges Jennifer and her years of service as a MAWEA director as she steps aside from this position. While she will no longer be a board member, we know she will continue to contribute to MAWEA and this industry for years to come.

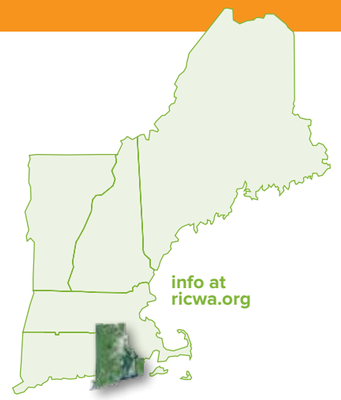
The MAWEA Annual Golf Outing took place at the Heritage Country Club in Charlton on June 11. This was our most successful golf tournament, with 116 golfers signed up. All the golfers had an amazing time, the steak dinner was incredible as always, and everyone enjoyed the weather. Many golfers took a post tournament trip next door to Treehouse Brewery to continue the fun. Thank you to all the golfers, sponsors, and companies and individuals who donated prizes. This event could not happen without your support.

Mass Chaos—WEFTEC bound again

The Mass Chaos team will take part in the national Operations Challenge competition at WEFTEC in Chicago, from September 28 to October 1. The team took part in the Operations Challenge competition at the NEWEA Spring meeting in Portland, Maine, in May and will attend the 38th Annual Operations Challenge as an invited at-large team! This year's team includes Scott Urban (Holyoke), Kelly Olanyk (Springfield), Kyle Schultzki (Holyoke), Justo Cabrera (Springfield), and Joanuel Claudio (Springfield). The team is thrilled to represent Massachusetts again in Chicago this year.

Rhode Island State Director Report

by Laura Marcolini
Laura.Marcolini@fando.com



We visited our Federal delegates at the Water Policy Fly-In in Washington, D.C., this spring. Dave Bruno and Rhode Island's Operations Challenge team, Rising Sludge, are preparing to compete in Division 2 at WEFTEC in October. Congratulations to RIsing Sludge for placing first at NEWEA's Spring Conference Operations Challenge. We all enjoyed our combined September 2025 (25th Annual) Trade Show and first annual regional Operations Challenge event, the "Rhody Rumble," which provided our New England teams a venue for last-minute WEFTEC preparation.

Government Affairs – D.C. Fly-In

On April 8 and 9 a Rhode Island delegation of water and wastewater professionals participated in the D.C. Fly-In. Water advocate Steven Soito from Rhode Island Water Works joined us in our "One Water" objectives. We met with Senators Jack Reed and Sheldon Whitehouse and Congressmen Gabe Amo and Seth Magaziner. We conveyed the importance of and appreciation for federal funding, including congressionally directed spending (CDS) grants and State Revolving Funds (SRF).

Technical discussions touched on "The Wipes" bill, the evolving issues associated with biosolids and residuals use and/or disposal, cybersecurity, and, of course, PFAS. To each delegate's office staff, we offered tours of Rhode Island water recovery facilities during our open-house events later in the spring, and we were then able to deliver tours to our federal delegates and staff members.

Rhode Island Clean Water Association (RICWA) is creating a Government Affairs Committee who will advise members of developments in water pollution laws, guidelines, regulations and programs; comment on proposed changes to said programs; coordinate the Rhode Island delegation's participation in future D.C. Fly-Ins, and organize Rhode Island's annual state legislative event.

A Well-deserved WEF Award

Congratulations to Rhode Island Speaker of the House K. Joseph Shekarchi, representing the city of Warwick, with its 39 miles (63 km) of coastline, for receiving the WEF Public Official Award this year. Since 2019, Rep. Shekarchi has invited RICWA into the State House for its annual legislative event. Every year he speaks at the event.

In 2022, Mr. Shekarchi was recognized as Rhode Island clean water legislator of the year along with several colleagues for passing the Rhode Island Act on Climate. As speaker, he has made changes that have unleashed the House Committee on Environment and Natural Resources, producing more legislation in a few years than had been seen for decades. Rep. Shekarchi humbly gives most of the credit to others who support his endeavors.

WEFTEC Operations Challenge and Operator Exchange

Two operators from Rhode Island and Maine "exchanged" positions during each state's annual trade show in September.

Congratulations to Operations Challenge team RIsing Sludge on qualifying to compete in Division 2 at WEFTEC in New Orleans, where it will represent RICWA and NEWEA on the national stage. The team will participate in five classic Operations Challenge events: process control, laboratory, safety, collection systems, and pump maintenance.

Another Congratulations to RIsing Sludge for placing first at NEWEA's Spring Conference. The team competed in Maine's operations challenge in August and the Rhody Rumble in September. The 2025 team includes Dave Bruno, coach/captain (Quonset Development Corp); Shaun Collum (Narragansett Bay Commission Bucklin Point); Courtney Iava-Savage (Veolia East Providence); Kevin Gardiner (RCAP); and Eric Lemoi (Wright-Pierce). We appreciate their commitment to competition, comradery, and promotion of the clean water industry.

New to 2025: Rhode Island Rumble, Regional Operations Challenge Invitational

Together with our 25th Annual Tradeshow September 11–12, RICWA hosted our first annual regional Rhode Island Rumble Operations Challenge. Teams from the region were invited to participate and hone their skills among friendly competition. This was a great way to build New England's expertise and prepare for the national stage, within a month of WEFTEC.

Academic Scholarship Winners

RICWA has awarded three $1,000 academic scholarships to college students, sponsored by our members and fundraising. Congratulations to our 2025 scholarship recipients: Serenity DaSilva, Juliana Cooper, and Lindsey Hazard.

Professional Development and Licensing Preparation

RICWA is partnering with Community College of Rhode Island and state regulators to provide operator education via formal courses and classes. We envision that participants will benefit from preparation for operator certification and, potentially, internships will develop from this program.

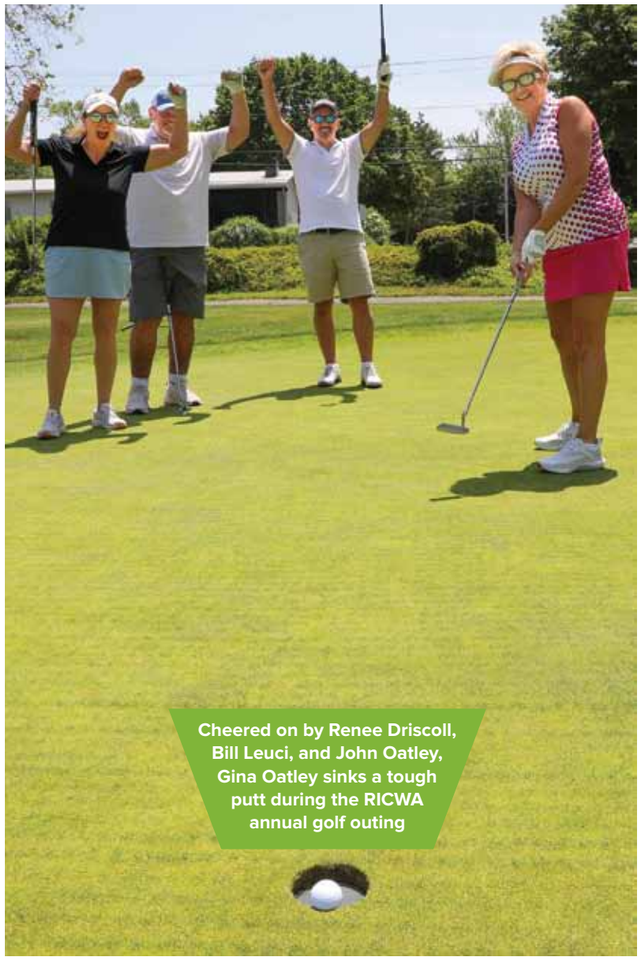
RICWA Events and Happenings

RICWA has a full slate of events throughout 2025. We encourage anyone interested in becoming a member of RICWA or NEWEA to join us at any of these events. We are always looking to welcome new faces to our organization and industry. The schedule is as follows:

- April 6–12: Clean Water Open Houses (Bristol, Newport, Quonset Point, Warwick and Providence/NBC participated)
- April 26: Earth Day Cleanup
- May 9: RICWA Awards Banquet
- June 16: Annual Golf Classic, Potowomut Golf Club. RICWA's annual golf outing, held in June, was a success, raising over $10,000 to support RICWA's clean water programs
- September 11–12: Annual Trade Show and new Operations Challenge Invitational
- December 5: Annual holiday party, food drive, and election of officers at Potowomut Golf Club

Visit www.ricwa.org for more information about our news and events.

Rhode Island Speaker of the House K. Joseph Shekarchi, this year's WEF Public Official Award winner, speaks at a RICWA state legislative event



Cheered on by Renee Driscoll, Bill Leuci, and John Oatley, Gina Oatley sinks a tough putt during the RICWA annual golf outing

Connecticut State Director Report

by Vanessa McPherson
vanessa.mcpherson@arcadis.com

Submitting my last *Journal* entry as state director for Connecticut is bittersweet. What a journey this has been! I am grateful for all the experiences that this role has afforded me, from the privilege of serving on NEWEA's Executive Committee and the Connecticut Water Environment Association (CTWEA) Board of Directors to the opportunity to participate in the National Water Policy Fly-In. Most notable, though, are the connections I have made with people both in my home state and across New England. We have made outstanding progress, and I am excited about the future. It is bright with the committed, talented, and passionate water heroes our industry attracts and develops.

2025 Wastewater Forum and Expo

The Wastewater Forum and Expo was held on May 5 at the Aqua Turf in Plantsville. This event included our annual business meeting, technical presentations, and exhibitors. As in prior years, the vendors and exhibits were in the same room as the technical presentations, allowing everyone in the industry to come together, learn, network, and see the latest in products, services, and equipment for Connecticut's wastewater industry. Special thanks to guest speakers Ivonne Grajko Hall (Connecticut Department of Energy and Environmental Protection), Melissa Biggs (DePino, Nunez & Biggs), Terry Tucker (York Sewer District, Maine), Scott Firmin (Portland Water District, Maine), Joachim Katchinoff (Carbon Crew), and Liie Hill (Jacobs). Our Operations Challenge Committee hosted a pipe-cutting competition, with excellent live coverage by Jeff Lemay on the action.

Ops Challenge

CTWEA recognizes the outstanding performance of our Operations Challenge team, Vector Attraction, at the 2025 New England regional competition on May 12–13 in Portland, Maine. Hosted by NEWEA, Operations Challenge brings together top wastewater professionals from across the region to compete in five high-stakes events that simulate real-world challenges—pump repairs, confined-space rescues, process control, safety protocols, and laboratory analysis—all demanding both technical skill and seamless teamwork under pressure. Team Vector Attraction—comprising Graydon Stewart (Simsbury), Zach Lamoureux (Carlsen Systems), Kevin Mauricin (Veolia-Norwalk), and Jared Sgroi (GA Fleet)—represented Connecticut with professionalism and precision. The team's exceptional showing across all event categories reflects dedicated preparation and a deep commitment to excellence in the water environment field. Although the team did not qualify to compete nationally at WEFTEC this year, it participated in the September Rhody Rumble. CTWEA is seeking eager operators, mechanics, and lab technicians to join our 2026 Operations Challenge roster. Whether you're an experienced operator or new to the field, joining the Connecticut team means gaining hands-on experience, forging strong professional relationships, and proudly representing our state.

Government Affairs and Legislative Outreach

CTWEA held an event at the State Capitol on May 21. We met with state legislators, discussed ongoing challenges and potential solutions, and enjoyed cupcakes from The Flour Girl Cafe. This past legislative session was busy with several bills that could affect the wastewater industry, from PFAS regulation to on-site sewage treatment systems to rules related to foreclosures and liens. A summary of key legislation and outcomes is provided below.

SB 1187 – **Foreclosures**. Passed. This limits the foreclosure and assignment of liens for delinquent sewer assessments and charges on owner-occupied real estate by municipal and regional sewer or water pollution control authorities (WPCAs).

HB 5002 – **Housing Bill**. Vetoed. Section 26 of the bill would have required the Office of Policy and Management to study the state's wastewater capacity.

SB 883 – **PFAS**. No Action. This attempted to replicate Maine's PFAS legislation in Connecticut, providing guidance for land application.

Connecticut also had a strong showing at the National Water Policy Fly-In. For the first time, clean water and drinking water delegates met together with our representatives. This was effective and will continue in the future.

CTWEA Awards and Scholarships

CTWEA Awards were presented at the Wastewater Forum and Expo in May. Congratulations to the deserving recipients:

- Laboratory Excellence – Carmen Krezsik (Meriden, CT)
- Operations Leadership – Dustin Watkins (Torrington, CT)
- Outstanding Service – Jason Nenninger (New Haven, CT)

Five $1,000 Scholarships were awarded to the following college-bound students pursuing a course of study in an environmentally related field:

- Reid Knorr (Stamford High School / University of Southern Maine / Environmental Science)
- Nathan Dhillon (Montville High School / Northeastern University / Environmental Engineering)
- Josselyn Liss (Montville High School / University of New Hampshire / Environmental Science)
- Adrian Bouchard (Ella T. Grasso Technical School (Groton) / Connecticut College / Environmental Engineering or Environmental Science)
- Himani Kumar (Farmington High School / University of Connecticut, Northeastern University, Carnegie Mellon, Yale / Environmental Engineering)

Sewer Open

The CTWEA Sewer Open Golfing event on June 6 had a great turnout. Thirty-two teams competed for the title (and bragging rights). Congratulations to the winning team from Core & Main. Thank you, Ray Bahr, both for founding the Sewer Open and for running the tournament for 20 years. Ray created a wonderful event that everyone looks forward to year after year. This year, Craig Burmeister coordinated the event, and we are grateful for his efforts. Fantastic job, Craig! Thank you also to Mike Spring for taking photos. Mike did a wonderful job capturing the day. You can view and download the event photos using this link: https://www.ctwea.org/2025-sewer-open-golf-tournament.html.

This tournament is a key CTWEA fundraising event. The Tee Sponsorships support the scholarship fund, this year raising $3,600. The Greens Sponsorships support Connecticut's Operation Challenge team, this year raising $3,200. Thank you to everyone who purchased Win the Driver raffle tickets, raising an additional $1,220 for Ops Challenge. We are grateful for all of our sponsors and participants.

Events and Happenings

- Member Outing (Yard Goats Baseball game) – September 2025
- Fall Workshop – October 17, Aqua Turf, Plantsville
- CTWEA is planning the 2025 Operator Exchange. Connecticut will host Vermont in October and visit the Green Mountain State in November.

The CTWEA event at the State Capitol on May 21

Operations Challenge team, Vector Attraction, at the 2025 New England regional competition on May 12–13 in Portland, Maine; l–r: Jason Nenninger (coach), Jared Sgroi, Graydon Stewart, Zach Lamoureux, and Kevin Mauricin

The CTWEA Sewer Open Golfing event on June 6

New Hampshire State Director Report

by Tracy Wood
tracy.wood@des.nh.gov

As I sit here and think about what I want to write, I recall my son's recent dental school white coat ceremony and the story told by one of the highly accomplished speakers. It was about how she was in a hospital setting and speaking with some doctors, and she said, "Well, I'm just a dentist." She went on to say that after some time, she thought about what it meant to be "just" a dentist and realized how her work affected the lives of her patients and was ashamed that she had diminished herself and her work.

It made me think of conversations I have had with wastewater professionals, and more specifically wastewater operators who have said, "Well, I am just an operator." Whenever I hear this, I am both saddened and angered. I can't help but tell the wastewater operator about all the important work being done in this role, and that this person is far from "just" an operator. No one is "just" anything. Water professionals are instrumental in protecting public health and the environment. I can't think of more important endeavors, can you?

Speaking of wastewater operators, this year New Hampshire exchanged operators with Massachusetts as part of the annual Operator Exchange event. In New Hampshire, the exchange took place from September 10–12, to coincide with the New Hampshire Water Pollution Control Association (NHWPCA) September 12 Fall Meeting in Peterborough. Ethan Cox, from the Upper Blackstone Clean Water facility in Massachusetts visited the wastewater treatment facilities (WWTFs) in Dover, Hooksett, Manchester, and Portsmouth (Peirce Island plant). I have heard that New Hampshire's operator, Cody Daigneault, enjoyed his experience in Massachusetts. Be on the lookout in an upcoming issue of NHWPCA's *The Collector* for an article by Cody accounting his experience.

Congratulations to the New Hampshire Ops Challenge team for placing first in Lab, first in Collections, second in Process, and third overall at the NEWEA Spring Conference in Portland, Maine. The New Hampshire Ops Challenge team is made up of folks from New Hampshire Department of Environmental Services (NHDES) including Andrew Carr, Joe Irving, and Sam Wood, all from the NHDES-operated Winnipesaukee River Basin Program treatment plant (WRBP) in Franklin. David Labombard, also previously from WRBP, was unable to participate after leaving WRBP for a position at the Bristol WWTF, so Patty Chesebrough, co-coach with Dan Demers from the NHDES Water Division in Concord, stepped in. I got to watch the team in action for the Lab Challenge, and were they on fire. Trying to perform a challenge under the pressure of time and several judges watching your every move did not phase these professionals. Well done! Since the New Hampshire team placed third overall (out of five teams), it will head to WEFTEC this fall to compete nationally.

Discover Wild New Hampshire Day was on April 19 at the New Hampshire Fish and Game Department in Concord. NHDES and NHWPCA put together a shared booth for the event with giveaways and educational handouts. Raffle drawings were held throughout the day, and around 25 fishing poles and branded fishing bobbers were given away to excited youngsters. Those who did not win a raffle took home NHWPCA stickers as well as pamphlets, and NHDES grease scrapers and grease can lids. New Hampshire Water and Wastewater Managers School participants also attended and hyped up the water profession with booth visitors. One of them, Dylan Delisle, in an article for the NHWPCA's summer *The Collector* newsletter, wrote, "Overall, Discover Wild New Hampshire Day was an amazing experience. It was a chance to connect with the public, share valuable information, and support a collective appreciation for the outdoors and environmental responsibility. I'm grateful I was able to take part and contribute to such a meaningful event, and I'm already looking forward to the next one."

The NHWPCA Annual Summer Outing took place on June 27 at Ellacoya State Park in Gilford. For over 60 years, NHWPCA has held a summertime celebration for the hard-working, dedicated professionals of New Hampshire's water pollution control profession. Sun, fun, and lots of food and camaraderie were enjoyed by all.

NHWPCA held its 35th annual Golf Tournament on August 7, at the beautiful Beaver Meadow golf course in Concord. The day started with an early morning shotgun start for teams playing a four-person scramble "Best Ball" format and finished with a hearty buffet lunch, awards, and door prize raffle drawings. This event is always an opportunity for colleagues of all ages to gather for fun, relaxation, and friendly competition on the greens.

The Granite State Rural Water Association held its annual Operator Field Day and Trade Show on August 14 at Pat's Peak Ski Area in Henniker. It was another great opportunity to join professionals in the water and wastewater industry, check out new products and services, attend continuing education classes, participate in field day games and activities, network with others in the water industry, and even enjoy an all-day open bar ice cream truck.

NHWPCA held its Annual Fall Meeting on September 12 at the Peterborough wastewater treatment plant with refreshments and plant tours in the morning highlighting recent plant upgrades, efficiency measures, and its 2024 "Plant of the Year" award, followed by a technical presentation and luncheon at the Monadnock Country Club. New Hampshire Construction Career Days will be held on September 25 at the Hillsborough County Youth Foundation Fairgrounds in New Boston. This event enables New Hampshire high school students to explore career paths in the construction and transportation industries, with hands-on exhibits and educational resources. Labor unions, construction companies, school districts, state agencies, and trade and professional organizations collaborate to introduce students to construction as well as enable them to see and operate construction equipment and learn about career opportunities.

The NHWPCA Annual Winter Meeting will be held on December 5, at the Hooksett WWTF with refreshments and plant tours in the morning followed by lunch, a brief business meeting, and the always popular Santa's raffle at the Puritan in Manchester. Who will be Santa this year? Come and see for yourself!

For more information on what's happening in the Granite State, check out the latest edition of *The Collector* at nhwpca.org.

NHWPCA's 35th annual Golf Tournament on August 7 at the Beaver Meadow golf course in Concord

Maine State Director Report

by André Brousseau
abrousseau@sanfordsewerage.org

Greetings from Maine! Early spring was just a short time ago when a well-attended North Country Convention was held on April 2–3, in Presque Isle, at the Northern Maine Community College. The attendees had great sessions in between vendor time. This event attracts both sides of the water sector. It's a pleasure to hear similar practical case studies that apply the same repair and replacement technologies used on both sides of the roadway.

This event continues to be organized by the outstanding staff of Joint Environmental Training Coordinating Committee (JETCC) and NEIWPCC, specifically Peter Zaykowski, Spring Connolly, and Aidan Maybey. Under Mr. Zaykowski's leadership, we recognized and celebrated the retiring Ms. Connolly's last conference with an announcement and recognition of her JETCC career. Spring had been working for JETCC and NEIWPCC for over 15 years. She played a key role in the training courses for the conferences as well as the ones throughout the year, and she had a strong presence in the management candidate school schedules over the years as well. Spring was also the all-important official keeper of the contact training hours for the certified wastewater operators. She will be sadly missed but was flooded with well wishes for a happy retirement.

On a more personal note, I traveled to the Presque Isle event with our very own WEF President Howard Carter. I can now say I've chauffeured a national president to an important event! It was great to catch up with a dear old friend—Howard and I go back a few decades.

We have positive news on the sludge handling front. Waste Management's Norridgewock drying facility is well under way with its construction project. Once up and running, the facility will accept residuals five days per week. The facility is designed to achieve the highest possible reduction of sludge volume, with a minimum goal of 75 percent dry solids going back into the landfill. At that moisture content, there will be no need to bind the dried biosolids with the construction and demolition waste (CDW) materials for stable landfill disposal. The condensate side stream will have the option for PFAS removal. The facility is projected to start its wet commissioning, followed by performance testing, both tentatively scheduled for completion sometime in 2026.

Concept drawing of the Sanford, Maine—Aries Clean Technologies biosolids facility

I am, however, sad to report that the Brunswick digester project is officially dead. The former anaerobic digester was to be significantly upgraded, providing another much-needed option for sludge disposal. The project met with extreme opposition soon after the former Naval air station tragic spill of Aqueous Film Forming Foam (AFFF) firefighting material, which contaminated surrounding groundwater and private drinking water wells. Kudos to the Maine Department of Environmental Protection (DEP) staff who tirelessly tracked and sampled the AFFF contaminant plume, minimizing further contamination.

Our Construction Materials Reclamation legislation, otherwise known as LD 1639, went into effect in July. The associated fees will allow for out-of-state CDW material to be processed for the necessary binding of all of our biosolids generated in Maine destined for landfill end disposal. Unfortunately, we will have to wait for the former CDW processing facilities to come online, as they require a complete facility transformation after the sludge crisis of a few years back.

Finally, the Aries Clean Technologies biosolids facility concept is gaining momentum in Sanford. Aries has invested in a private land parcel and wants to develop a drying and gasification facility for the local region. Early stages of planning are proceeding, and we hope to hear of further development which would provide another outlet for biosolids disposal.

Team Force Maine is now preparing to compete at WEFTEC, members (l–r) Darren Lauletta, Coach Chris Cline, Nick Textor, and Jeff Warden pose with their second place trophy and event exhibitor Tristan Linderholm

Maine voters will not have the chance to vote on a $50 million bond resolution due to the competitive race among items for placement on this year's ballot. The proposed bond was fully backed by DEP, and (had it been on ballot and passed) the bond proceeds would have been disbursed via grant application with grading criteria for the awarding process. Without some financial relief, our local ratepayers will foot the cost for capital projects associated with the ever-necessary need for higher-performing dewatering technology while also adapting dryer technology. The height of land application in Maine was likely 1997 when 48 percent of its 267,000 tons (242,000 tonnes) of sludge was sent for beneficial land reuse, while 38 percent went into composting, and only 1 percent was disposed of in landfills. Regional processing facilities may be the saving grace, with ultra reduction as the end goal—but their emergence hinges on the cost and funding. A $50 million bond would have been only a starting figure for the massive financial needs of these dewatering upgrades.

The NEWEA Spring Conference took place in Maine, in what is "right in the backyard" for some of us. Those attending the Portland conference enjoyed well-attended conference sessions and the rare convenience of having all the Operations Challenge events in one large room. Team Force Maine competed against stiff competition, placing in most events while taking home second place overall, and is now preparing to compete at WEFTEC. The team has been practicing once a week since July and tuned up at the Rhody Rumble in early September. Prior to WEFTEC, the team and MEWEA promoted the Ops Challenge at our fall conference on September 17–18, hoping to attract a few new players for the 2026 competition. Also, Maine and Rhode Island are trading operators for this year's NEWEA exchange program. This is a wonderful opportunity for operators to participate in guided facility tours and VIP treatment at the host state membership gatherings.

The Maine Water Utility Association (MWUA) summer outing was held at the Lost Valley ski area in Auburn on August 4. This was a special celebration for the MWUA 100th anniversary. About 20 clean water folks joined the conference on a picture-perfect day. Many activities were available, but most important for some was a fun-filled cornhole tournament. Rob Pontau, general manager of the Brunswick Sewer District and MEWEA vice president, took top honors.

MEWEA's fall conference was held at the Sunday River Ski Resort in Newry. It kicked off on September 16 with a golf tournament, followed by technical sessions and a crowded exhibit hall on Thursday and Friday. September 17 featured our own MEWEA cornhole event that always draws many avid participants. We were glad to see all who were there at "the River" to collaborate on our evolving clean water issues, network, and enjoy the precious western Maine mountains.

Vermont State Director Report

by Jennie E. Auster
jennifer.auster@wright-pierce.com

Vermont has had an active legislative session in 2025. One bill where Green Mountain Water Environment Association (GMWEA) was engaged concerned capacity. GMWEA had several opportunities in discussions and testimony to make clear the nexus between water and sewer capacities and housing. GMWEA member-operators testified about their individual system capacity challenges, particularly with aged infrastructure. These efforts likely played a part in the ultimate passage, nearly unanimously, of S127—An Act Concerning Housing and Development. This allows $200 million in tax increment financing over 10 years: This provides a potential $2 billion investment in municipal infrastructure to support additional housing. GMWEA will continue to follow and give input on implementation and how investment in upgrading aged infrastructure can support additional housing as those important details become defined.

GMWEA 2025 Spring Meeting

Thank you to everyone who joined us in Killington for our Spring Meeting on May 22. It was a great day of valuable technical sessions on drinking water, wastewater, and stormwater; networking opportunities with peers and vendors; and celebration of our award winners. Special thanks to the Continuing Education Committee for organizing a diverse program. GMWEA elections were held in May for the following roles:

- President – Christina Adams, RMI
- Vice President – Harry Shepherd, Town of Stowe
- Second VP – Jeremy Rathbun, Town of Middlebury
- Past President – Christine Dougherty, City of Williston
- Director – Jennie Auster, Wright Pierce
- Director – Nate Fraser, Town of Springfield
- Director – Kaytee Manchester, Stantec

GMWEA Annual Awards

We congratulate the following award winners, recognized at the 2025 Spring Meeting in Killington:

- President's Award – Chelsea Mandigo, City of Essex Junction
- Wastewater Operator Excellence Award – Jacob Drown, City of Barre
- Outstanding Service Award – Andrew Fish, Laboratory Excellence, LLC
- Stormwater Award – Blue Stormwater Program, Burlington
- NEWWA State Leadership Award for Vermont – Harry Shepard, Town of Stowe
- Wastewater Facility Excellence Award – Bellows Falls Wastewater Facility
- Michael J. Garofano Operator of the Year – Roy Farrar, Town of Springfield
- Corporate Sponsor of the Year – Stantec
- Andrew D. Fish Laboratory Excellence Award – Richard LeDrew, Town of Springfield
- Bob Wood Young Professionals Award – Monika Ingalls, Geosyntec Consultants
- Bob Wood Young Professionals Award – Cale Whitcomb, City of Burlington


Chelsea Mandigo

Fall Trade Show, DoubleTree Hotel in South Burlington, November 6

Each fall, over 400 water, wastewater, and stormwater professionals, water quality technology and service providers, Department of Public Works administrators, staff from nonprofit organizations, and state agency administrators convene at the DoubleTree Hotel. After a night-before welcome session in the exhibit hall, they attend six hours of training, tour over 90 vendor exhibits, eat a delicious lunch, and hear distinguished speakers from Vermont and throughout New England. Trainings and speakers vary each year, depending upon member preferences expressed in comments and planning sessions.

Upcoming Meetings & Events


August 14, 2025
NEWEA Teacher Training
MWRA, Deer Island

WEFTEC CHICAGO
McCormick Place, Chicago, IL
September 27– October 1, 2025

JOINT INFORMATION TECHNOLOGY & ASSET MANAGEMENT FAIR
NEWWA Training Facility, Holliston, MA
October 6, 2025

NORTHEAST RESIDUALS & BIOSOLIDS CONFERENCE, EXHIBIT & TOUR
AC Hotel, Worcester, MA
November 18–19, 2025

ANNUAL CONFERENCE & EXHIBIT
Marriott Copley Place, Boston, MA
January 25–28, 2026

AFFILIATED STATE ASSOCIATIONS AND OTHER EVENTS

NHWPCA CONSTRUCTION CAREER DAY
Hillsborough County 4H Youth Center, New Boston, NH
September 25–26, 2025

CTWEA FALL WORKSHOP
Aqua Turf, Plantsville, CT
October 17, 2925

NEWWA 2025 WATER RESOURCES AND SUSTAINABILITY SYMPOSIUM
Devens Common Center, Devens MA
October 29, 2026

GMWEA FALL TRADE SHOW
Doubletree Hotel South Burlington, VT
November 6, 2025

NHWPCA WINTER MEETING
Hooksett WWTF
December 5, 2025

RICWA ANNUAL HOLIDAY PARTY, FOOD DRIVE, AND ELECTION OF OFFICERS
Potowomut Golf Club, East Greenwich, RI
December 5, 2025

NEWWA DECEMBER MEMBERSHIP MEETING
Granite Links Golf Club, Quincy, MA
December 17, 2025

NEWWA/NHWWA JANUARY MEMBERSHIP MEETING
Carriage House at Murphy's Taproom, Bedford, NH
January 15, 2026

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

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

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

New Members February – August 2025

Travis Adjutant
Wells Sanitary District
Wells, ME (YP)

Sophia Bailey
Eastern Research Group
Boston, MA (YP)

Emma Baron
Normandeau Associates
Bedford, NH (PRO)

Ian Beattie
CDM Smith
Boston, MA (PRO)

Ron Bliss
Warwick, RI (STU)

Ashley Brewer
Fuji Clean USA
Brunswick, ME (CORP)

Eric Cardenas
North Brookfield Sewer
North Brookfield, MA (PWO)

Greg Carreira
Stafford Springs, CT (PWO)

Israel Cavallo
FSM Group/Bosfuel
Danvers, MA (PWO)

Devon Case
NEIWPCC
Lowell, MA (YP)

Manisha Choudhary
University of Maine
Orono, ME (YP)

Morgan Conklin
Woodard & Curran
Andover, MA (YP)

Alex Cross
WateReuse Association
Alexandria, VA (YP)

Kaylee Cruz
Cambridge, MA (PRO)

William Duplock
Carroll Capital
Greenwich, CT (YP)

Madelyn Dwyer
Dewberry Engineers
Boston, MA (PRO)

Ethan Esposito
Cheshire, CT (YP)

Andy Field
Woodard & Curran
Portland, ME (PWO)

Britni Fortin
Ti-SALES
Sudbury, MA (PRO)

Jessica Fosbrook
Braintree, MA (PRO)

Drew Gallant
Environmental Partners
Woburn, MA (PRO)

Ross Gambino
Veolia
Norwalk, CT (PRO)

Kevin Gardner
RCAP Solutions
Ashaway, RI (PWO)

Clarissa Garzon
Tighe & Bond
Woburn, MA (YP)

Julie Gillette
Metropolitan District
West Hartford, CT (PRO)

Ashley Gudrian
City of Meriden
Middletown, CT (STU)

Justin Hazard
Bluefield Research
Boston, MA (YP)

Julia Horlitz
Colchester, CT (YP)

Courtney Iava-Savage
Veolia
East Providence, RI (PWO)

Christopher Johnson
Kennebunk Sewer District
Kennebunk, ME (PRO)

Eric Fugen
Veolia North America
Danbury, CT (PWO)

Brian Gannon
Norton, MA (YP)

Christopher Halleron
Jersey City, NJ (PRO)

Andrew Hammond
MWH Constructors
Limerick, ME (PRO)

Stella Hindman
CDM Smtih
Medford, MA (PRO)

James Houle
UNH
Durham, NH (ACAD)

Kaylee Jurecka
Infiltrator Water Technologies
Old Saybrook, CT (YP)

Julia Kelly
Hazen and Sawyer
Woburn, MA (YP)

Richard Kesseli
Xylem, Inc.
Charlotte, NC (PRO)

Raymond Krueger
Flow Tech
South Windsor, CT (CORP)

Cassandra LaRochelle
Tighe & Bond
Worcester, MA (PRO)

Eric Lemoi
Wright-Pierce
Providence, RI (YP)

Wendy Leo
Melrose, MA (RET)

Lethycia Lourenço Sanchez
UMASS Lowell
Lowell, MA (STU)

Jose Lovell
Kleinfelder
Springfield, MA (PRO)

Mark Lyons
Aries Clean Technologies
Franklin, TN (PRO)

Kevin Mauricin
Veolia
Norwalk, CT (PRO)

Philip McHenry
Wright-Pierce
Portsmouth, NH (YP)

Craig Meehan
United Concrete Products
Yalesville, CT (PRO)

Kenneth Mensah
University of Maine
Orono, ME (STU)

Bianca Milano
Monroe, CT (YP)

Pasquale Napolitano
Komline-Sanderson
Chattanooga, TN (PRO)

Jeffrey Neal
Town of Ipswich WWTP
Ipswich, MA (PWO)

Jared Oliver
Moosup, CT (PWO)

Nisha Patel
CTDEEP
Hartford, CT (PRO)

Nicki Pellenz
Augusta, ME (PRO)

David Perrotta
The Maher Corporation
Rockland, MA (PRO)

Alyson Pohlit
ESRI
Chesterbrook, PA (PRO)

Marinna Raucci
Veolia North America
Orleans, MA (YP)

Dean Rheaume
Town of Middlebury, VT
Middlebury, VT (PWO)

Eleanor Roberts
Acorn Engineering, Inc.
Portland, ME (YP)

Anna Ropes
CDM Smith
Manchester, NH (YP)

Megan Ruggieri
Woodard & Curran
Providence, RI (STU)

Kirsten Ryzewic
NHDES
Concord, NH (YP)

Ken Sansone
Concord, NH (PRO)

Luke Sawitsky
Cambridge, MA (PRO)

Hugh Scott
Shea Concrete Products
Woburn, MA (PRO)

Jason Scott
City of Essex Junction
Essex Junction, VT (UPP)

Joshua Senackerib
City of Essex Junction
Essex Junction, VT (UPP)

Arjav Shah
MIT
Cambridge, MA (STU)

Harry Shepard
Town of Stowe
Stowe, VT (PRO)

Lydia Silber
WateReuse Association
Alexandria, VA (YP)

Kseniya Slavsky
Accenture
Boston, MA (PRO)

Heather Smith
Arcadis
Wakefield, MA (PRO)

Joshua Soper
CDM Smith
Boston, MA (YP)

Eliza Styczynski
Brown and Caldwell
Andover, MA (PRO)

Mark Taylor
Lummus Technology LLC
Kemah, TX (PRO)

Phonepaseuth Thammalath
University of Hartford
West Hartford, CT (STU)

Joshua Tyler
Chittenden Solid Waste
Shelburne, VT (PRO)

Niccolo Valente
Tighe & Bond
Portland, ME (YP)

Jeffrey Valentine
Northborough, MA (YP)

Dina Wagdy
Schneider Electric
Boston, MA (PRO)

Rachel Wagner
Somerville, MA (STU)

Kaleigh Walsh
Chelmsford, MA (YP)

Liam Walsh
NBC
Coventry, RI (PWO)

Yakera Ward
Jacobs Engineering
Manchester, CT (YP)

Zoe Warren
Hazen and Sawyer
Boston, MA (YP)

Stephen West
Tighe & Bond
Auburn, NH (PRO)

Robert Whalen
Woodard & Curran
Tiverton, RI (YP)

Jacob White
Hoosac Water Quality District
Williamstown, MA (PRO)

Jennifer Wood
Springfield, MA (PRO)

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)
Retired (RET)
Student (STU)
Utility Partnership Program (UPP)
Young Professional (YP)

Advertiser Index

NEWEA/WEF* Membership Application 2025

wef member association

NEWEA WORKING FOR WATER QUALITY

Personal Information (please print clearly)

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

Business Name (if applicable) | Job Title

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/dd/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) | WEF25

Membership Categories (select one only)

		Dues
☐ **Professional**	Individuals involved in or interested in water quality	$219
☐ **Young Professional**	Water quality professionals, 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..	$88
☐ **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 # _____	$129
☐ **Academic**	Instructors/Professors interested in subjects related to water quality.	$219
☐ **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.	$28.50
☐ **Executive**	Upper level managers interested in an expanded suite of WEF products/services.	$394
☐ **Corporate** (member benefits for one person)	Companies engaged in the design, construction, operation or management of water quality systems. Designate one membership contact.	$457
☐ **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
All memberships receive these:	■ Water Environment & Technology ■ Water Environment Research Online ■ WEF Conference Proceedings Archive Online ■ WEF SmartBrief ■ Complimentary WEF Webcasts	

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 upp@wef.org to join.

Payment (Forms without payment will not be processed till payment is received.)

☐ **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
www.newea.org

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☐ Master Card
☐ Discover

Card # | Security/CVC

Signature | Exp. Date

Name on Card (please print)

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/membership--community/membership-center/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 Management Level

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)

☐ **I would like to join the communities associated with my key focus area(s).**

1 Air Quality and Odor Control

2 Biosolids and Residuals

3 Climate

4 Collection Systems and Conveyance

5 Disinfection and Public Health

6 Drinking Water

7 Energy

8 Finance and Investment

9 Industrial Water Resources

10 Intelligent Water Technology

11 Laboratory Analysis and Practices

12 Nutrients

13 Operations

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 and Watershed

21 Utility Management and Leadership

22 Watershed Management

23 Wastewater Treatment, Design, and Modeling

24 Water and Wastewater Treatment

25 Workforce

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

Gender: ☐ Female ☐ Male ☐ Non-binary

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

How Did You Learn About NEWEA/WEF?

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

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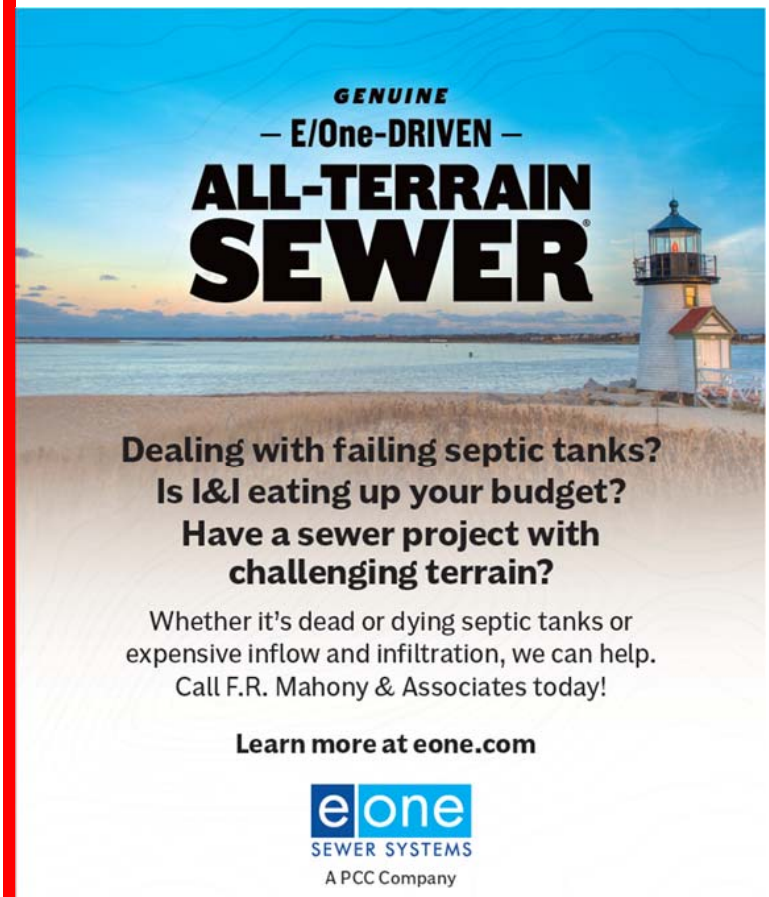
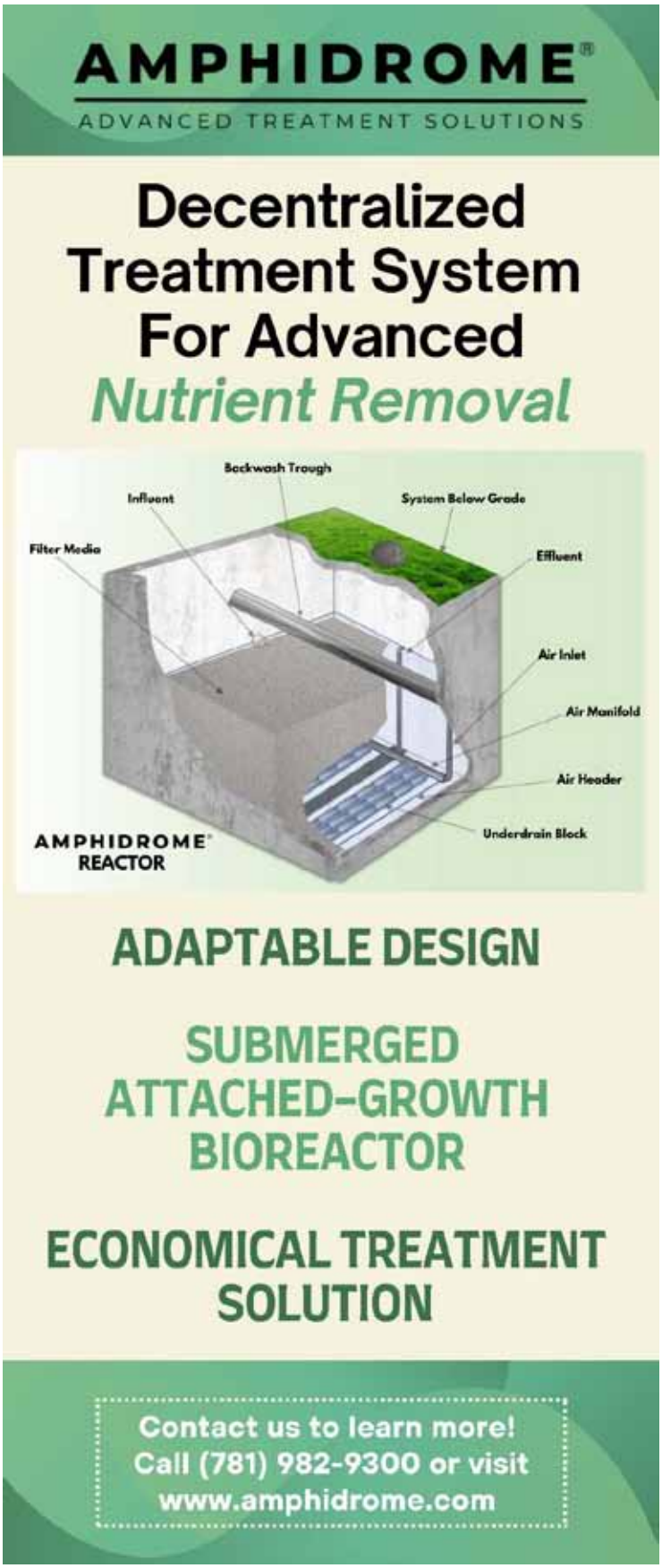
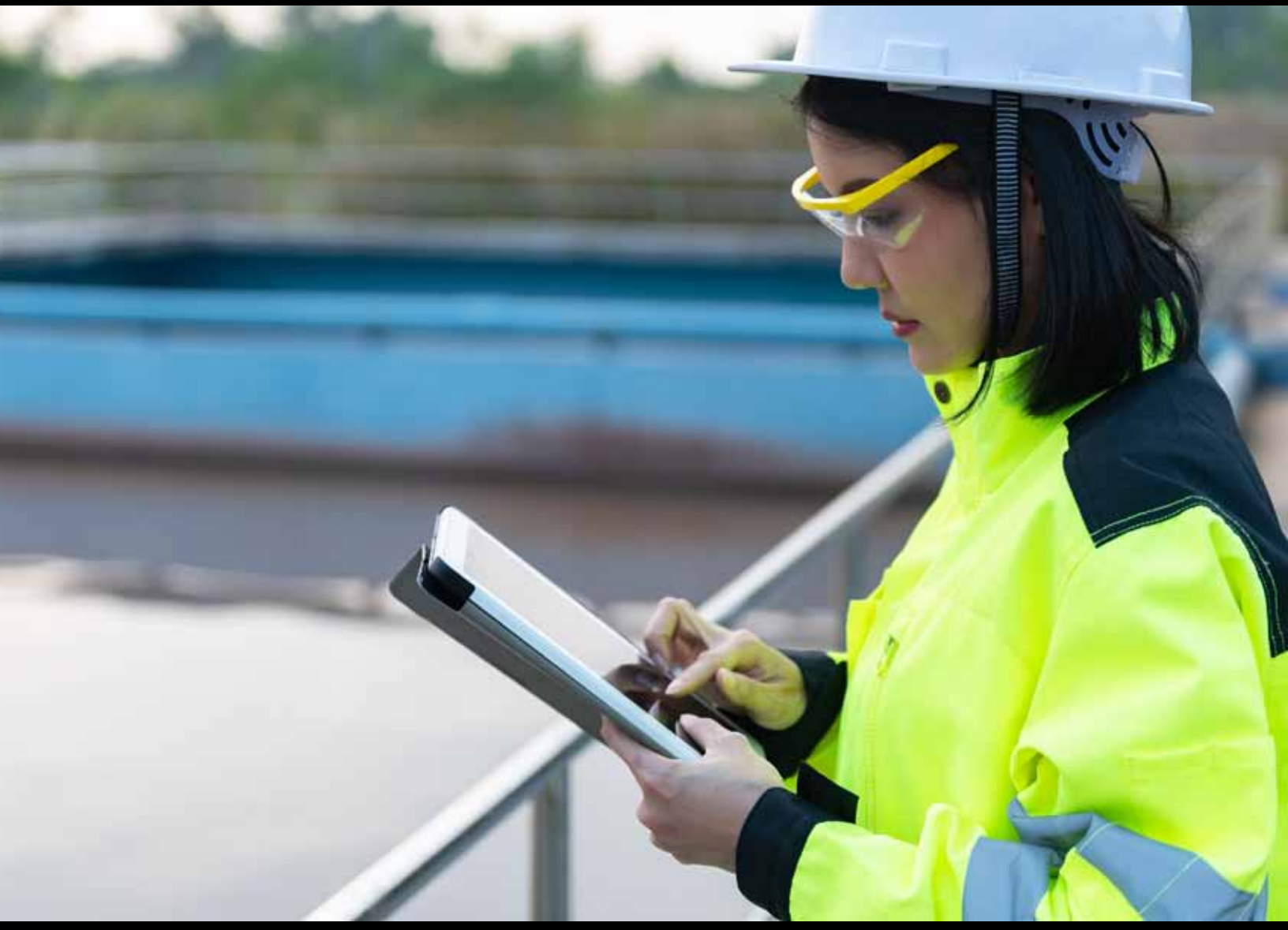




Innovative Solutions Throughout The Water Cycle

- Treatment and Conveyance
- Climate Resilience
- Client Enterprise Solutions
- Municipal and Industrial Sectors



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