JOURNAL

OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

VOLUME 59 NUMBER 4 / ISSN 1077-3002 **WINTER 2025**

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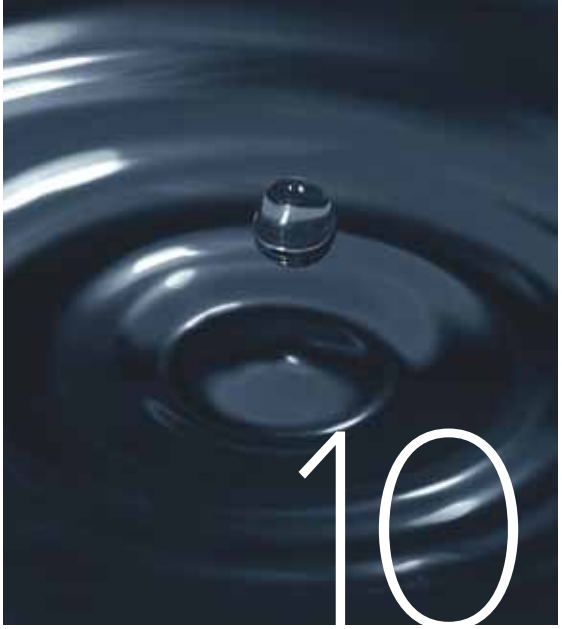

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On the cover: Environment activists join a Bristol Youth Strike 4 Climate rally in Bristol, England, on February 28, 2020. Greta Thunberg led thousands during the demonstration.

Page 60: Measurement unit conversions and abbreviations

The concepts, ideas, procedures and opinions contained in the articles in this publication are those expressed by the various authors who submit the material for publication. The New England Water Environment Association, its executive committee, the editors, the executive director, and administrative staff hereby assume no responsibility for any errors or omissions in the articles as presented in this publication, nor are the concepts, ideas, procedures and opinions in these articles necessarily recommended or endorsed as valid by NEWEA, its executive committee, the editors, the executive director or staff. References to specific products or services do not constitute endorsement of those offerings by NEWEA. The Journal's committee reserves the right to make any editorial changes deemed necessary for publication of submitted papers.

NEWEA Journal ISSN #1077-3002
Published four times annually by
New England Water Environment Association, Inc.
This is Volume 59 Number 4
Periodical postage paid at Woburn, MA 01801, and at additional mailing offices

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Postmaster:
Send address changes to:
NEWEA Journal
10 Tower Office Park, Suite 601
Woburn, MA 01801-2155

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Frozen Waterfall in White Mountains, NH (page 2)
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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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Regulatory	50
Academic	219
Young Professional	88
PWO	129
Dual	50
Student	28.50

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New England Water Environment Association | Statement of Ownership, Management and Circulation

Publication Title	The NEWEA Journal
Publication	#24559
Issue Frequency	Quarterly (four per year)
Annual Subscription Price	$24 (included with membership dues)
Complete Mailing Address, Known Office of Publication, General Business Office, Editors and Owner (non profit organization)	NEWEA, 10 Tower Office Park, Suite 601, Woburn, MA 01801
Contact Person/Managing Editor	Mary Barry, NEWEA Executive Director
Tax Status	No change during the preceding 12 months

Issue date for circulation data below: 09/30/2025

Publication title: The NEWEA Journal	Extent and nature of circulation: Technical/ Educational/ Environmental	Average no. copies each issue during preceding 12 months	No. copies of single issue published nearest to filing date
Total number of copies		2,176	2,379
Legitimate paid and/or requested distribution	Outside country paid/requested mail subscriptions	0	0
	In-country paid/ requested mail subscriptions	2,090	2,289
	Sales through dealers & carriers	5	5
	Requested copies distributed by other mail classes	0	0
Total paid and/or requested circulation		2,095	2,294
Total nonrequested distribution		0	0
Total distribution		2,095	2,294
Copies not distributed		81	85
Total		2,176	2,379
Percent paid and/or requested circulation		100	100

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President's Message

Reflections on my presidential term

As I write this final article for the *Journal* as president, I am filled with profound gratitude and reflection. Serving NEWEA this past year has been both an honor and a privilege, allowing me to witness firsthand the dedication and passion that defines our association. This concluding article offers a brief reflection on the journey, an update on our strategic initiatives, and a look ahead to an exciting Annual Conference and Exhibition in January.

One focus during my presidential term has been the development of NEWEA's new strategic plan. The process has been collaborative and thoughtful, involving input from many members and stakeholders. While we are still finalizing it, I can share that significant progress has been made. The commitment and enthusiasm from our leadership and membership have ensured that our plan will not only address current challenges but also set a clear, ambitious course for the future. I remain committed to seeing this work through to completion, confident it will be a valuable foundation for NEWEA's continued growth and impact.

As we prepare for the upcoming Annual Conference and Exhibition, anticipation is building for what is sure to be a memorable event. The conference provides a unique opportunity for us to gather, share knowledge, and celebrate our collective achievements. I am excited to announce that at the opening session the strategic plan will be officially presented to our members. This milestone will mark a new chapter for NEWEA, and I look forward to engaging with all of you as we chart our path forward together.

I offer this reflection to those who may not have had the opportunity to observe the role closely. Serving as NEWEA president is both demanding and rewarding. The position requires attendance at monthly senior management team (SMT) meetings to discuss organizational health and address current issues. It also involves engaging with state associations by participating in their conferences. One highlight of these interactions was re-presenting NEWEA and WEF awards, which allowed me to meet individuals whose achievements contribute significantly to our collective success. Additionally, as president, I participated in Finance Committee meetings, where I worked on budget balancing, which informed our strategic plan. My responsibilities often included delivering welcoming remarks, providing NEWEA updates, and expressing appreciation to those supporting our organization. While initially nervous about public speaking, I quickly realized that addressing audiences that comprised my colleagues and friends (with smiling faces) was rewarding.

2025 Annual Conference and Exhibition

This year's accomplishments would not have been possible without the unwavering support of many individuals and organizations. I extend my heartfelt thanks to the SMT, whose guidance and expertise have been instrumental. The Executive Committee has provided steadfast leadership, and the NEWEA staff has demonstrated exceptional dedication in managing the day-to-day operations of our association. I also recognize my employer, Brown and Caldwell, for its support throughout the year. Together, you have helped make NEWEA stronger, and I am deeply grateful for your commitment and collaboration.

As my term draws to a close, I am reminded that NEWEA's strength lies in its people—the passionate members, dedicated volunteers, and committed staff who work tirelessly to advance our mission. The journey has been rewarding, filled with challenges and triumphs that have shaped my perspective and deepened my appreciation for our community. I leave this role optimistic about NEWEA's future and excited for the opportunities that lie ahead. Thank you for allowing me to serve as your president. I look forward to seeing many of you at the Annual Conference and to supporting NEWEA's ongoing success in the years to come.

NEWEA's strength lies in its people—the passionate members, dedicated volunteers, and committed staff who work tirelessly to advance our mission.

From the Editor

Welcome, NEWEA friends, to our winter edition of the *Journal*. In this edition, we highlight the critical topics of climate justice and sustainability. As we are well aware, the Northeast, and especially New England, is warming faster than other regions of the United States. We are experiencing shorter and milder winters, more days of record heat in the summer, heavy precipitation and flooding throughout the year, and shifts in our seasonal weather patterns. These events have been felt acutely on the coasts of each New England state with high-tide events with historical sea level rise causing street inundation, shoreline erosion, property damage, and saltwater intrusion into local groundwater supplies. In many cases, our water infrastructure does not have the capacity to withstand these impacts due to its age, lack of conveyance and storage capacity, and the public's financial constraints to provide capital investments needed to make these systems more sustainable and resilient.

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An important aspect of addressing climate change is its impact on the residents and businesses in our communities. It is not just an environmental problem; it is also a social and ethical one. Often, communities experience its impacts unequally. Those least responsible for climate change—most notably, the long-term effect of greenhouse gas emissions due to the industrialization, urbanization, and population growth of modern society—are most affected by it. We all have the right to a safe, healthy environment and protection from climate change. Climate justice aims to identify these inequities and ensure we work together to equally distribute mitigation and adaptation efforts throughout our communities. But action speaks louder than words, and in this edition of the *Journal*, we present four features from water professionals who are acting on the front lines to address these vital issues.

Our first feature discusses the escalating challenges of unpredictable weather patterns, rapid urbanization, and constrained public budgets that demand a fundamental shift from reactive to proactive stormwater management by introducing continuous monitoring and adaptive control (CMAC), also known as real-time control, to address these challenges. CMAC integrates weather forecasts and real-time sensor data to autonomously manage stormwater facilities, providing an adaptable, equitable, and sustainable approach to managing water infrastructure that enhances community resilience and ensures long-term environmental sustainability.

Our second feature highlights a workshop intended to create partnerships to bridge the gap in the industry between resilience project needs and funding caused by an increasing mismatch between climate risk reduction strategies for public agencies and the funding and financing available. This gap represents an opportunity and an incentive to diversify and realign long-term financing from the outset of projects, catalyzing non-traditional partnerships that enable their development.

Our enlightening third feature shows that communities cannot be resilient if segments of the population remain systematically overburdened and underserved. It highlights that infrastructure improvements, hazard mitigation projects, and adaptation investments are necessary but insufficient without equal attention to the social conditions that determine whether people can prepare for, respond to, and recover from climate impacts. By integrating current literature and state and national data sets with on-the-ground anecdotes and practitioner experience, this article emphasizes that resilience is not only an engineering challenge but also a sociological challenge.

Finally, our fourth feature describes how communities across New England are experiencing increased flooding, drought, excessive heat, variable winters, and other extreme weather events that threaten the functionality of critical infrastructure like water and wastewater systems. To better understand these issues, water and wastewater system vulnerability assessments were conducted for 14 communities across New Hampshire to identify vulnerabilities within their water and wastewater infrastructure systems related to natural disasters and extreme weather events. With this understanding, the authors note that utilities can minimize these vulnerabilities which, if not addressed, could not only prove costly to fix after an event but also put public health at risk.

In addition, this issue includes the latest Industry News and NEBRA highlights, reports from our WEF delegates highlighting their exploits at WEFTEC, news about our four Operations Challenge teams that represented NEWEA with pride and gusto, and a Young Professional spotlight featuring Mabel Smith, a project engineer with Apex Companies. As is customary with our winter issue, past president, avid golfer, and host of NEWEA's annual golf tournament, Fred McNeill, presents his "Swings and Things" recap of our fifth annual golf classic at his beloved Derryfield Country Club course.

As always, we offer our thanks and appreciation to our *Journal* advertisers and event sponsors whom we recognize for their vital role in supporting our NEWEA programs. In closing, as our holiday season is now upon us, on behalf of the *Journal* Committee, I wish all of you and your loved ones a happy and healthy holiday season and a prosperous 2026, which notably will be the 60th anniversary of the *Journal*. I assure you we will be celebrating this important milestone with you throughout the coming year.

Industry News

New resources to protect water systems, strengthen cyber resilience

In late October, EPA released new and updated planning tools that water systems across the country can use to help prevent and respond to cybersecurity incidents. These tools will help all public water systems protect access to safe water and aid systems conducting risk and emergency planning for cybersecurity.

"Strengthening cybersecurity for the U.S. water sector is critical because cyber resilience and water security are important to national security," said EPA Assistant Administrator for Water Jess Kramer. "Systems across the country are facing cyberattacks that threaten the ability to provide safe water. Guarding against cyberattacks is central to this mission of strengthening cybersecurity."

To better address potential vulnerabilities and provide all water systems with information and emergency safeguards to protect drinking water and wastewater treatment operations, EPA has developed the following resources:

- The Emergency Response Plan (ERP) Guide for Wastewater Utilities updated plan describes strategies, resources, plans, and procedures utilities can use to prepare for and respond to an incident, natural or man-made, that threatens life, property, or the environment.
- The new Template for Developing an Incident Response Plan assists drinking water and wastewater systems with developing a Cybersecurity Incident Response Plan (CIRP).
- EPA is publishing two new Incident Action Checklists, as requested by the water sector, to help drinking water utilities prepare for, respond to, and recover from emergencies such as wildfires, power outages, floods, and cybersecurity incidents.
- The Cybersecurity Procurement Checklist will help water and wastewater utilities incorporate cybersecurity into the procurement process. It will help utilities assess the cybersecurity practices of suppliers, including vendors and manufacturers, and their products during procurement.

Cybersecurity for critical infrastructure is a human health and national security priority. EPA will continue to work with the Cybersecurity and Infrastructure Security Agency, state programs, and water associations to help reduce cyber risks to water systems. The agency will also continue to collaborate with water systems to implement best management practices to swiftly address any cybersecurity concerns as they arise.

In August, EPA announced $9 million in grant funding for midsize and large water systems to protect drinking water from cybersecurity threats and improve resiliency for extreme weather events. The agency also published a report highlighting 10 recommendations to strengthen resiliency to cyberattacks in the water sector.

Cyberattacks against water systems have increased several-fold in recent years and can disrupt or contaminate drinking water and compromise the treatment of wastewater. EPA, federal partners, and utilities have a collective responsibility to ensure that cyber threats do not imperil the critical lifeline of clean and safe water.

Next steps on regulatory PFOA and PFOS cleanup efforts announced

In September, EPA announced the next regulatory steps to address cleanup of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS).

"When it comes to PFOA and PFOS contamination, holding polluters accountable while providing certainty for passive receivers that did not manufacture or generate those chemicals continues to be an ongoing challenge," says EPA Administrator Lee Zeldin. "EPA intends to do what we can based on our existing authority, but we will need new statutory language from Congress to fully address our concerns with passive receiver liability."

EPA is retaining the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) hazardous substance designation for PFOA and PFOS, and will initiate future rulemaking to establish a uniform framework governing designation of hazardous substances under section 102(a) of CERCLA. On September 17, 2025, the U.S. Department of Justice (DOJ) submitted a court filing on behalf of EPA as part of ongoing litigation about the designation of PFOA and PFOS as CERCLA hazardous substances. The agency is retaining the rule that became effective on July 8, 2024.

CERCLA imposes broad, retroactive, and potentially costly strict liability on those who released hazardous substances to the environment. In some cases, this liability can attach to entities that did not manufacture or generate the substance but received it in feedstocks, products, or waste. Such entities are sometimes referred to as "passive receivers."

EPA intends to develop a CERCLA section 102(a) Framework Rule. The rule will provide a uniform approach to guide future hazardous substance designations, including how the agency will consider the costs of proposed designations. Section 102(a) gives EPA authority to designate additional hazardous substances beyond those substances listed under the other statutes referenced in CERCLA (the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act).

Outreach initiative

EPA recently launched a PFAS OUTreach Initiative (called PFAS OUT) to connect with every public water system known to need system upgrades to address PFAS, including those finding PFOA and PFOS in their water. The agency will share resources, tools, funding information, and technical assistance opportunities so that no community is left behind in protecting public health and positioning water systems to comply with PFAS drinking water standards. PFAS OUT will support utilities, technical assistance providers, and local, state, Tribal, and territorial leaders in developing effective and practical solutions where they are needed most.

Massachusetts Clean Water Trust Board of Trustees approves loans and grants

The Massachusetts Clean Water Trust's Board of Trustees approved $280 million in new low-interest loans and grants at its meetings on September 10 and October 1. The Trust, in collaboration with the Massachusetts Department of Environmental Protection, helps communities build or replace water infrastructure by providing low-interest loans and grants to cities, towns and water utilities through the Massachusetts State Revolving Fund Program.

The funding includes grants and low-cost loans for clean water improvement projects, drinking water PFAS and metal treatment projects, community septage programs, asset management planning, and school water improvement grants. The communities and drinking water/clean water districts receiving this financial assistance are as follows: Barnstable, Bellingham, Brockton, Dennis, Fitchburg, Lawrence, Mashpee, Nantucket, New Bedford, Oak Bluffs, Plainville, Revere, Shirley Water District, Stoughton, Upper Blackstone Clean Water, Ware, West Bridgewater, Westport, and Whitman.

RIsing Sludge settles well in WEF Operations Challenge

Rhode Island's RIsing Sludge team, among four teams from New England, claimed second place overall in Division 2 (l-r : David Bruno, Courtney Iava-Savage, Kevin Gardner, Shaun Collum, and Eric Lemoi)

In an awards ceremony on September 30 at the end of two days of high-tension competition involving a record-breaking 57 teams from all over the United States as well as from Denmark and the United Kingdom, Rhode Island's RIsing Sludge team, among four teams from New England, claimed second place overall in Division 2. While competing in this exciting professional development program, the Rhode Island team matched wits and wills with other teams during five fast-paced events, and garnered first-place finishes in both the Process Control and Safety events in their division.

Each team earned an overall score based on their weighted performance in each of the five Operations Challenge events that test a different aspect of work in the wastewater profession: process control, laboratory, safety, collection systems, and pump station maintenance. The following teams were the national winners:

Division I Winners

- First Place: Elevated Ops (Rocky Mountain Water Environment Association)
- Second Place: Sewerside Squad (Rocky Mountain Water Environment Association)
- Third Place: Double Duty (Rocky Mountain Water Environment Association)

Division II Winners

- First Place: Team HRSD (Virginia Water Environment Association)
- Second Place: RIsing Sludge (New England Water Environment Association)
- Third Place: Surge (Water Environment Association of South Carolina)

Division III Winners

- First Place: Rowdy Rotifers (Chesapeake Water Environment Association)
- Second Place: TRAilblazers (Water Environment Association of Texas)
- Third Place: River Rangers (Pacific Northwest Clean Water Association)

Congratulations to all of our teams from NEWEA who competed well in this year's national event: RIsing Sludge, Maine's Force Maine, New Hampshire's Winni River RAScals, and Massachusetts's Mass Chaos (which participated by special invitation).

NEWEA 2026 Spring Meeting & Exhibit

May 17–20, 2026 • Sea Crest Beach Resort, North Falmouth, MA

Call for Presentations and Papers

NEWEA invites the submission of abstracts for presentation at the upcoming 2026 Spring Meeting & Exhibit.

This annual meeting consistently attracts more than 300 engineers, consultants, scientists, operators, and students, and features a variety of technical sessions, exhibitor displays, and the Operations Challenge competition. It provides an opportunity for professional exchange of information and state-of-the-art concepts in wastewater treatment and water environment issues.

Please consider submitting an abstract on water quality topics such as:

- Biosolids
- Clean Water Infrastructure Stories
- Collection Systems
- Infrastructure Funding
- Resiliency
- Small Communities/On-Site Systems
- Spotlight on Clean Water Professionals
- Stormwater/Flood Detection

Visit springmeeting.newea.org and click *Submit an abstract* to complete the online abstract submittal form.

Abstract submission deadline: January 30, 2026

It is NEWEA's policy that all participants and speakers are responsible for their own conference registration fee and other meeting-related expenses

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Future-proofing stormwater systems for resilient communities

DAVID RUBINSTEIN, CEO, OptiRTC, Inc., Boston, Massachusetts

ABSTRACT | The escalating challenges of unpredictable weather patterns, rapid urbanization, and constrained public budgets demand a fundamental shift from reactive to proactive stormwater management. This paper introduces continuous monitoring and adaptive control (CMAC), also known as real-time control, to address these challenges. CMAC integrates weather forecasts and real-time sensor data to autonomously manage stormwater facilities, thereby providing an adaptable, equitable, and sustainable approach to managing water infrastructure that enhances community resilience and fosters long-term environmental sustainability. Case studies show CMAC's ability to reduce capital and operational costs, prevent combined sewer overflows, and create high-performing, future-proofed infrastructure that can adapt to evolving regulatory and climate realities. This article provides a comprehensive and practical guide for water professionals, discussing best practices for successful CMAC adoption—from systematic site assessment and navigation of the regulatory landscape to strategic vendor selection and robust project management best suited for an advanced digital infrastructure.

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

The stormwater industry's current management approach is based on using passive infrastructure to capture and treat the runoff from a static design storm. This "design storm" is a fixed, historical rainfall event of a specific intensity and duration (e.g., a "100-year storm") that is assumed to represent the worst scenario. However, this methodology creates significant challenges in the era of climate change. Because historical data no longer accurately predict future weather, this rigid infrastructure is often undersized for the more frequent and intense storms of today, leading to widespread urban flooding, costly damage, and increased water pollution.

The maxim "change or die" certainly holds true for the stormwater industry. Technological advancements have rendered the reliance on passive, costly stormwater infrastructure obsolete, as this reactive, "set-it-and-forget-it" model is proving to be an inflexible and unreliable defense against modern climate realities. From an environmental perspective, a failure to embrace these advancements and alter our approach to managing stormwater will undoubtedly lead to adverse consequences for all. A paradigm shift is imperative; future development cannot be predicated on historical precedents. What was once considered a 100-year design storm has been reclassified, and precipitation patterns are demonstrating increased intensity. Meanwhile, four 1,000-year storms occurred across the United States this year alone (NBC News, 2025). Instead of adhering to outdated design-storm methodologies, a more agile and adaptable approach to stormwater challenges is required.

The software industry offers a valuable example. In the nascent stages of data processing, software development adhered to a "waterfall methodology," encompassing sequential phases of requirements gathering, design, construction, testing, and implementation (Atlassian, n.d.-b). By the time software was disseminated to users, business requirements had often become obsolete, leading to user frustration and exacerbating, rather than resolving, business challenges. The industry subsequently transitioned to the "agile methodology" in the 1990s, thereby facilitating rapid advancements in computing and at a reduced cost and risk compared to the former waterfall approach (Atlassian, n.d.-a).

Does this resonate? When a community endures prolonged waiting periods for a capital improvement plan, the original requirements become outdated, and costs invariably escalate. The integration of technology into infrastructure, combined with a design-bid-build framework, increases risk and cost. The business sector abandoned the design-bid-build model for software development with the advent of agile methodologies precisely for these reasons—to mitigate time, risk, and cost, while delivering superior outcomes.

The stormwater industry should consider a similar approach and transition to proactive, adaptable stormwater control systems. With increasing urbanization, today's passive facilities rapidly become obsolete. Passive facilities cannot react to forecasted and real-time conditions nor can they adapt when objectives change over time. The solution cannot always be to "build another storage basin" or "dig a deeper tunnel."

Stormwater management becomes much more efficient, cost-effective, and beneficial through technology. This concept is familiar, considering the technological advancements that have revolutionized outdated methods and best practices (e.g., the transition from rotary phones to smartphones, or retail on-site shopping to e-commerce). Our communities should, therefore, reap the benefits of these technological advancements. My experience confirms that change fosters opportunities.

SMART STORMWATER MANAGEMENT

Contemporary stormwater management has evolved into a future-proofing solution facilitated by continuous monitoring and adaptive control (CMAC), also referred to as real-time control. CMAC optimizes stormwater storage by integrating weather forecasts with real-time data to autonomously control facility operations. For example, the system can automatically lower water levels before a forecasted storm, increasing effective storage capacity by 40 to 60 percent to capture the anticipated runoff. Passive systems lack this capability, as their drawdowns are gravity-dependent, analogous to the outflow in a bathtub. CMAC can simultaneously address other site-specific objectives, such as modulating valves and gates to mitigate downstream erosion. This smart technology involves issuing commands that initiate actions based on real-time data, providing "instant, actionable insights," and eliminating the need for human intervention, keeping personnel safe during storm events. This approach minimizes dependence on an operator's manual input, as the system autonomously executes actions, continuously refines its algorithms, and provides real-time data for subsequent analysis.

CMAC technology offers numerous advantages that passive facilities cannot:

- Facilities can be retrofitted with CMAC technology, increasing capacity by 40 to 60 percent at approximately one-tenth of the cost of altering a facility or constructing a new one.
- CMAC is an optimal solution for urban environments where land is costly and constrained. New stormwater facilities may be eligible for downsizing due to the 40 to 60 percent capacity increase provided by CMAC. In one example, a private landowner saved $2 million by eliminating one of two underground detention facilities as a result of CMAC implementation.
- Stormwater can be leveraged as an asset through rainwater harvesting and reuse systems for property irrigation or other on-site water uses. One CMAC user reports annual savings on the municipal water bill of $80,000 by integrating rainwater harvesting with a retrofitted stormwater facility. This also contributed to an additional three Leadership in Energy and Environmental Design (LEED) credits, elevating the property to Gold certification.
- CMAC facilities can be interconnected to form a smart watershed network, which can deliver superior performance compared to the individual performance of each site. A smart watershed network integrates sensor readings from upstream and downstream locations, including the wastewater treatment plant, an effective strategy for reducing combined sewer overflows (CSOs).
- CMAC facilities demonstrate significant resilience, mitigating future damage. A recent study showed that every $1 invested in resilient solutions can save $10 in disaster recovery (WRI, 2025). As a future-proofing technology, CMAC provides long-term sustainability and resilience through real-time adaptation and controls.
- CMAC systems are highly intelligent and configurable. The extensive data collected provide insights into facility performance. In the event of regulatory changes, software configuration adjustments enable the system to adapt, whereas a passive system may increase construction expenses. The system can also alert operations and maintenance personnel to any behavioral anomalies within the facility.

CMAC provides an agile approach to community protection, bypassing lengthy and expensive capital planning to immediately address the most critical needs and deliver climate justice to vulnerable areas. Stormwater facilities can be implemented quickly and networked together over time, achieving long-term resilience goals without the cost and delay of a traditional capital plan. As an adaptive technology, CMAC provides a future-proof solution that ensures lasting sustainability, major cost savings, and peace of mind that comes from a system built to respond to real-time conditions.

1. Washington Park Lake
2. Ryckman Wetland
3. Hansen Underground Detention
4. Albany HS Lower Underground Detention
5. Albany HS Upper Underground Detention
6. West Lawrence St Underground Detention
7. VA Medical Center Detention Basin
8. Academy Rd. Constructed Wetland
9. Future CMAC Site

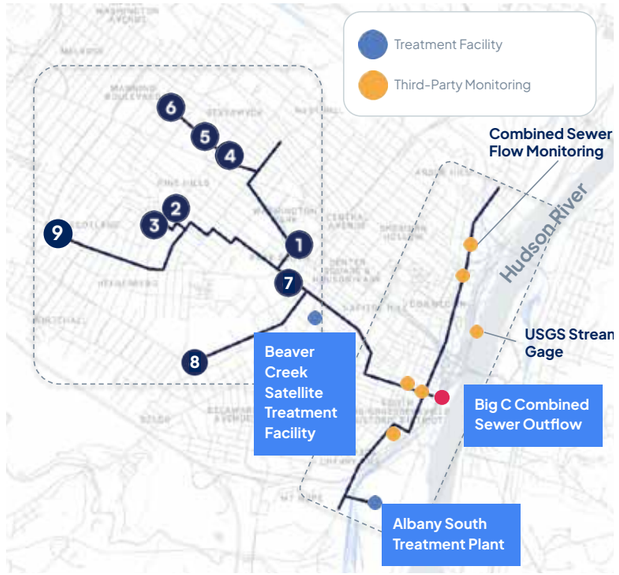

Figure 1. Map of the smart watershed network in the city of Albany, New York

CASE STUDIES

Apartment Complex in Bronx, New York

Developers of a 123-unit affordable housing complex in the South Bronx faced a dual challenge: maximizing rainwater harvesting to supply a 10,000 ft² (929 m²) rooftop greenhouse while minimizing stormwater pollution entering New York City's waterways. Additional objectives included earning and maintaining LEED credits for water conservation and meeting strict regulations for mitigating CSOs.

CMAC was included in the system's design to control the timing of water discharge from a 15,000 gal (56,780 L) cistern. Using National Weather Service forecasts, the CMAC software predictively draws down the water level in the cistern ahead of a storm to maximize rainfall capture. Afterward, the captured water is retained for reuse.

Property managers use CMAC's web-based dashboard to monitor performance statistics, review historical data summaries, and enable automatic control of the outflow valve. The CMAC platform also helps them prepare quarterly reports with performance data to achieve environmental compliance and maintain building LEED Platinum and other certifications.

Within one year, the CMAC system increased efficiency by 4.6 times compared to traditional passive management. By adding CMAC climate adaptive controls, the developer achieved the following:

- Converted a passive system with two cisterns for storing 134,650 gal (509,705 L) to a CMAC active system requiring one cistern for storing 15,560 gal (58,900 L), thereby reducing capital expenditures
- Reduced the footprint needed by relocating the cistern under a parking lot, creating space for alternative use and additional revenue
- Prevented sewer overflows while reusing stormwater on-site to achieve LEED credits, thereby reducing potable water bills and operational expenditures

Smart Watershed Network in Albany, New York

Albany's largest sewershed, the Beaver Creek District, historically discharged over 530 MG (2,006 ML) of CSOs annually to the Hudson River. In response, the Albany Water Board launched an integrated plan featuring green, grey, and technological solutions. As the plan's core technology, the CMAC solution actively controls 17.5 MG (66.2 ML) of storage capacity to help solve the problem.

The smart watershed network consists of monitoring stations and eight stormwater facilities that use CMAC to control and coordinate the timing and rate of discharge based on weather forecasts and real-time data. The customer's platform receives monitoring data from three sources—two treatment facilities, four sewer monitoring sites, and one U.S. Geological Survey gauging station. The data show asset status, performance, and maintenance needs, allow early detection of potential problems and impending flooding, and inform decisions on the release of stormwater from CMAC sites.

Several stormwater facilities were retrofitted and enhanced by incorporating CMAC. Washington Park Lake, originally separated from the combined sewer, was retrofitted with CMAC controls to create 7 MG (26.5 ML) of storage that protects the downstream sewer system. A West Lawrence Street box culvert as well as two underground detention facilities were retrofitted with CMAC controls to allow intelligent runoff management that prevents CSOs and promotes infiltration by using coordinated, timed drawdown logic with other in-line facilities. Several new green infrastructure facilities were constructed throughout the sewershed as well. These include an underground infiltration gallery and stormwater harvesting facility in Woodlawn Park, and two constructed wetland systems.

This system integrates eight CMAC facilities with data from third-party monitoring stations. Releases from the CMAC facilities are coordinated with real-time monitoring data to strategically reduce wet weather contributions to the combined sewer system (Figure 1).

Together, the new and retrofitted facilities create the eight-facility smart watershed network. The CMAC system functions like a traffic control network to prevent CSOs into local waterways, with its actions guided by water levels at the "Big C" CSO outfall (Figure 1). Under normal conditions, the eight upstream control sites operate independently, managing water flow based on local data. However, during heavy rain, if the water level at the "Big C" rises to a predetermined height, a central network command activates. This central command overrides the local sites and closes their outlet valves, temporarily holding water back to prevent them from adding additional stormwater to the combined sewer. Once levels within the sewer system have decreased, normal, independent operation resumes at each site.

The smart watershed network provides many benefits to the Albany community, including CSO and flood mitigation and operational insights for targeted operations and maintenance. Prior to CMAC implementation, the system's wet weather capture was estimated to be only 10 to 20 percent of the annual stormwater runoff volume. By creating a smart watershed network, the wet weather capture rate increased to approximately 90 percent. In 2024 alone, almost 200 MG (760 ML) of stormwater were retained during wet weather, thereby greatly reducing contributions to the combined sewer system (Figure 2).

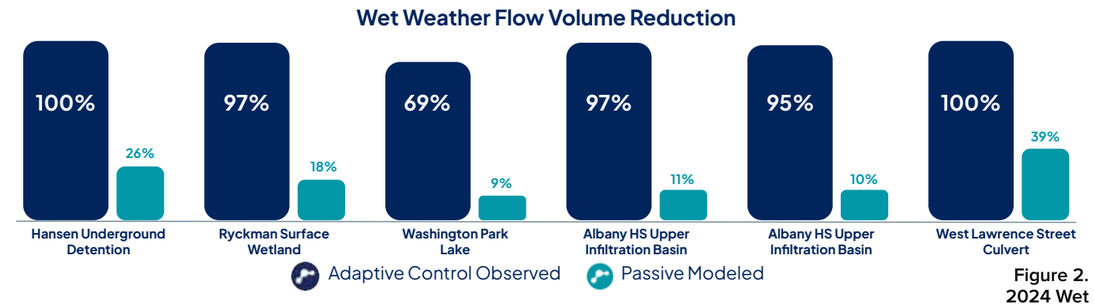

Figure 2. 2024 Wet weather flow volume reductions

Wet weather flow volume reductions, as determined by using observed data, are presented in Figure 2 as a percentage of the annual total volume of stormwater runoff reduced (in millions of gallons). The system was modeled as a passive system (i.e., without CMAC), and wet weather volume reductions are shown for comparison. Veterans Health Administration Medical Center detention basin and Academy Road constructed wetland sites are not included, as they were commissioned in late 2024.

BEST PRACTICES FOR IMPLEMENTING A CMAC SYSTEM

Site Assessment Framework

Before starting a CMAC project, the regulatory environment must be assessed and a site chosen that is conducive to CMAC implementation.

Navigating the regulatory landscape is a critical first assessment step. Some agencies seek CMAC solutions and are integrating them rapidly, while others may resist such changes. Moreover, regulations are not one size fits all; they can vary significantly based on federal, state, and local mandates. For example, while EPA sets national standards under the Clean Water Act, state and local agencies often have their own requirements and permitting processes. Understanding the rules that govern each facility is fundamental.

Before implementation, the following questions should be explored and answered:

- Can we achieve our specific regulatory goals—such as CSO reduction or water quality targets—with a CMAC system in our facilities?
- Which flow, volume, and pollutant regulations apply to each facility, and how will the system address them?
- Are there other applicable requirements, such as long-term control plan mandates, consent decrees, or watershed management goals?

Treating regulators as key stakeholders rather than hurdles is crucial, and this begins with early and continuous communication. Proactively engaging with regulatory bodies allows the agency to educate them on CMAC technology, build trust through a commitment to transparency, and collaboratively

identify potential concerns before they become problems. This transforms the relationship from a simple compliance check into a true partnership focused on the shared goals of protecting water quality and community safety.

To satisfy regulators, the goal is to show that a CMAC system is a reliable and effective tool that will meet or exceed their mandates. A strong case should highlight how the system enhances control to manage flows and storage, minimizing downstream impacts. This is complemented by superior data, as high-resolution information offers unprecedented insight into more transparent reporting. Together, these features offer clear performance verification, using a data-backed record of operations to prove a commitment to protecting the community and the environment.

The second assessment step involves evaluating site suitability for CMAC implementation. Retrofitting a stormwater facility is often the most strategic starting point for a CMAC program due to its rapid implementation timeline and significantly lower cost than construction of a new facility. An underground detention facility can be retrofitted and made operational within four to eight weeks, while a stormwater pond can be retrofitted and made operational within 16 to 24 weeks; new construction projects can take months or even years to complete, extending the time to value realization.

A successful CMAC retrofit hinges on a systematic qualification process that evaluates a site's strategic objectives, technical feasibility, downstream impact, and logistical viability, as outlined below:

1. Define site objectives: Clearly establish the primary and secondary goals for the CMAC system. Common objectives include water quantity control (flooding), water quality enhancement, or channel protection. This will determine the required control logic and performance metrics.
2. Assess physical and hydrological feasibility:
   - Calculate Active Storage Volume: Determine the volume of water below the primary outlet that can be controlled by a valve or gate. A facility with significant active storage is a strong candidate.
   - Analyze Site Hydrology: Use hydrologic and hydraulic (H&H) models to understand the runoff characteristics (volume, timing) from the upstream catchment area.
   - Evaluate Outlet Structure: Confirm that the outlet is suitable for a retrofit. A single, concentrated low-flow outlet is ideal for installing an automated valve or gate.
3. Evaluate downstream network impact: Analyze the facility's role within the broader conveyance system. Use a hydraulic model to simulate CMAC control strategies and ensure that managed releases will not create or worsen downstream problems, such as flooding or erosion at vulnerable areas like undersized culverts.
4. Confirm logistical viability: Assess the practical aspects of installing and operating the system at the site. This includes the following:
   - Access: Ensure there is reliable, year-round access for installation and maintenance.
   - Power: Identify a continuous power source (grid connection is ideal; otherwise, evaluate solar feasibility).
   - Data Connectivity: Verify the site has a reliable data connection (e.g., cellular signal) for transmitting data and receiving commands.
   - Ownership: Resolve any land ownership or access easement issues.

A comprehensive analysis of these factors is critical to ensure that a CMAC retrofit will be both technically feasible and effective in achieving the operational objectives.

Implementing CMAC in a new development project offers a different opportunity compared to retrofitting. Instead of adapting to a facility's constraints, engineers can holistically design the stormwater management system around active control from the project's inception. This integrated approach can optimize the facility's footprint, potentially reducing land acquisition and earthwork costs by designing a smaller, more efficient basin that leverages technology rather than sheer volume. While the upfront budget must account for the technology and hardware, these costs can be offset by the savings in land and construction, making it financially viable for creating a high-performance, "future-proofed" development.

PROJECT MANAGEMENT

Research from the *PM World Journal* on information technology (IT) project failures offers a critical insight: Technology is rarely the cause of failure (Arcidiacono, 2017). Instead, projects typically fail due to human factors like poor stakeholder commitment, team misalignment, or an unclear return on investment. This principle applies to any complex initiative, and it is especially true for CMAC implementation, which inherently crosses departmental lines from engineering and regulatory to operations and maintenance. Therefore, successful implementation must begin with a focus on engaging the entire team and all stakeholders.

Treating CMAC implementation as an organizational change initiative is crucial. All stakeholders must be involved, engaged, and committed for alignment among people, processes, and the technology itself. Figure 3 illustrates a proven framework for managing such change, showing that five key components—vision, skills, incentives, resources, and an action plan—are essential. The absence of any single component can result in confusion, resistance, or frustration, hindering progress.

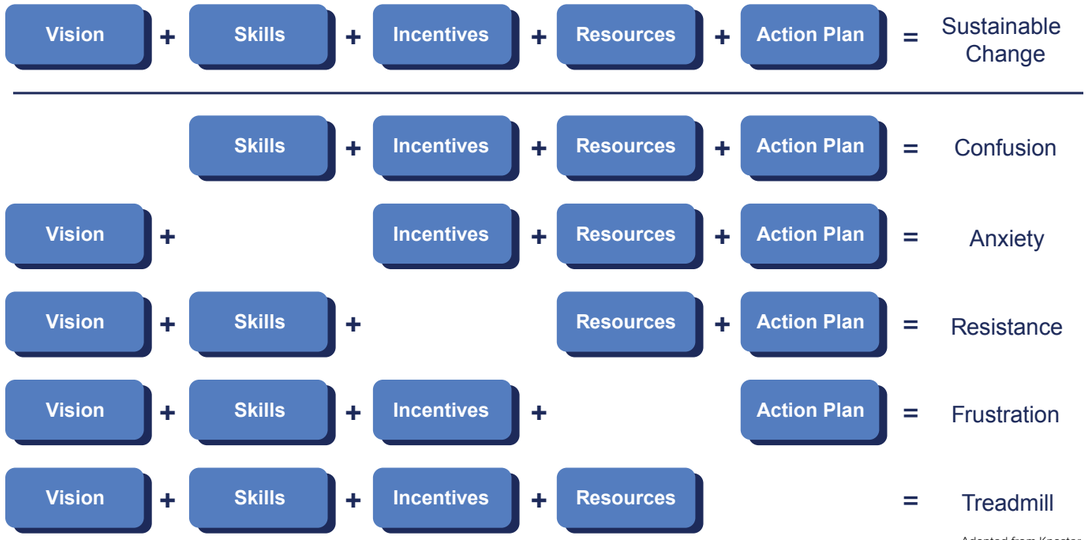

Figure 3. A framework for thinking about systems change

Adapted from Knoster, T., Villa, R., & Thousand, J. (Eds.), *Restructuring for caring and effective education: Piecing the puzzle together* (pp. 93-128). Baltimore: Paul H. Brookes Publishing Co. (2000).

With this focus on people and process in mind, organizations can avoid two common pitfalls. The first is mistakenly treating technology as an afterthought, which significantly diminishes the likelihood of success. A proactive "involvement strategy" from the start is important. The second pitfall is in vendor selection; choosing a vendor based on the lowest price raises risk. Instead, the selection process must prioritize a partner's qualifications and delivered value, as this is a determining factor in achieving the desired outcome.

VENDOR SELECTION

The selection of a CMAC vendor requires an assessment of both software capabilities and technical infrastructure, encompassing cybersecurity, disaster recovery, and redundancy. This enumeration is not exhaustive, and many organizations may benefit from involving their IT department in evaluating technology vendors.

Since CMAC is a new software application, it's crucial to evaluate a vendor's maturity beyond just its hardware and software. When assessing CMAC vendors, it is imperative to confirm that the vendor possesses a documented implementation methodology that outlines roles and activities for your team and its affiliates. The presence of such a methodology signifies an experienced vendor committed to continuous improvement of its product and implementation services.

From a personnel perspective, it is desirable for the vendor to show extensive experience in software architecture, software engineering, and development operations. These core competencies are indispensable for any commercially viable software product. It is common for a new software application domain to feature numerous vendors that have rapidly developed the application yet lack critical software infrastructure components. Such solutions typically have a curtailed lifespan, often presenting cybersecurity vulnerabilities, scalability limitations, and designs not conducive to software upgrades. These capabilities are vital for sustained application performance and optimal outcomes.

CMAC SOFTWARE DESIGN

Software functionality and cybersecurity infrastructure are two core elements with CMAC software design.

Software Functionality

When evaluating software functionality, the focus should be on its capacity for predictive, data-driven control, which can be configured for one objective, like flood control, or for multiple objectives, such as simultaneously managing water quality and peak flow mitigation.

The system's cornerstone is its control logic. At a minimum, a CMAC platform should be able to perform forecast-based pre-event drawdowns to create storage capacity ahead of a storm, extend post-event retention durations, and modulate releases during wet weather to reduce peak flow. The software should also be able to manage both

dry- and wet-weather target water surface elevations. Critically, this site-specific control logic should be flexible and easily configurable by users through an intuitive online interface.

A CMAC platform's intelligence is driven by its ability to integrate diverse data sources to make predictive decisions. CMAC should integrate with internet of things (IoT) technology for sensor data and leverage real-time weather forecasts from sources like the National Oceanic and Atmospheric Administration. A vital architectural feature is that the platform should be "sensor agnostic" with a robust application programming interface (API). This ensures the system can use a customer's monitoring networks and integrate with third-party sensors, actuators, and supervisory control and data acquisition systems, maximizing flexibility and protecting infrastructure investments.

For the stormwater operator, system management and performance verification are critical success factors. The software should provide user-specific dashboards that display real-time conditions and on-site operating parameters. The system should be able to summarize and display site data by individual storm events, essential outcomes for analysis, and regulatory reporting. To ensure timely responses, it should also be able to send automated email alerts to users based on configurable thresholds relating to current and future site conditions.

Cybersecurity Infrastructure

Cybersecurity is top of mind for all of us; it is in the news almost every day.

A CMAC platform must offer secure, continuous access to designated sites, built on robust security with strong encryption. Ideally, there should be single sign-on support and the option for multi-factor authentication, similar to many smartphone apps.

Security certifications such as SOC-II (Systems and Organization Control 2) tell us the vendor has wisely invested in cybersecurity. SOC-II is a security framework that specifies how organizations should protect customer data from unauthorized access, security incidents, and other vulnerabilities.

For a CMAC system, cybersecurity should also provide the following protections:

- Security for end-user sign-on and system administration
- A secure cloud environment that detects intruders
- A secure IoT layer that detects intruders

A cyber hack is a matter of "when" and not "if." When the system detects an intruder, end users should be notified and the system set into "manual mode." Manual mode turns the CMAC facility into a passive facility while intrusion detection is in process. During this process, all data should continue to be collected at the stormwater facility location. Once the intrusion process is completed (i.e., the system is secured), the system can be placed back in automatic mode. All data collected during the intrusion process should be loaded into the CMAC database for on-line queries and reporting.

PROJECT IMPLEMENTATION

Robust project management practices should be diligently applied throughout all project phases. The selected CMAC vendor should provide comprehensive solution design and analysis support for its hardware and software. One key is collaborative H&H modeling. Working with the customer's design team, the vendor should use the customer's site-specific data and storm scenarios to model and verify critical performance requirements like failsafe conveyance, drawdown times, and regulatory compliance.

Software

Before finalizing the design, the CMAC vendor must provide a software configuration report confirming that the proposed settings will achieve the site's objectives. For this report, the vendor translates high-level goals (e.g., flood mitigation) into specific software parameters, which are then validated for compatibility and simulated for performance. The final report must also include all data inputs and third-party integrations, and specify which metrics will be managed via the system's APIs.

Software implementation begins with provisioning the control panel, which acts as the system's decision-making hub. During this process, the vendor's cloud software is synchronized with the panel and configured for site-specific objectives, enabling it to process real-time sensor and forecast data to manage hardware like automated valves. This process is similar to downloading an app to a smartphone, as it sets up the data exchange between the app and the phone.

The operator experience is critical, requiring intuitive online dashboards for remote system control, real-time status monitoring, storm alerts, and performance analysis. The final phase integrates all key data sources, deploys device telemetry and public APIs, and establishes a user administration system with defined roles, permissions, and security protocols.

Hardware

A complete CMAC hardware installation includes several core components for autonomous operation:

- IoT sensors (e.g., level sensors, rain gauges) to gather real-time data
- Communications panel with reliable connectivity (cellular, Wi-Fi, etc.) to transmit data to the cloud
- Actuated flow control device (e.g., valve, slide-gate) to execute control decisions
- Reliable power source (solar or direct line) with a backup system to ensure continuous operation

Alongside the physical hardware, the vendor must deliver a complete documentation package for the site plan set and submittals. This includes installation details, electrical schematics, a full bill of materials, manufacturer specifications, and comprehensive construction specifications covering commissioning and quality assurance.

Support

As an integral part of its service, the CMAC vendor should offer full support to the end-user. This includes on-call remote customer support during regular business hours to address immediate needs and respond to inquiries. To manage issues efficiently from submission to resolution, a help desk and tracking system is essential. In addition to reactive support, the provider should also deliver periodic performance reports, offering insights into the system's operational effectiveness.

Post-Implementation Optimization

Following installation, site optimization is essential to validate the system's performance using real-world data, which provide more accurate results than modeling alone. During this period, the vendor and customer should collaborate to fine-tune software configurations and control logic, ensuring the system is fully optimized to meet the facility's primary objectives.

CONCLUSION

The stormwater industry is at a critical juncture, much like the software industry was before its transition to agile methodologies. Continuing to rely on the static "design-storm" approach is an inflexible and increasingly ineffective defense against a dynamic climate. By adopting CMAC, we shift from a passive, "set-it-and-forget-it" model to an active, intelligent one that maximizes performance, minimizes costs, and adapts our infrastructure to future challenges. This evolution is important to create safer, more sustainable communities prepared for an uncertain future. With a digital mindset, no challenge is insurmountable.

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Mr. Rubinstein has over 40 years of leadership in building and scaling high-tech startups. He has led the transformation of OptiRTC, Inc., from consulting services to a digital water product company. Throughout his career, Mr. Rubinstein has been a leader in digitally driven solutions to over a dozen industries. His expertise in business transformation, including change management and cultural alignment, has been a key ingredient for team success.

Resilience by design—and by dollars: financing climate adaptation

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EMMA THEBAULT, PhD, ENV SP, WEDG, STV, New York, New York

ABSTRACT | What if the best means to adapt our infrastructure to future hazards were to make its funding more resilient? To answer this question, STV and PRE Collective hosted a half-day program called "Building Strong Futures: Unlocking Funding through Risk Reduction" on September 23, 2025, with 45 professionals from public, private, insurance, risk management, academia, and non-profit organizations. The goal of the program was to create partnerships to address the gap in the industry between resilience project needs and funding—a gap caused by an increasing mismatch between climate risk reduction strategies for public agencies, and the funding and financing stakeholders and mechanisms. This gap provides an opportunity and an incentive to diversify and realign long-term financing from the outset of projects, catalyzing non-traditional partnerships that enable their development. The first part of this article exposes challenges in resilience project execution in the public sector. The article then develops the basis to rescale the resilience value to a common understanding in a broader community of practice, including investors. Lastly, the article concludes with a call to action to realign the local and regional resources.

KEYWORDS | Resilience, infrastructure, finance, funding, investment, value, partnerships

Decades of constrained investment have left much of the nation's infrastructure in need of renewal, with implications for both daily life and local economies (ASCE, 2024). The American Society of Civil Engineers estimated an investment gap of $2.9 trillion for the period 2024–2033 to acheive a state of good repair for infrastructure only (including surface transportation, water transportation, energy, aviation, and drinking water, wastewater, and stormwater), assuming a continued federal investment. This gap increases to $5.4 trillion under a scenario of federal disinvestment (ASCE, 2025). For wastewater, stormwater, and drinking water alone, the gap in investment is evaluated at almost $1 trillion for the same period, under a continued federal investment scenario (Figure 1).

The age of the infrastructure and buildings, increased demand on transportation, energy, and water systems, and the diversification of technologies compound this need, as do ever-intensifying natural disasters. In 2024 alone, the United States experienced 27 weather and climate disasters each causing at least $1 billion in damages (NOAA NCEI, 2025). Focusing on our changing environmental conditions, the community of practice has conceptualized resilience as our built environment's structural capacity to withstand events or chronic climate stressors, but also our capabilities to prepare for and recover from these events. Beyond life safety requirements, safeguarded by building codes and standards, resilient projects and infrastructure aim to minimize current and future risks.

In 2024, the U.S. Chamber of Commerce, in concert with a major national insurance corporation and the U.S. Chamber of Commerce Foundation, modeled 25 disaster scenarios ranging in damage and cleanup costs from $1 billion to $130 billion and found that every $1 spent on resilience and preparedness saves communities about $13 in damages, cleanup costs, and economic impact (U.S. Chamber of Commerce, 2024). This study further supports the implementation of resilience projects by broadening their demonstrated value, moving beyond avoided losses to also capture their positive economic impacts.

To date, funding for resilient infrastructure is local and federal public investment. Most of this funding

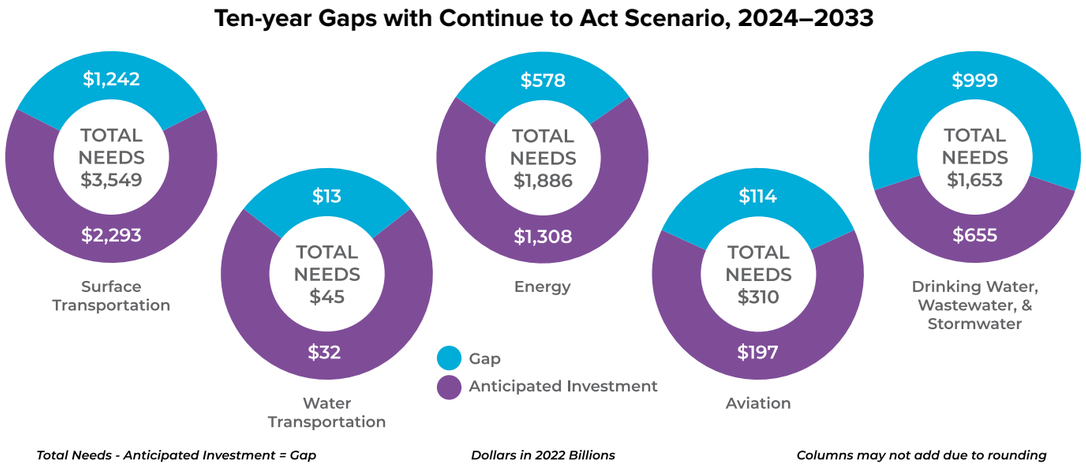

Figure 1. Projections of the infrastructure investment need and gap for 2024–2033 (Source: ASCE, 2025)

comes from federal discretionary grants (e.g., Federal Emergency Management Administration [FEMA] Hazard Mitigation Assistance, FEMA Flood Mitigation Assistance, or U.S. Department of Housing and Urban Development Community Development Block Grants), and most monies only become available after a disaster occurs. Since 2021, after the passage of the Infrastructure Investment and Jobs Act, and the initialization of programs like FEMA's Building Resilient Infrastructure and Communities (BRIC), support for the adoption of resilience programs accelerated. This refreshing, top-down endorsement of the importance of resilience as a new asset class triggered partnerships with private investors.

Now, a mere four years later, with changing federal priorities, some of these programs are canceled, in litigation (e.g., BRIC), or otherwise on indefinite hold until funds are redistributed under different priorities. This uncertainty is affecting the industry, with some projects now on hold, underscoring the vulnerability in relying on public coffers. Because the investment required is large, using solely or mostly public monies to fund these upgrades is a battle the United States has been fighting and losing ground on for over 60 years.

Additionally, the residual risk not covered by physical performance of our built environment is partly covered by insurance—a risk transfer solution, which in this context is increasingly fragmented and unaffordable. Insurers are pulling back from high-risk regions, reducing coverage options in many communities (Deloitte, 2024). As a result, society is now confronting a far more difficult challenge: a widening insurance protection gap and sharply rising premium costs just to keep pace with the escalating risks.

OBJECTIVES

Taken together, lack of infrastructure investment, volatility of federal discretionary funding, and greater insurance instability are catalyzing a critical moment for our resilience communities of practice. This moment calls for reflection on alternative ways to unlock capital for resilience and highlights the need to diversify the sources of funding for more reliability. Potential strategies include forming nontraditional partnerships with the private sector, developing innovative approaches to revenue generation, and adopting methods for capturing the comprehensive value of resilient projects.

During our program "Building Strong Futures: Unlocking Funding through Risk Reduction," we shared public and private perspectives on pathways to harvest the benefits of resilience for the communities we serve. In the pursuit of those pathways, we analyzed institutional challenges and set the basis to rescale the resilience value.

The first part of this paper, Insights: Working Through Industry Constraints, presents three persistent and structural challenges in how we scope, procure, and deliver projects. Acknowledging that we are all "time famished and system familiar," we recognized that resilience is still seen as not essential—a misconception that can inhibit funding.

In the second part of this paper, Solution: Democratize Motivation, we offer a basis for rescaling the resilience value. By recontextualizing the resilience projects within the communities they serve, we enlarge the array of stakeholders, and of potential investors, for our projects.

We end this paper with a two-layered perspective, presented in our discussion and conclusion. We share ways to transform future benefits into funding through creating partnerships. More broadly,

Panel discussion from the program "Building Strong Futures: Unlocking Funding through Risk Reduction"

we collectively agree on the need for a resilience marketplace tailored and suitable to fund our infrastructure, as a critical priority.

INSIGHTS: WORKING THROUGH INDUSTRY CONSTRAINTS

Both public and private sectors aim to make sound business decisions, but the motivation is often divergent. The public sector typically seeks to offer safe and reliable services (e.g., protect wastewater plants from flood events) and otherwise be good stewards of taxpayers' dollars; whereas the private sector looks for a return on investment, which in the case of resilience investments often involves limiting economic losses and business interruptions. The default assumption in the public sector is that the infrastructure will need to last, typically for decades. For the private sector, the duration is variable across stakeholders, from the developer mindset that flips the investment in a couple of years to the investor's wish for flexibility to relocate resources if the portfolio becomes riskier. The commonality, however, is that both public and private investors want to make their infrastructure cost-efficient and their commitments risk-averse, so why is resilience not considered a baseline risk management strategy? Which execution challenges make the adoption of this mindset difficult?

Resilience Framed as an Option

In the public sector, departments within an organization need first to see the common need and come together to integrate climate adaptation. Resilient infrastructure is a new asset class, distinct from conventional infrastructure systems, bringing with it a necessary but challenging learning curve. However, rather than embedding resilience across all aspects of public decision-making, some agencies have treated it as a standalone initiative, separate from the core functions of infrastructure planning and management.

Identified climate champions (e.g., chief resilience officer, climate policy and planning lead, or resilience subject matter expert) are left with the task of finding resources for resilience projects in their organization and often have to advise from a position of little to no decision-making authority. Connection between climate offices and departments in charge of funding and finance or insurance is limited, a sign of the failure to integrate their distinct but common goals. This situation leads to the false assumption that resilience is "nice to have," a special option, rather than being foundational to sound physical, organizational, and financial risk management.

Fragmented Financial Landscape Limits Resilience Strategy Implementation

Another reason for the slow adoption of resilient infrastructure is often described as the "color of money" problem—the strict categorization of funds, grants, and revenues by their intended use. Traditionally, public agencies have focused capital spending on two areas: new projects that expand or modernize infrastructure systems (such as constructing new treatment facilities or upgrading equipment) and post-disaster recovery. The latter often results in replacement-in-kind projects, not by choice, but because federal and state recovery grants typically pay only to rebuild what existed before, rather than to invest in improvements that offer more resilient alternatives.

An apt analogy would be a boat builder who remodels the decks and builds lifeboats rather than repairs the hole in the hull. Similarly, our infrastructure funding systems readily provide money for "remodeling" and for "lifeboats," that is, for upgrades and emergency response, but rarely for "patching the hole" through proactive resilience improvements. The challenge often comes down to classification: Should these resilience upgrades be funded through the capital or the operating budget? Or should the development of (partner-sponsored or federal) resilient infrastructure (e.g., coastal shoreline protection) be how agencies manage climate risk, and if so, by whom?

For grants and appropriations, each funding stream has its own narrowly defined purpose such as capital, construction, pre- or post-disaster, infrastructure type, and so on. This fragmentation makes it difficult to pursue comprehensive, cross-cutting resilience initiatives that strengthen infrastructure systems.

Thinking Outside Organizational Constraints

The need to upgrade infrastructure for climate adaptation and to prepare and plan for disaster recovery exceeds an entity's jurisdiction or capacity. Climate hazards, after all, do not stop at jurisdictional boundaries, nor do they adapt to departments' and agencies' missions. Or, as otherwise phrased by Shalini Vajjhala, executive director of PRE Collective, resilience "is everyone's problem and no one's job."

The question becomes, Who? Who holds the vision and the resources to move the implementation needle? For a city and its agencies to become "resilient," we may need to move beyond the constraints of agency-specific budgets in how we identify and prioritize projects. The rigidity of annual budget cycles limits long-term thinking and forces project sponsors into recurring, resource-intensive competition for limited funds. Every year, project sponsors must advocate for their project: a tedious and resource-intensive prospect. As a result, our ability to address systemic challenges can be constrained by short-term fiscal structures rather than guided by long-term resilience goals. Resilience needs can be solved only by thinking and planning beyond an annual budget or capital improvement plan.

That is where cross-boundary organizations, such as councils of government and metropolitan and rural planning organizations show promise (Route Fifty, 2025). This scale of vision setting is where the most resilient solutions are born. It operates outside the budgetary constraints and the service focus of local agencies, such as the Massachusetts Water Resources Authority (MWRA), Boston Water and Sewer Commission (BWSC), and others. Sharing a collective vision that serves all infrastructure systems, in effect, captures a panoramic vision of risk reduction and the benefits and co-benefits arising from climate adaptation. Holding the vision is essential, but this alone is not enough as it must be coupled with holding the resources required for an agency to implement it.

SOLUTION: DEMOCRATIZE MOTIVATION

Our intent was to explore the mismatch between the resilience projects and programs and the financing resources, understood as the cause of the lack of implementation, beyond a general and chronic lack of investment in infrastructures in the United States. Setting the situation led us to the basis for a methodology: Understand who is affected by the lack of implementation, and thus, whose interest it is to implement resilience projects and programs. It means reframing our understanding of climate risks and climate adaptation benefits by asking two main questions, raised by Shalini Vajjhala of PRE Collective: Who suffers and who is losing money due to climate risks? And, who benefits and who are the beneficiaries of climate adaptation?

Who Profits from Climate Adaptation?

By asking *Who is suffering?* we move beyond narrowly considering risks endured by the direct owners or operators of the infrastructure. For example, a combined sewer system being filled with brackish water from sea level rise impedes the Water Department's mission to convey stormwater to avoid inundation and to protect the waterbodies from overflows. But it also impacts adjacent residents, who are experiencing basement and street flooding. This reframing shifts attention toward the broader social and economic costs of natural hazards and allows the assessment of resilience value to reflect the full spectrum of community impacts. It also underscores the importance of recognizing the benefits of resilience investments for underserved populations, who are often disproportionately exposed to climate hazards.

If we examine *Who is losing money?* with the same scenario, we can identify the transit provider, which experiences recurrent corrosive water exposure to its subgrade electrical cabling; local landowners and real estate developers, as land and properties are devalued by the hazards; and insurers. Typically, resilience projects are scoped as a result of a climate risk assessment, where environmental hazards are weighed, and projects are prioritized. By asking *Who is losing money?* project identification criteria broaden to include the impacts of climate hazards—tying their value to the entities that are seeing the greatest losses.

These losses may not show up geospatially in hazard models but instead on balance sheets. For example, we could see the value proposition for resilient infrastructure reveal itself in workers' compensation claims from lost work due to heat-related illnesses, including the insurance provider as a meaningful stakeholder in the business justification for the project. Or, if a Department of Transportation is having chronic flooding issues, by asking *Who is losing money?* one might reveal that the agricultural resources along that roadway are losing access to reliable infrastructure, and thus their ability to do business. If we performed a climate risk assessment

NEW ENGLAND IS A REGION WITH PROGRESSIVE CLIMATE LEADERSHIP and programming in government and copious local climate data. STV aims to open doors for projects to access private capital and leverage insurance to address water-related resilience problems. Particularly in water management, where innovative stakeholders, such the Boston Water and Sewer Commission, are embedding an enterprise risk reduction strategy within life cycle management approach (through its "Resilience Hub"). Approaches like these result in a roadmap to upgrade the facilities to emerging conditions. If we want to reframe risk management over the lifecycle of these assets, we need to determine what is holding stakeholders back from seizing the opportunity to advance these projects.

for a local department of transportation, agricultural resources dependent on the roadway may be outside the scope. Asking this question brings non-traditional partners to the table with shared urgency since they are losing money *now*.

Who Benefits from Climate Adaptation?

Who are the beneficiaries of climate adaptation? This may be answered by the *Who is suffering?* question. But after further examination, it widens the lens to include other positive outcomes or co-benefits. An example is the City of Hoboken's Northwest Resiliency Park ("ResilienCity Park"), where a recurrent flooding issue was solved by addressing a community's need for more parks and enhanced stormwater management (City of Hoboken, New Jersey, 2025). The "resilience value" of this project is from its flood risk reduction benefits, but the project sponsor is the local Parks Department. In this way, the resilience improvements were so highly integrated with the public space that the project solved both the community's immediate needs and the greater need to address the impacts of climate change simultaneously. Such an approach can be scaled. So, when we ask, *Who benefits from this project?* it opens the door to consider insurers, developers, property owners, local businesses, and so on. Further, this provides an opportunity to narrow the funding gap by bringing together the identified broadened pool of beneficiaries to help narrow it.

Asking these questions sets a basis for regional coordination and cross-sector partnerships by harnessing collective action based on a comprehensive and realistic estimate of the resilience value. It also has the added benefit of meaningfully engaging stakeholders early in project delivery, de-risking the future consensus-building to bring these projects to fruition. Anchoring the financing of these (future) resilient infrastructure projects in this discovered shared risk and shared value leads to better scoping. With better scoping the project can often be made more "attractive" to more potential funding and financing partners.

DISCUSSION

Why is this not already happening? If resilience is, as discussed during our program, not controversial, why is this not coming to fruition? If we appreciate the complexity of our institutional challenges, what emerges is a plain-as-day communication exercise. The most resilient system goes unnoticed—a storm hits but a community isn't devastated—a quality that does not attract investors. From there it's all about that gap between risk reduction strategy formulation and funding and financing logic. During our event, it was referred to as the "English to English" translation needed. That is, the common vernacular needed among the transportation engineer, the stormwater program manager, and a budget officer to communicate a project's need, value, and urgency. That vernacular is (likely) born from agreeing on resilience economic benefits, tethering its value to something more tangible than estimated avoided losses. For us, as a community of practice, it means getting out of the comfort zone and having professionals on all sides of the issue open about what they know and do not know. It requires being brave in the interstitial space between project development and funding, and shaping the story, connecting what is happening now to future risks. How does this project alleviate suffering? Who benefits from this work? Who are the beneficiaries of climate adaptation? These questions frame a strong business justification.

If a more regional vision is advanced through an agency—for example, the new Massachusetts initiative for building statewide capacity for climate change adaptation and resilience, called ResilientMass—the chief resilience officer's role could be more a coordinating body, translating regional vision into the equivalent performance-based criteria for the agency. It's critical to champion priority projects, both technically and, more importantly, through communication of the "resilience value" to the funding and financial departments. They could then act as "master conveners," adopting an entrepreneurial mindset to break down organizational constraints by democratizing motivation.

CONCLUSION

The goal of leading the program "Building Strong Futures: Unlocking Funding through Risk Reduction" was to reveal the path to secure structured finance at scale. We wanted to uncover creative ways to orient our resilience projects such that they are not limited to annual capital program budgets, or the grants obtained. What we heard was that as you change governance, structure, or scale, different investments become available. For BWSC and other municipal agencies in New England, we are optimistic that the (forthcoming) ResilientMass financing strategy may provide the governance-related enabling environment to build and scale enterprise-level risk reduction strategies for New England.

Antithetical to the way we typically solve problems as engineers (e.g., breaking challenges down to smaller, more manageable problems), we need to rescale the value that pertains to climate risk management. We do this by putting resilience at the core, not the periphery, making it impossible to value engineer out. We do this by partnering differently with the private sector—philanthropic, investors, and insurance.

As Victoria Salinas, former deputy administrator for resilience at FEMA, reflected at the end of the program, this work requires listening: We need to understand each other, agree on what creates value, and link this all back to our communities and planet. Creating a market of resilience project ideas and solutions is essential. Investors want to invest in resilient buildings and infrastructure. The short-term benefits are more readily captured, and resilient infrastructure provides the prospect of lower insurance costs or, at minimum, a viable pathway back to insurability, leading to better pricing from the bank, higher credit ratings, and so on. Once the resilience value is captured fully in the concept of the project, project finance is more readily connected.

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ACKNOWLEDGMENTS

We thank the panelists who shaped this discussion. Speakers included Garo Hovnanian, executive vice president advisory services, STV; Laurian Farrell, deputy commissioner, Bureau of Coastal Resilience, New York City (NYC) Department of Environmental Protection; Abby Sullivan, chief resilience officer, Office of Sustainability, City of Philadelphia; Aminul Haque, project manager, NYC Health and Hospitals; Claudia Reuben, deputy chief of risk management, NYC Metropolitan Transit Authority; Elle Hempen, venture partner, Tailwind Futures; Patricia Macchi, vice president, national director of infrastructure economics and grants advisory, STV; and, Victoria Salinas, climate leader in residence at Duke University, former deputy administrator for resilience for FEMA.

We also thank Shalini Vajjhala, executive director, and Caroline George, project manager at PRE Collective, for sharing their time and knowledge.

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We are *not* all in the same boat—building climate resilience through social justice

DANIELLE DOLAN, MS, PMP, ClimateThrive Community Strategies, Hull, Massachusetts

ABSTRACT | Communities cannot be truly resilient if segments of the population remain systematically overburdened and underserved. Infrastructure improvements, hazard mitigation projects, and adaptation investments are necessary but insufficient without equal attention to the social conditions that determine whether people can prepare for, respond to, and recover from climate impacts. By integrating current literature and state and national datasets with anecdotes and practitioner experience, this article demonstrates that resilience is not only an engineering challenge but also a sociological challenge. The discussion concludes with guidance for municipalities, consultants, and practitioners: how to embed equity, civic engagement, and community-driven design into resilience practice to strengthen both infrastructure and the social fabric.

KEYWORDS | Environmental justice, climate resilience, social vulnerability, equity, engagement, capacity building

This summer, a town engineer in a mid-sized, middle-income Massachusetts community explained to the Parks and Recreation director why environmental justice (EJ) mattered for a stormwater project. This individual was not an activist, planner, or academic, but a public works professional who once bristled at terms such as *equity* and *social vulnerability*. Yet in plain terms the engineer described a reality:

"Some people in our community can't withstand the impacts of a flood. If we're not protecting them, then the community as a whole is less resilient."

> ***"Some people in our community can't withstand the impacts of a flood. If we're not protecting them, then the community as a whole is less resilient."***
>
> — A MASSACHUSETTS TOWN ENGINEER

That simple truth reflects the slow, quiet revelation spreading through municipalities across New England: Climate resilience is inextricably linked to social vulnerability.

It is often said, "We're all in the same boat," meaning "we're all in this together." When it comes to climate change, we may all be in the same storm, but we are decidedly not all in the same boat. Climate-related events and impacts affect some community members far more than others, depending on their situation. Some households ride out climate events from sturdy yachts—well-insured, with backup power and financial resources to rebuild. Others cling to fragile rafts, stretched thin by economic stressors, insecure housing, health issues, or lack of social networks. Without attention to these disparities, investments in "resilient" infrastructure risk leaving behind the very people most vulnerable to climate impacts.

This reality is especially relevant to the water and wastewater industry. Most climate change-related events affect the water system. Excessive rainfall causes flooding and stormwater and wastewater overflows; extreme drought reduces and impairs water supply; excessive heat affects source water quality and impedes treatment plant functions. Infrastructure and natural systems under stress do not operate in isolation from those they serve. Our most vulnerable infrastructure is disproportionately located in BIPOC (Black, Indigenous, People of Color), low-income, and ESL (English as a second language) communities.[1] When flooding damages low-income neighborhoods, when sewer overflows threaten public health in communities without adequate healthcare access, or when drought restrictions affect households without alternative supplies, technical resilience is clearly contingent on social resilience, and social resilience is not equally distributed.

Resilience planning has focused on engineering and infrastructure: protecting against floods, upsizing culverts, reinforcing pipes, upgrading treatment facilities, and backing up power supplies. These investments remain essential. Meanwhile, the definition of resilience is evolving. A municipality with state-of-the-art infrastructure is not resilient if that infrastructure does not protect all community members, remove barriers to recovery, or address exposure to risks. A seawall may protect a downtown district, but if residents in adjacent neighborhoods cannot evacuate, find shelter, or access recovery funds, the community cannot be considered resilient.

The literature increasingly affirms that resilience is about far more than building infrastructure that can withstand and recover from extreme weather events. Adoption of this new definition is not occurring swiftly, through sweeping policy change or cultural revolution. Municipalities are instead like aircraft carriers: They change direction very slowly, through incremental adjustments. This paradigm shift is occurring through dedicated, long-term advocacy and the painstaking work of coaching, community organizing, and capacity building. Forward-looking resilience practitioners are leaving their desks and getting out into their communities.

It is especially necessary that municipal staff, in addition to their consultants or non-governmental organization (NGO) partners, engage directly. This is the only way to grasp the experience, and thus the holistic climate vulnerability, of the community their decisions affect.

STRUCTURAL INEQUITIES AND COMPOUNDING STRESSORS

In 2023, the Census reported that nearly 24 percent of the U.S. population has three or more risk factors that reduce resilience to extreme heat.[5] The same dataset shows that counties with above-average income inequality have a much higher proportion of highly vulnerable populations—23.4 percent compared to 19.2 percent in counties with below-average inequality.[6]

These data never tell the whole story. Census data are inherently inaccurate and often underrepresent vulnerable populations.[7] Even if the data were complete and accurate, they do not express the context of the experience underlying the numbers. Nor are they capable of representing the compounding effects of any two or more of these factors occurring simultaneously. The experience of these vulnerabilities is not simply additive. Rather, each additional social burden increases the potential risk exponentially.

DEFINING SOCIAL RESILIENCE AND MAPPING VULNERABILITY

Social resilience is the capacity of individuals and communities to anticipate, cope with, resist, and recover from hazards or negative impacts.[2] It is shaped not only by income, but also by intersecting factors such as race, age, disability, language proficiency, housing stability, education level, and access to transportation. These influencing factors are referred to as social vulnerabilities.[3]

To better understand these conditions, public agencies and private institutions have developed data analytics and mapping tools to interpret and visualize social vulnerability factors by geographic area. The Centers for Disease Control and Prevention's Social Vulnerability Index (SVI), for example, incorporates 14 census-based variables across themes of socioeconomic status, household composition, minority status, language, housing, and transportation. The SVI is widely used in emergency response and public health planning to highlight which communities are likely to need additional support before, during, or after a disaster.[4]

Similarly, the U.S. Census Bureau's Community Resilience Estimates provide metrics of household risk factors affecting resilience. These conditions influence whether a climate-related hazard that would be a mere nuisance for some could be a hardship or even a catastrophe for others.

Massachusetts and Connecticut have led New England in local EJ mapping. Massachusetts Executive Office of Energy and Environmental Affairs released its Environmental Justice Map Viewer in 2021, and Connecticut's EJScreen tool was released in 2023 by the University of Connecticut's Connecticut Institute for Resilience and Climate Adaptation and the Connecticut Department of Energy and Environmental Protection. Massachusetts and Connecticut both require use of their tools for state grant applications. Vermont Agency of Natural Resources is following suit, with building of its own tool mandated by the 2022 Vermont Environmental Justice Law (Act 154), to be completed by 2027. New Hampshire has relied on EPA's EJScreen tool, but it was removed by the federal administration in February 2025.

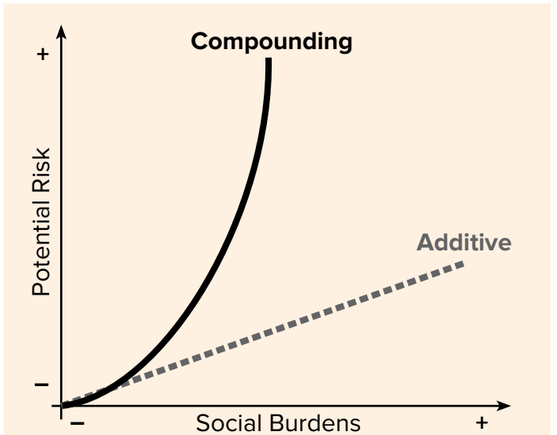


Figure 1. Additive vs. compounding risk of social burdens

Just as the social conditions underlying climate vulnerability are not isolated, neither did they emerge by chance. They are the product of historic, institutionalized systems of oppression and inequity that concentrate risk in specific communities. Housing segregation, discriminatory lending, and zoning practices, for example, have relegated BIPOC populations to flood-prone areas, neighborhoods with inadequate infrastructure, and other environmental threats such as harmful industries.

Climate resilience and EJ practitioners are calling for a paradigm shift: human-centered, community driven, integrated resilience planning. This approach emphasizes participatory democracy, equity in funding, and the recognition that benefits for the most vulnerable populations ripple outward to strengthen the entire system.

The Brookings Institute's U.S. Climate Vulnerability Index illustrates these disparities: Black- and Latino-majority census tracts make up about 24.7 percent of all tracts nationwide but represent 34.6 percent of those classified as highly or extremely climate vulnerable.[8] These tracts are disproportionately more likely to face multiple, compounding hazards, such as extreme heat, flooding, air pollution, and storm surge.

As the pace of climate change accelerates, these inequities are further amplified. A moderate flood, for example, may inconvenience a wealthier neighborhood with flood insurance, but in a lower-income community without insurance, reliable transportation, or accessible recovery funds, the same flood can be devastating, potentially causing displacement, job loss, and insurmountable financial ruin.

Climate Hazards and Disproportionate Impacts

There are innumerable climate threats that disproportionately affect marginalized and socially vulnerable communities. Three common threats—extreme heat, flooding, and storm surge—are discussed below:

- **Extreme Heat**—Those without air conditioning, in older homes, or with pre-existing health conditions are at much greater risk of illness or death from extreme heat events. According to the National Equity Atlas, more urbanized or industrial parts of a region are 3 times more likely to be home to low-income and BIPOC residents than moderate income or white residents. These same neighborhoods typically have higher surface temperatures, far less tree canopy, and fewer waterfront areas for heat relief.
- **Flooding**—In New England, most of our riverfronts were the first places to industrialize, using the river for power, transportation, and waste disposal. These rivers have been altered—with dams, armaments, and channelization—making them even more prone to flooding. Neighborhoods in these areas, like those noted above, tend to be less affluent and have a higher percentage of BIPOC residents. Disinvestment is common in these areas, leading to older infrastructure and fewer green spaces that could otherwise absorb floodwaters. Communities in these riverine floodplains are at risk, especially as climate change causes more extreme, flashier rain events. The devastating impacts of the July 2023 flood along Vermont's Winooski River are a compelling example.
- **Storm Surge**—Coastal areas are often thought of as high-wealth areas: Examples include Cape Cod, Massachusetts; Mystic, Connecticut; Portland, Maine; and Newport, Rhode Island. These communities are investing heavily in climate resilience strategies. But not all of New England's coastline is privileged. Similar to our riverine areas, many of New England's older coastal communities were and are industrial hubs. These highly altered, densely developed areas, such as Chelsea, Massachusetts; Portsmouth, New Hampshire; South Providence, Rhode Island; and Bridgeport, Connecticut, will be hit hardest by sea level rise and coastal storm surge, and they are home to higher percentages of marginalized and vulnerable populations. These communities face a greater combined burden of environmental hazards and socioeconomic stressors, in addition to those posed by sea level rise and storm surge.

HUMAN-CENTERED, INTEGRATED RESILIENCE

Climate resilience and EJ practitioners are calling for a paradigm shift: human-centered, community-driven, integrated resilience planning. This approach emphasizes participatory democracy, equity in funding, and the recognition that benefits for the most vulnerable populations ripple outward to strengthen the entire system.

Many states now require EJ considerations in permitting processes and state funding. California was the first to do so, but Massachusetts was next in line, followed closely by Connecticut. It will not be long before all six New England states do the same.

Evidence from Massachusetts with its Municipal Vulnerability Preparedness (MVP) 2.0 program and other pilot initiatives suggests that while such community engagement is slower and more resource-intensive than data analytics and mapping tools alone, it produces more durable and widely supported solutions. In short, addressing social burdens is not only a moral imperative but also the most efficient path toward long-term resilience.

Public servants and consultants alike should embrace this shift, institutionalizing equity in every aspect of the climate resilience movement. Only then will we begin to shift the inherent inequities in our existing systems.

Beyond Data—Community-Led Approaches

Municipal resilience planning has emphasized hazard mapping, engineering upgrades, and infrastructure hardening. Typical approaches include sea walls, elevated pump stations, stormwater storage, or backup power for treatment plants. These projects are essential, but by themselves they treat climate resilience as a solely technical problem to be engineered.

Such methods often rely heavily on quantitative tools such as Federal Emergency Management Agency (FEMA) flood maps, precipitation models, or regional hazard assessments. While these data-driven approaches provide critical baselines, they often miss the human realities of how hazards affect different populations. For example, a pump station designed to handle a 100-year storm is irrelevant to residents who cannot afford flood insurance, lack reliable transportation to evacuate, or do not receive emergency warnings in their language.

Evidence increasingly shows that data do not tell the whole story. Tools like the Social Vulnerabilty Index (SVI) and Community Resilience Estimates (CRE) can highlight where risks are concentrated, but they cannot explain how historical injustices, cultural norms, or daily burdens shape responses. Without community engagement, resilience strategies risk producing unintended consequences and failing to address underlying needs.

Human-Centered, Community-Driven, Integrated Planning

Below is a more effective approach, human-centered, community-driven, integrated planning:[9]

1. Acknowledge and re-evaluate previous histories of inequitable decision-making
2. Require all planning processes, projects, and/or grantees to develop a plan for building authentic community relationships
3. Increase and promote accessibility to public meetings, whether online or in-person
4. Foster two-way communication and reciprocity with your community
5. Focus on building relationships with local organizations or informal groups that are already engaging with marginalized communities
6. Coordinate with partner agencies and across internal departments to leverage resources, staff, and data to address engagement fatigue
7. Emphasize that governments must be responsive to the interconnectedness of community concerns
8. Establish an advisory committee, task force, or community decision-making body to inform local planning and support marginalized communities in owning and shaping environmental solutions

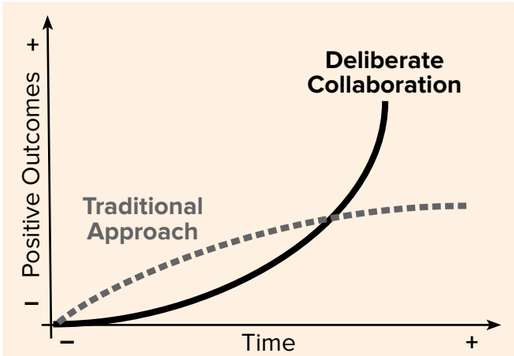


Figure 2. Impact of traditional planning vs. deliberate collaboration—exponential vs. linear Impact

Integrating social vulnerability into climate resilience planning takes time and resources. It may not be as fast, or as affordable, as some would like, but it produces solutions that are more widely supported, more durable, and often less expensive in the long-term.[10] This concept is common in strategic planning and facilitation, sometimes referred to as "deliberate collaboration."[11]

A greater investment up front may seem slow to start, but will achieve higher gains in the end than fast progress at the outset that quickly plateaus with limited final gains. The up-front investment is also more likely to institutionalize positive change. Incremental progress is still progress; it lays a foundation for future compounding improvements. State grant programs and pilot projects, like MVP 2.0 in Massachusetts, are testing this theory and accelerating integration of social vulnerability into climate resilience.[12]

CASE STUDY: MASSACHUSETTS MVP 2.0

The Massachusetts MVP 2.0 program is a leading regional example of institutionalizing equity in climate planning. Since its launch in 2017, MVP has provided funding and technical support for municipalities to conduct local climate assessments and develop action plans. The new MVP 2.0 framework, piloted in 2023 with 33 communities and one Tribal Nation, requires municipalities to explicitly integrate EJ principles, prioritize engagement with frontline populations, and tie grant funding to equitable outcomes.[13]

Phase 1 (5 months)
Developing a Core Team
(1) Groundwork
(2) Recruiting a Core Team
(3) Core Team Training

Phase 2 (5 months)
Revisiting Resilience Priorities
(4) Uncovering Social Resilience
(5) Revisiting Community Resilience Priorities

Phase 3 (13 months)
Implementing a Seed Project
(6) Selecting a Seed Project
(7) Developing an Implementation Plan
(8) Implementing a Seed Project
(9) Reflecting, Adjusting, and Next Steps

Figure 3. The MVP 2.0 pilot process (note: The MVP 2.0 process has since been updated, and this process has been slightly modified.)

Early Results

Early results show positive outcomes.[14] Municipal staff are learning firsthand about social vulnerability and equity in climate resilience. They are gaining practical skills for understanding and connecting with their communities, especially those who are most marginalized, and with whom municipalities have had difficulty engaging in the past. MVP 2.0 prioritizes culturally sensitive, multi-lingual outreach, multi-directional engagement that fosters dialogue, and compensation for participating community leaders. No program is perfect, but MVP 2.0 communities are building real connections with community, and integrating community perspectives into their resilience priority-setting. MVP 2.0 is yielding higher-quality projects with stronger community support thus far. Towns piloting MVP 2.0, for example, have implemented multilingual outreach, compensated community participants, and restructured workshops to enable meaningful dialogue.

In some MVP 2.0 communities, the program is already paying dividends, as municipal project managers are applying what they've learned to other programs and projects in their own departments and sharing these learnings across departments. Institutional culture is shifting, and some municipalities are seeking to institutionalize these changes, thus beginning to break down historic structural and procedural inequities.

Community Anecdotes—Everyday Resilience Burdens

Data and case studies tell only part of the story. Experiences illuminate how resilience is felt daily, and how human-centered, community-driven, integrated planning such as the MVP 2.0 program will lead to broader and deeper social resilience, far beyond climate stressors. Consider the following scenarios:

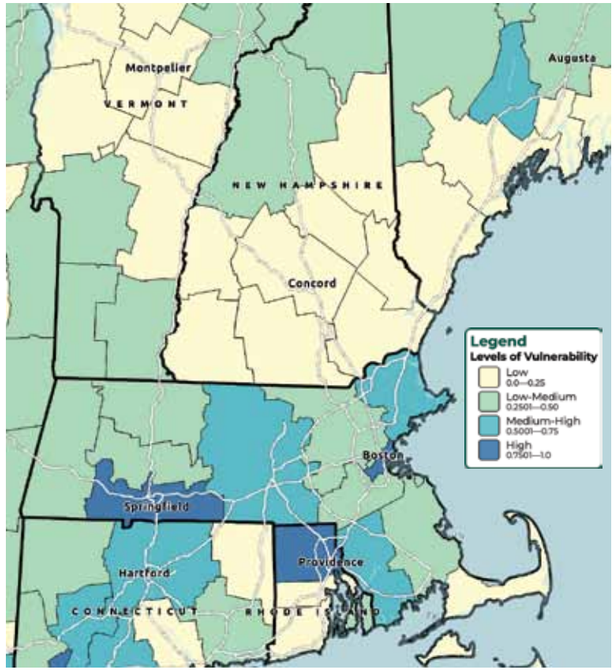
- Maria moved her family from South America to a mid-sized, working-class town about 15 years ago. At first, she did not understand paying taxes, especially local taxes; she thought it was unfair. Over time, she got more involved with the town, and began to see how her taxes supported services she and her family relied on—good schools and free services for her special needs child, safe water to drink, nice parks, trash pickup, and public safety. She no longer minded paying taxes. When Maria, a real estate agent, heard questions about permitting, she would explain to clients that "the process is not in place to penalize you, but to protect you and others. You have to do things the right way, for all of us." By sharing her perspective with friends and neighbors, Maria became a community champion and helped build deeper connections with the town.
- Yasmin is recovering from substance use disorder, after her life was saved by local firefighters. Since that incident, she's felt indebted to the city, and looked for opportunities to give back. Passionate about maintaining a clean and healthy environment, Yasmin was eager to join the town's climate initiative. She's grateful that the town is giving her a stipend so she can pay the bus fare to get to and from meetings, as she's on disability and lives in subsidized housing. It's difficult for Yasmin to make the meetings, scheduling around medical appointments and transit schedules, but she does her best. Yasmin is involved in her community and regularly brings its perspectives into group conversations. Yet some of the other team members, especially the municipal staff, continually dismiss her ideas and seem impatient with her. It's not a very welcoming environment, but she keeps showing up and sharing her voice because she wants to do right by her community.
- Christopher is a lifelong public servant, working in IT for a small, rural community. As a person of color, he was tapped to lead the town's Diversity, Equity, and Inclusion (DEI) committee. He was skeptical when invited to participate in the town's climate resilience effort, wondering what climate change had to do with either IT or DEI. When Christopher learned that the committee would be talking to community members, he was especially uncomfortable, as he's not naturally outgoing and felt he saw enough of the community through their online comments and at public meetings. However, proceeding through the process, Christopher challenged his own assumptions, overcame his biases, and bridged a mental gap between his perceived commonalities and differences within the community. "It put me out of my comfort zone, going out to talk to people, and seeking out conversations. It enabled me to see another side of (our town)." Christopher became the program's best spokesperson and a strong community bridge-builder.

Everyday resilience burdens include seemingly minor but compounding stressors. For some families, a car breakdown is a temporary inconvenience; for others, it means missing work, missing school, and cascading penalties. These cumulative pressures stretch families to breaking points, even before climate events strike. Resilience is tested not only in disasters, but also in the daily fragility of systems upon which vulnerable families depend. Similarly, resilience is built not only with climate infrastructure, but also with the social fabric and support systems that make a municipality into a community.

COMBATTING COUNTERARGUMENTS

Various counterarguments need to be addressed:

- ***Equity and engagement are too expensive or time-consuming***. Engagement and equity-focused planning can require additional resources up front: Translation services, stipends, childcare, and extended outreach increase project costs. However, evidence demonstrates that up-front investments can prevent more costly failures later. Repeatedly, communities find that projects developed with robust community input achieved broader buy-in, reducing delays and legal challenges.[15] National data confirm that disasters disproportionately harm vulnerable populations, amplifying recovery costs. FEMA has reported that every $1 invested in hazard mitigation saves $6 in recovery costs.[16] Equitable engagement is not an inefficiency; it is an efficiency strategy for long-term resilience.
- ***We try, but nobody shows up***. Low participation is often cited as evidence that communities are apathetic. However, research and practitioner experience show that barriers preclude marginalized groups from participating. Some barriers include inconvenient meeting times, inaccessible locations, childcare and/or transportation challenges, and lack of trust in government. Best practices in equitable engagement demonstrate that participation increases when municipalities remove as many of these barriers as they can, providing translation and interpretive services, transit passes, free babysitting, stipends or incentives, and multiple engagement formats.[17] The issue is rarely apathy; it is often insufficient program design.
- ***A rising tide lifts all ships***. Universalist arguments suggest that any investment benefits everyone equally. Yet as the boat analogy illustrates, a rising tide does not lift ships that have leaking hulls. Resilience measures that ignore inequities may inadvertently benefit those already advantaged. For example, green infrastructure projects can increase adjacent property values, but without safeguards, they accelerate gentrification and displace the very communities they were intended to protect.[18]
- ***We already have the data***. Quantitative tools such as FEMA flood maps, SVI, and CRE are valuable, but they deliver incomplete analysis of social vulnerability and resilience. They highlight exposure but not actual experiences. For example:
  - An in-depth flood analysis with robust community engagement in Hampton Roads, Virgina, revealed that 12 percent of residents lose work access during recurrent floods, disproportionately affecting vulnerable groups.[19] These impacts were not evident in traditional hazard maps.
  - In one Massachusetts community, they have many parks and open spaces within walking distance to its mapped EJ neighborhoods, but engaging with the community directly, the town discovered that immigrants with younger children did not feel safe there because of busy streets, lack of sidewalks, play areas not being fenced, and fear of police presence. None of this information was reflected in the data.
  - Studies of power outages during winter storm Uri showed longer outage durations in vulnerable tracts, despite identical outage footprints.[20]
- ***Equity is Unfair or Discriminatory***. Some individuals, especially those who have had less



New England Social Vulnerability Index
Source: Centers for Disease Control and Prevention (by county 2022)

exposure to personal hardship or that of others, worry that prioritizing investments in vulnerable populations could constitute favoritism, "reverse discrimination," or affirmative action. On the contrary, prioritizing equity in resilience planning does not allocate resources unfairly; it corrects historic underinvestment. The Massachusetts EJ policy explicitly states that prioritizing EJ communities ensures compliance with civil rights law and yields stronger collective outcomes.[21] In practice, focusing first on vulnerable populations benefits all residents by strengthening the weakest points in community resilience. Similarly, Vermont's Act 154 affirms that no segment of the population should bear a disproportionate share of environmental burdens or be denied equitable environmental benefits based on race, culture, or economic makeup.[22] Connecticut's policy acknowledges that vulnerable communities face disproportionate adverse human health or environmental effects from environmental laws, regulations, and policies. Thus, the policy is not "reverse discrimination;" rather, it strives to reverse discrimination.[23]

BENEFITS FAR OUTWEIGH THE COSTS

In addition to the direct benefits of holistic, community-centered climate resilience, this approach provides ancillary or indirect benefits that strengthen communities. Some examples follow:

- **Public Health Outcomes**—Heat vulnerability is linked to higher hospitalization and mortality rates in socially vulnerable populations.[24] Equitable cooling infrastructure (e.g., tree canopy, cooling centers) reduces these risks for entire neighborhoods.
- **Economic Resilience**—Disasters exacerbate wealth gaps; low-income households recover more slowly or not at all.[25] Investments in vulnerable communities stabilize local tax bases and reduce long-term disaster aid requirements.
- **Social Cohesion and Trust**—Studies show that communities with stronger social networks recover faster from disasters.[26] Equitable engagement builds trust, increasing compliance with emergency measures and support for public investments.
- **Sustainability Synergies**—Green infrastructure projects in EJ neighborhoods reduce heat, improve air quality, and sequester carbon. Transit investments for vulnerable groups reduce emissions while increasing resilience to fuel price shocks.

INSTITUTIONAL AND POLICY IMPLICATIONS

For at least the past decade, the trend toward integrating EJ into climate resilience has been progressing. FEMA included equity as a scoring criterion for its Building Resilient Infrastructure and Communities (BRIC) program,[27] and then the Justice40 Initiative was passed by executive order in 2021, which committed 40 percent of federal climate and infrastructure investment benefits to disadvantaged communities.[28] These policy shifts reflect recognition that equity is no longer optional; it is a requirement for accessing funding and compliance with civil rights law.

The current administration, however, has been reversing the federal stance on EJ since taking office in January. It has removed the EJScreen tool and all source data from the EPA website and scrubbed all references to climate change, EJ, DEI, and the like from all federal websites. One recent attack on EJ and equity is the claim that prioritizing investments in vulnerable populations constitutes favoritism. In 2011, then-Florida Attorney General Pam Bondi argued that federal equity directives were "reverse discrimination." Now the U.S. Attorney General, Bondi has issued federal guidance on "ending illegal DEI and DEIA Discrimination and Practices" in February 2025, instructing all federal funding recipients (including FEMA, Community Development Block Grants, and BRIC programs) to eliminate any related activities that her office considers "discriminatory."

This memo concerned many practitioners and municipal employees who rely heavily on these grants for resilience work. In response, some communities have walked back their commitment to equity in resilience. The opposite is what's needed in the absence of federal leadership: greater state and local action. New England states are doubling down on their climate resilience and equity efforts to fill the void left by the federal reversal. Massachusetts Attorney General Andrea Joy Campbell, in partnership with 12 other state attorneys general, issued multistate guidance affirming the legality and necessity of EJ initiatives. (Connecticut and Vermont are the two other New England states helping to lead the effort.) The guidance provides justification for EJ, as well as recommendations for local governments and practitioners to uphold these important principles.

Municipal Workforce as Resilience Leaders

We often look to state and federal leadership for establishing policy and incentivizing action. But with climate resilience and social vulnerability, we need local leadership. Municipal staff—engineers, department of public works crews, planners—manage the systems and infrastructure we all rely on every day (e.g., water, wastewater, waste, transportation). Their decisions have the most direct impact on communities. Fostering a cultural shift among these municipal resilience leaders, as illustrated by the opening anecdote from a town engineer, demonstrates the potential for institutional transformation from within. Training, technical assistance, and cross-departmental collaboration can accelerate this cultural shift.

CALL TO ACTION

Climate resilience practitioners must face uncomfortable truths about inequity, vulnerability, and responsibility. Our systems continue to disproportionately burden communities that are least responsible for the climate crisis and yet are bearing the greatest impacts. We cannot engineer our way out of this disparity. Traditional planning and decision-making processes will only perpetuate, if not exacerbate, inequities. Instead, we need to shift our paradigm to look first not at potential mitigation and adaptation strategies, but rather at the communities themselves, and the *social* vulnerabilities they face and how to reduce them. As the town engineer explained to the aforementioned colleague, resilience is not simply about storm drains, levees, or seawalls. It is about people. By reducing the compounding burdens affecting our most vulnerable people, we will in turn increase the climate resilience of the entire community.

By centering community voices, we are effecting real change, creating real connections, and building real climate resilience for all. While prioritizing equitable engagement may be slower and more costly at the outset, doing so pays dividends: It results in more effective and durable solutions, reduces long-term costs, and builds trust between municipalities and their communities. Public servants, NGOs, and consultants alike are critical partners for this transformation. By embracing community-driven, human-centered, integrated planning, practitioners can ensure that resilience investments not only benefit all but also help to reverse inequities. A rising tide could lift all ships, but we must first plug the holes in those boats that would otherwise sink when the tide rises. We need to do so before the storm rolls in.

ACKNOWLEDGMENTS

The stories shared in this article are true, but the names and locations have been anonymized for privacy.

The author acknowledges the Massachusetts Executive Office of Energy and Environmental Affairs for its leadership in developing the MVP 2.0 framework and the municipalities across New England that continue to advance equity-centered climate resilience. She thanks Reena Doyle and Gail Watts for their partnership in this work. Danielle also credits former teammates Atley Keller and Emily Finnegan for co-developing the "Guiding Principles for Equitable Engagement in Coordinated Planning," and thanks Smart Growth America for funding that work.

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From risk to resilience—protecting municipal water and wastewater systems from extreme weather

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ABSTRACT | Communities in New Hampshire, like others across New England, are experiencing increased flooding, drought, excessive heat, variable winters, and other extreme weather events that threaten the functionality of their critical infrastructure like water and wastewater systems. By the end of this century, it is projected that New Hampshire communities will experience an additional 50 or more days with temperatures above 90°F (32°C) compared to today. Additionally, annual precipitation is expected to increase by about 5.5 in. (14 cm) per year, a 12 percent increase.

To better understand the current and future impacts of extreme weather on critical infrastructure, the New Hampshire Department of Environmental Services (NHDES) initiated water and wastewater system vulnerability assessments for 14 communities across the state. Such an assessment process enables the ability for the criteria to be scaled based on the user's community, the flexibility to adapt as new climate assets or systems data become available, and the ability to allow the user to prioritize projects based on each asset's identified vulnerability.

Through this effort, NHDES intends to help municipalities and utilities identify vulnerabilities within their water and wastewater infrastructure systems related to natural disasters and extreme weather events. With this understanding, utilities can minimize these vulnerabilities, which if not addressed could not only prove costly to fix after an event but also put public health in jeopardy.

KEYWORDS | Water, wastewater, vulnerability, infrastructure, risk, resilience, extreme weather, adaptability

Vulnerability assessments are crucial for understanding how drinking water and wastewater treatment systems will be affected by changes in long-term weather patterns and extreme weather events. Utilities across New Hampshire have already felt the impacts of flooding, extreme heat, drought, and other climate hazards that have disrupted the functions and operations of these essential services.

The purpose of the vulnerability assessment was as follows:

- Assess climate impacts on water and wastewater infrastructure
- Develop conceptual strategies to increase resilience
- Prepare utilities to incorporate vulnerability assessment data into their asset management programs to prioritize projects and enhance system resilience

Understanding an asset's vulnerability to extreme weather is essential for strengthening decision-making around asset management, guiding capital investment planning, and ensuring compliance with new permit requirements. Such an assessment positions New Hampshire communities to meet emerging regulatory requirements, like those under the National Pollutant Discharge Elimination System (NPDES) program, while preparing for extreme weather over the coming century. The goal is to advance understanding of how climate hazards affect water and wastewater systems and to translate that knowledge into actionable planning tools.

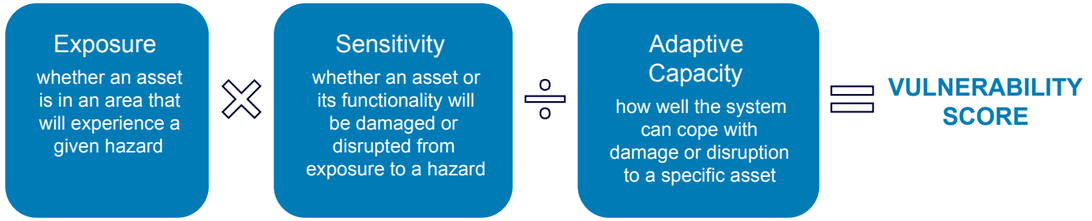


Figure 1. A vulnerability assessment's "vulnerability score" is a function of three components: exposure, sensitivity, and adaptive capacity

Findings aim to integrate seamlessly into asset management systems, hazard mitigation plans, and standard operating procedures, and support informed decisions that reduce risks to infrastructure and public health. By identifying vulnerable assets, a vulnerability assessment enables communities to prioritize funding, plan targeted adaptations, and anticipate when a facility may become increasingly at risk under future climate scenarios. In this way, a vulnerability assessment provides both a near-term decision-making framework and a long-term roadmap for building resilient utility systems.

VULNERABILITY ASSESSMENT

A vulnerability score (Figure 1) developed through the assessment process represents the degree to which a system is susceptible to adverse effects of extreme weather. It is a function of three components:

1. Exposure, or whether an asset is in an area with a given hazard
2. Sensitivity, or whether an asset or its functionality will be damaged or disrupted from exposure to a hazard
3. Adaptive capacity, or the ability of an asset to accommodate or recover from the impacts of climate hazards

The climate hazards assessed included the following:

- Sea level rise/storm surge (coastal towns)
- Extreme precipitation (pluvial and fluvial)
- Extreme heat
- Winter weather
- Drought
- Wildfires
- Landslides
- Wind

The vulnerability assessments used three planning horizons to identify changing climate conditions:

- Baseline (2010–2039)
- Short-term (2040–2069)
- Long-term (2070–2099)

Assessors categorized the climate hazards as primary or secondary based on the availability of high-quality future climate projection data, primarily from the New Hampshire Climate Assessment 2021[1] (Figure 2). The primary hazards included sea level rise/storm surge, extreme precipitation, extreme heat, and winter weather, with the remaining hazards considered secondary.

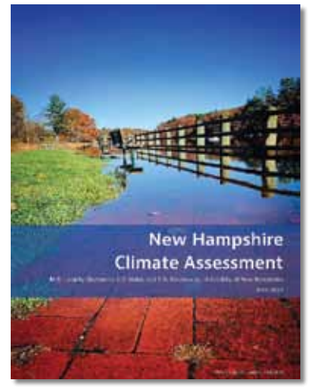


Figure 2. The team categorized climate hazards based on the availability of high-quality future climate projection data, primarily from the New Hampshire Climate Assessment (2021)

These hazards are central to determining exposure, sensitivity, and adaptive capacity, enabling the evaluation of both system-scale and asset-scale vulnerabilities to inform asset management and capital planning. They also help utilities meet new NPDES permit requirements for wastewater systems.

By addressing both scales of vulnerability, a vulnerability assessment not only provides asset-specific insights but also establishes broader system-level planning and coordination. The findings are intended to facilitate conversations and assessments in communities about the vulnerability of water and wastewater systems to extreme weather.

DATA COLLECTION AND ENGAGEMENT

The vulnerability assessment process was initiated with site visits to the participating communities' vertical assets associated with their water and wastewater systems. This was to gather information about the asset's critical systems, condition, and surrounding area. Commercial geographic data collection and management software was used to geolocate asset data, which fed into the vulnerability assessment scoring.

Engagement with water and wastewater system operators was important in understanding the functionality, vulnerabilities, and resilience of these essential infrastructure systems. Site visits provided valuable institutional knowledge from operators who had long-term experience managing their systems under varying conditions.

In-person discussions and site assessments allowed insights into system design, operational challenges, and past climate-related impacts. In

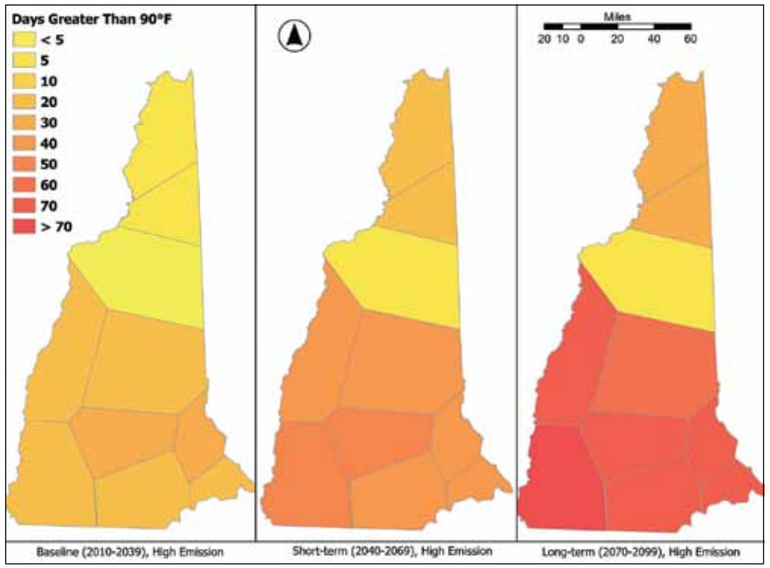


Figure 3. Projected number of days with maximum temperature above 90°F (32°C) across New Hampshire extrapolated based on data from New Hampshire Climate Assessment (2021)

addition to on-site discussions with system owners and operators, the vulnerability assessments also brought together participating communities to share experiences, inform methodology development, and provide practical context that strengthened the assessment.

EXPOSURE APPROACH

The exposure assessment considered how water and wastewater assets in one New Hampshire community could be affected by a range of hazards, both now and in the future. To capture how risks might change over time, the three planning horizons noted earlier (baseline, short-term, and long-term) were used based on the New Hampshire Climate Assessment, which provides detailed projections from 10 weather stations across the state. A geographic tool helped extend these projections beyond the stations themselves, allowing communities without direct monitoring to still benefit from locally relevant estimates. This approach created a consistent statewide dataset that highlighted how conditions such as hotter days and heavier rainfall could vary by region.

The maps in Figure 3 show temporal and spatial variations in days above 90˚F (32˚C) under high emission scenarios across New Hampshire after extrapolating data from 10 weather stations using projections from the New Hampshire Climate Assessment.

Table 1. Primary and secondary hazards and their data sources

Hazard	Indicator	Data Source
Primary Hazards		
Sea Level Rise/Storm Surge	Present day MHHW + XX ft SLR	NOAA Sea Level Rise Mapper
Extreme Precipitation (Drainage Flooding)	Total Annual precipitation (RCP 8.5, Planning Horizon)	NH Climate Assessment 2021
Extreme Precipitation (Riverine Flooding)	FEMA 500-year flood zones	FEMA National Flood Hazard Layer
Extreme Heat	Number of days over 90°F (32°C) (RCP 8.5, Planning Horizon)	NH Climate Assessment 2021
Snowfall/Winter Precipitation	Total Winter precipitation (RCP 8.5, Planning Horizon)	NH Climate Assessment 2021
Secondary Hazards		
Wildfire	Wildfire hazard potential	USDA Forest Service
Drought	History of drought	Field data
Landslides	Landslide susceptibility	USGS Landslide Inventory
Wind	Modeled historic average wind speeds	Climate Risk and Resilience Portal

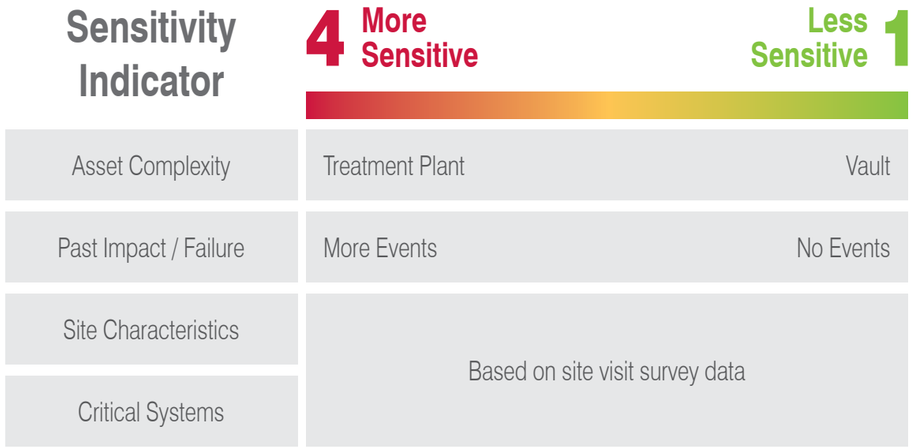


Figure 4a. Sensitivity indicators and respective scoring used to calculate sensitivity scoring

The exposure analysis looked at nine hazards, as discussed earlier: five primary and four secondary hazards. For each hazard, multiple indicators were used (such as flood zone mapping, precipitation projections, or land cover) to estimate how exposed each facility was under current and future conditions. Table 1 shows example indicators and their respective data sources used in the exposure analysis. Field data collected with the data management tool strengthened this analysis by capturing site-specific details. Each asset received exposure scores across the three planning horizons for primary hazards and a baseline score for secondary hazards.

SENSITIVITY APPROACH

The sensitivity approach considered four key indicators, as shown in Figure 4a.

The inclusion of these indicators seeks to capture the range of impacts that exposure could have on an asset based on its characteristics. Complexity, history of extreme weather events, site layout, and other factors can all contribute to varying degrees of sensitivity. For example, for indications related to site characteristics, questions such as these were considered:

- Are there concerns about maintaining site access (e.g., road conditions, possible falling trees, steep slopes, snow plowing, etc.)?
- Are there any road/stream crossings on site or nearby (e.g., culvert, bridge, etc.)?
- Does grading slope toward the building or structure?

Each indicator was assigned a score from 1 to 4, and these individual scores were then summed to produce a sensitivity score. A higher total score indicates greater sensitivity of the asset, meaning it has more weak areas that could increase its vulnerability to extreme weather events.

ADAPTIVE CAPACITY APPROACH

To learn what utilities were doing to adapt to climate impacts, the adaptative capacity framework included indicators to understand redundancy, accessibility of necessary supplies, and hazard-specific measures. Some indicators include questions like:

- Is there a backup power supply?
- Does the system have any redundancy?
- Does the building have remote operations?
- What is the storage capacity?
- Does it have any existing flood or heat protection measures?

Adaptive capacity indicators also received scores from 1 to 4; however, a higher adaptive capacity score means a greater ability to respond to a climate hazard (Figure 4b), the opposite of sensitivity.

VULNERABILITY RESULTS

Figure 5 *(next page)* illustrates how vulnerability scores are calculated by combining exposure and sensitivity and then adjusting for adaptive capacity. As discussed earlier, each asset received scores across

Figure 4b. Each indicator received a score on a scale of 1 to 4, with a score of 1 meaning lower adaptive capacity and 4 meaning greater adaptive capacity

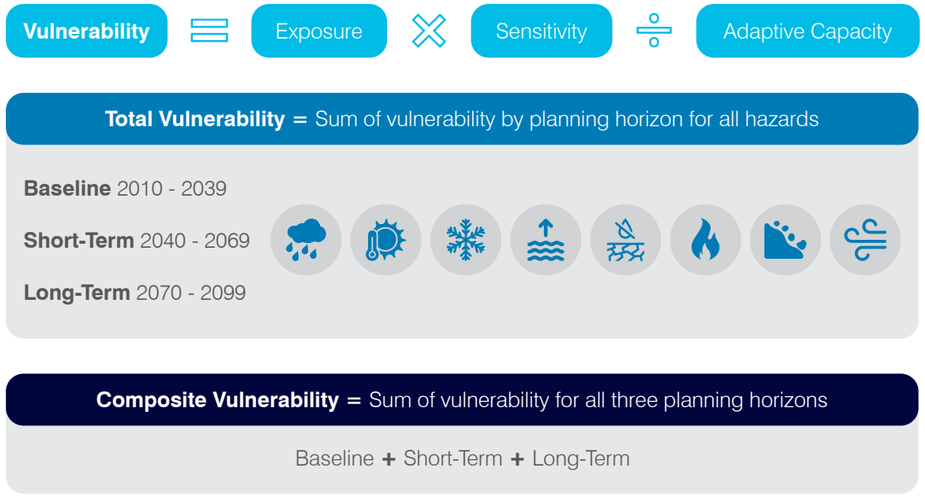


Figure 5.
The framework for calculating vulnerability scores

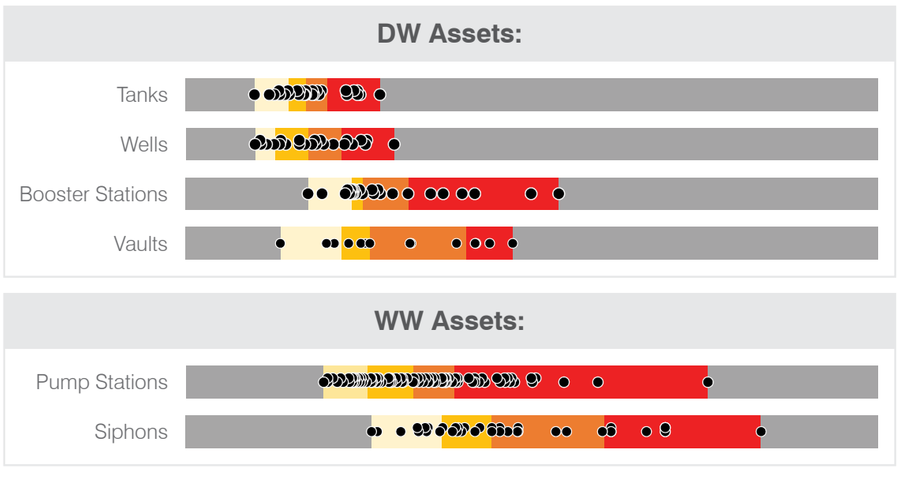
the three planning horizons for multiple hazards. The total vulnerability is the sum of scores for all hazards within a given horizon, while the composite vulnerability aggregates results across all three horizons to show how risks evolve over time.

The vulnerability assessments revealed several important trends in how water and wastewater infrastructure are likely to be affected by a changing climate. The results demonstrate that vulnerability is not uniform across asset types, reflecting differences in design, function, and adaptive capacity (Figure 6) in multiple communities. Pump stations consistently demonstrated the widest spread of scores, with many clustered in the higher vulnerability ranges, underscoring their operational complexity and reliance on multiple critical systems.

In contrast, storage tanks and wells exhibited more moderate distributions, while booster stations and vaults showed narrower spreads but included several high-vulnerability outliers. These differences highlight that vulnerabilities are not evenly distributed within or across systems, reinforcing the need for asset-specific evaluation rather than generalized assumptions about system-wide risk.

The results highlighted the role of temporal change in shaping vulnerability. Assets that may have only moderate vulnerability under current conditions are projected to face significantly higher risks by the mid and late terms.

For instance, in the example in Figure 7, vulnerability to extreme heat and precipitation events increases across the three planning horizons, with



Preliminary scoring for first nine communities

Figure 6.
Distribution of vulnerability scores across asset types, showing that the spread and magnitude of risk vary by infrastructure category

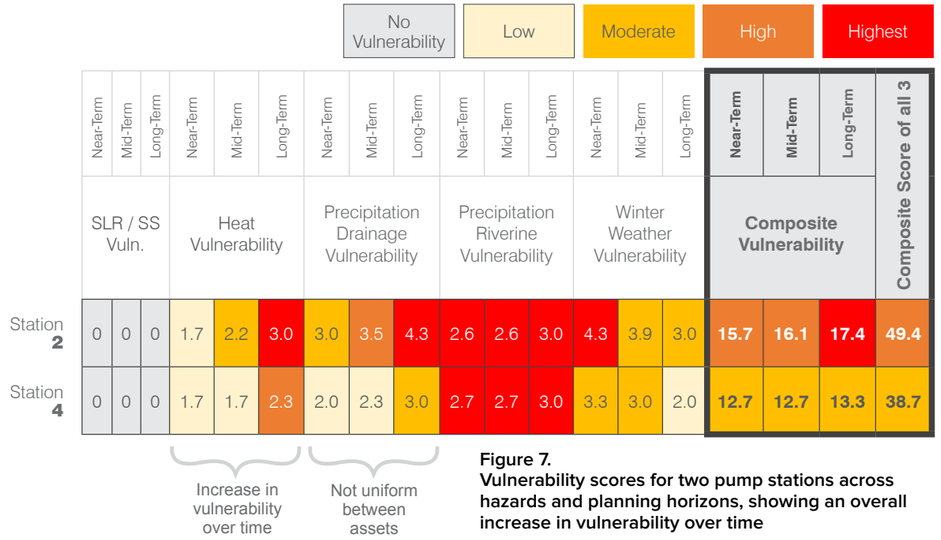


Figure 7.
Vulnerability scores for two pump stations across hazards and planning horizons, showing an overall increase in vulnerability over time

vulnerability scores reflecting both the intensification of climate hazards and the limitations of existing protective measures. Winter weather vulnerability showed a more variable pattern: While near-term risks remain high, some systems may experience a reduction in vulnerability later in the century as winters shift toward warmer and wetter conditions.

Comparative vulnerability scoring highlights significant variability among pump stations, with results distributed across categories from low to high (Figure 8). This spread illustrates how, even within the same asset class, site-specific factors such as location, system design, and existing protections can drive markedly different vulnerability outcomes.

Two pump stations scored at the lower end of the spectrum, reflecting fewer past impacts and stronger adaptive measures, while the three others fell into the moderate-to-high range due to greater operational sensitivity. The pump station that scored the highest vulnerability of the five was driven by both high exposure to hazards and limited redundancy of critical systems.

By presenting results in a format that shows each community's assets relative to others of the same type, utilities and decision-makers can better understand where their facilities fall along the vulnerability spectrum. This approach not only allows communities to see how their own assets compare internally but also provides context for their level of vulnerability across multiple communities.

These results underscore the value of the vulnerability scoring framework not only in identifying at-risk assets but also in creating a structured pathway for future planning. By translating exposure, sensitivity, and adaptive capacity into

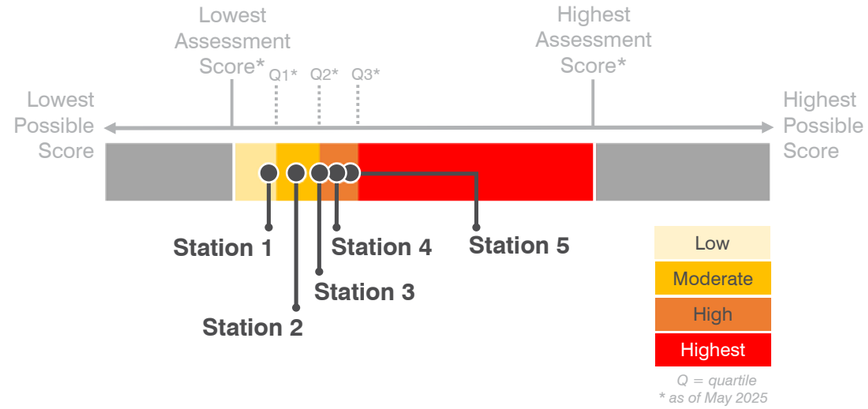


Figure 8.
Vulnerability scores for five pump stations in one New Hampshire community. This illustrates the variation among assets within the community and their relative position when compared across a broader community scale.

composite vulnerability scores, communities can gain a clear, evidence-based understanding of where their systems are most susceptible. Importantly, these scores can be directly integrated into asset management systems, where they complement traditional data such as condition, maintenance history, and replacement cost. This integration allows utilities to prioritize capital improvements, schedule maintenance, and plan upgrades with climate risk in mind.

At the same time, the scores support compliance with evolving regulatory requirements such as NPDES permits by providing a defensible basis for identifying critical assets and planning adaptive measures. In this way, the vulnerability assessment results move beyond a static report to become a practical decision-making tool embedded within day-to-day asset management.

BENEFITS OF A VULNERABILITY ASSESSMENT USING THE GIVEN APPROACH

The vulnerability assessment framework is adaptable across systems of different sizes and complexities. Its modular structure—based on exposure, sensitivity, and adaptive capacity—allows the same methodology to be applied to anything from small utilities with a few assets to large systems with more extensive infrastructure. By using regional climate projections, asset data, and standardized scoring, the framework ensures consistent evaluation while remaining flexible to local conditions. This scalability not only supports system-specific adaptation planning but also enables cross-community comparisons, helping to prioritize investments and inform resilience strategies at broader regional or statewide scales.

The framework is also flexible, allowing it to evolve as new climate science, data, and regulations become available. Its modular design and reliance on standardized yet adaptable indicators mean that updated climate projections or revised risk models can be incorporated without overhauling the process. This iterative structure means assessments remain current and actionable, enabling utilities to refine strategies in step with emerging climate trends and regulatory requirements. Such flexibility strengthens long-term resilience planning by allowing utilities to move from a static, one-time analysis toward a living process that adapts with both science and policy.

The framework guides utilities in prioritizing projects by pinpointing assets most at risk from climate hazards. Through the combined evaluation of exposure, sensitivity, and adaptive capacity, the process identifies critical vulnerabilities and translates them into actionable insights for decision-making. This "more-bang-for-the-buck," targeted approach enables utilities to allocate resources to measures that yield the greatest resilience gains, balancing cost-effectiveness with long-term service reliability, regulatory obligations, and protection of public health and the environment.

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ABOUT THE AUTHORS

- Indrani Ghosh is a senior associate at Weston & Sampson in Boston, Massachusetts, with over 20 years of experience as a water resource engineer and as a technical lead in climate change resiliency projects, specializing in leading interdisciplinary teams and stakeholders through risk-based prioritization of adaptation solutions.
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- Christina Rambo is a resilience and adaptation manager with the New Hampshire Department of Environmental Services Drinking Water and Groundwater Bureau and Wastewater Engineering Bureau in Concord, New Hampshire. She has over 10 years of experience and specializes in developing programs to enable wastewater and drinking water infrastructure to prepare for the current and anticipated impacts of extreme weather.

Committee Focus

Sustainability

Driving resource recovery, resilience, and triple bottom line plus innovation

The NEWEA Sustainability Committee exists to promote sustainable solutions and practices across all projects and operations in the water sector within the realm of NEWEA influence. The clean water industry was founded on the principles of sustainability: use of natural resources in ways that preserve and protect them for continued use by future generations.

Sustainable practices include reuse and recycling, resiliency, resource recovery, and energy and resource conservation—all practices that have been part of the water industry mindset for decades. Nonetheless, we continue to find ways to innovate and improve upon successes, achieving cleaner water, using less energy, improving resiliency, and recovering nutrients.

In September, the Sustainability Committee in collaboration with the Small Communities Committee presented "The Sustainability of Decentralized Systems in New England" conference (l to r: Wayne Bates, Todd Brown, Maeve Carlson, Carmela Antonellis, and Meredith Zona)

Shaping the Future of Resource Management

The Sustainability Committee is a dynamic and innovative team of professionals dedicated to driving sustainable practices. To highlight these improvements and to stimulate further innovation, the committee focuses on the following:

- Transformation of systems to resource recovery centers. The committee encourages the transformation of wastewater collection and treatment systems into "resource recovery systems." These systems aim to:
  - Reduce the use of water, energy, staffing, chemicals, and capital construction and O&M materials, and occupy a smaller footprint
  - Reuse more water, produce more energy, and recover more nutrients/biosolids/fertilizer
  - Achieve high economic value, and be operator friendly, regulatory compliant, technically reliable and flexible, environmentally friendly, and socially acceptable
- Implementation of the triple bottom line plus (TBL+) framework. The committee educates members and other NEWEA committees on TBL+, a critical framework for evaluating the sustainability of wastewater collection and treatment systems based on their environmental, economic, social, and technical performance.
- Collaboration and recognition. The committee works with other NEWEA committees to increase awareness and sustainability of NEWEA activities and practices. We recognize excellence through the annual Green Steps Award, which honors an organization or project that demonstrates initiative and leadership in implementing innovative, sustainable practices that incorporate resource efficiency, social awareness and connectivity, and economic viability.
- Engagement and opportunities. The committee accomplishes these goals through technical sessions at the Annual Conference and Spring Meeting, specialty conferences, and webinars. We also share knowledge through articles in the *Journal*.

Get Involved with the Sustainability Committee

The committee is always looking to increase its membership and invites you to become a part of this dynamic and innovative team to further promote sustainable practices in the clean water industry. Join our community of engineers, utility managers, researchers, and consultants to share and lead the industry's shift toward resource recovery. We need professionals interested in resource recovery, resilience planning, and TBL+ implementation.

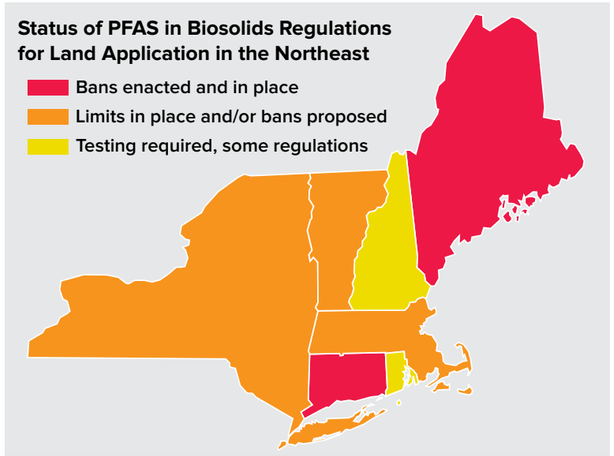
Committee Leadership Team:

- Outgoing chair: Maeve Carlson, PE, Wright-Pierce (Maeve.Carlson@wright-pierce.com), serving through 2026
- Incoming chair: Carmela Antonellis, Stantec (Carmela.Antonellis@stantec.com), serving through 2027
- Incoming vice chair: Serena Takada, PE, STV Inc. (Serena.Takada@stvinc.com), serving through 2027

Interested in joining the Sustainability Committee?
Reach out to Maeve Carlson or Carmela Antonellis to learn more!

The Squeeze is On—Northeast Continues to Lose Capacity for Managing Biosolids

Pressure on regional biosolids outlets continued in 2025. Without federal guidance or regulations around PFAS in biosolids, Northeast states—and even local governments—are making decisions that affect biosolids management not just in their own communities but throughout the region. Both Maine and Massachusetts are looking at 2028 as the year when sludges generated will exceed known outlets. Here's what's been going on in the Northeast that is sure to affect those projections.



Connecticut legislature bans sale or use of biosolids fertilizer

In the 2025 session, the Connecticut Legislature closed the door on the beneficial use of biosolids with a late amendment to Senate Bill No. 1497 titled An Act Concerning Programming at the Department of Agriculture and Other Farming and Agriculture Related Provisions. The new provision, which became Public Act No. 25-152 when signed by the governor on July 1, appeared on page 21 of 22 of the bill and states:

No person shall use, sell or offer for sale in this state [as] any fertilizer intended for land application or [a] soil amendment that contains any biosolids or wastewater sludge that contain PFAS.

The Connecticut Department of Agriculture is enforcing the new law. The department notified licensed sellers that they must prove their product does not contain PFAS or take it off the shelves. The original deadline of August 31 was extended to October 31. Two communities are affected by the new law (Fairfield and Stamford, which were making Class A EQ products for distribution, see Connecticut — National Biosolids Data Project) and must reconsider their sludge management processes. The amount of soil amendments and fertilizer products manufactured from other states' biosolids that were sold or used in Connecticut in the past is also significant.

Woonsocket to shutter its sewage sludge incinerator

Woonsocket, Rhode Island, is planning to permanently shutter its sewage sludge incinerator (SSI) that has operated since the 1970s. That was clear from the August 25 City Council Resolution and quotes from city leaders following the unanimous approval to start negotiations with the Narragansett Bay Commission (NBC) to take over ownership of Woonsocket's wastewater facility and SSI. The reference to closing the SSI came up five times in the two-page resolution, as in the clause about making wholesale changes to the treatment facility and entering into negotiations with a third party with the "strict condition that the incineration facility must be permanently shuttered and closed by a date certain."

The Woonsocket SSI facility has 105 dry tons (95 dry tonnes) per day of sludge processing capacity and, according to a contract engineer's report for the Massachusetts Department of Environmental Protection (MassDEP, [Residuals & Biosolids | Mass.gov]), is by far the largest in the region. According to that same report, the SSI still is capable of an estimated 28 years of useful life. The original multiple hearth incinerator was upgraded in 2007 to fluidized bed technology to comply with new federal air pollution limits.

Woonsocket contracts for both the treatment facility and SSI operations with Jacobs Engineering and Synagro, respectively. All three entities are the subject of legal action by the Rhode Island Attorney General's office after a spate of discharge permit violations a few years ago. The City is still under long-term contracts with both parties but has decided to part ways with them and move on from owning and operating the infrastructure. Woonsocket is contractually required to take over maintenance of the SSI from Synagro by July 1, 2027. It also faces major capital improvements at the SSI and treatment facility, estimated at $40 million to $50 million.

Woonsocket had previously announced its intention to cut liquid sludge acceptance by 50 percent as of January 1, 2026, with the rest being eliminated by early 2027. It's not only Rhode Island facilities that depend on the Woonsocket SSI to take care of their sludges. As a MassDEP report shows, a lot of the liquid sludge comes from Massachusetts.

Hawk Ridge composting facility in Maine is closing its doors

At the end of August, Casella Resource Solutions closed the gates at its almost 40-year-old, award-winning composting facility in Unity Township, Maine. Since the Hawk Ridge Composting Facility opened in 1989, Casella has processed about 1.5 million yd³ (1.15 million m³) of sewage sludges as well as 240,000 yd³ (184,000 m³) of papermill sludges and 130,000 yd³ (99,400 m³) of other feedstocks in making its compost.

Under current Maine state law, it is illegal to sell or use biosolids-based compost. That put a dent in Hawk Ridge's compost business, with Casella having to find other places to market its products. Sources from the company say the uncertain regional market—especially in states like Massachusetts—was a driver for closing Hawk Ridge. Casella was also looking at significant capital improvements to Hawk Ridge's composting infrastructure, and the company decided it was not worth it. Casella stopped taking wastewater sludges as of August 30, though it is honoring existing contracts and finding homes for customers' sludge elsewhere at no additional cost or disruption to service.

According to news reports, the Maine Department of Environmental Protection (DEP) is concerned with PFAS levels in impoundment water at the Hawk Ridge site and has concerns with the site going forward, specifically PFAS in surface waters on and adjacent to the composting facility. What the media has not noticed is that the Hawk Ridge site previously received biosolids for land application that were industrially impacted, from the same source of biosolids that was the cause of contamination at dozens of other farms in the greater Fairfield area. The PFAS contamination up-gradient of the Hawk Ridge composting operation is just as high as on those other farms, and may contribute to contamination down-gradient of the compost facility. Casella is cleaning up the site and will cease operations in the spring of 2026, although it may still use the site for storage and non-regulated activities as negotiations with DEP continue. Casella submitted its closure plan to the Maine DEP in late August with a facility closure slated for June 30, 2026.


Hawk Ridge Composting Facility

The Hawk Ridge composting facility shutdown comes when Maine is still struggling to find solutions for managing its biosolids. In 2025, the state legislature approved another temporary measure to allow for the continued import of bulky wastes to mix with biosolids at landfill, where an estimated 90 percent of Maine wastewater sludges end up. According to a state-funded engineering study (December 2023), the state-owned (and Casella-run) Juniper Ridge landfill will run out of space in 2028 unless something is done. Although Maine DEP supports the request to expand the landfill, that application is being contested, especially by its neighbors, the Penobscot Nation.

Meanwhile, Maine's wastewater operators are trying to get legislators to revisit the law that limits in-state options for biosolids to landfilling. They may be getting some traction as indicated by recent media attention: Maine's wastewater industry urges state to stop landfilling biosolids (WGME news). The Maine Water Environment Association cites state reports that point to better solutions and mention effective regulatory models in other states.

Massachusetts legislators visit Maine ahead of upcoming bills

The General Court of the Commonwealth of Massachusetts aims to pass PFAS legislation. As of press time, the legislature was considering an omnibus bill covering various PFAS concerns as well as two bills targeting biosolids:

- An Act to Protect Massachusetts Public Health from PFAS (H.2450/S.1504)
- An Act Protecting Our Soil and Farms from PFAS Contamination (H.109/S.56)
- An Act Prohibiting the Use and Sale of Toxic Sludge (H.136)

NEBRA at WEFTEC

Owing to NEBRA member PW Tech, NEBRA had space on the trade show floor at WEFTEC 2025 in Chicago. A lot of people stopped by to chat about their biosolids and residuals management issues. Shown with the NEBRA booth are Reg-Leg Committee Vice Chair Jeff McBurnie and Chris Hubbard and Deb Mahoney from the board.

In August, a group of Massachusetts legislators met with their counterparts in Maine. The group visited a PFAS-contaminated farm in Arundel, Maine, and the Maine State House for presentations and discussions, including a roundtable with lawmakers, farmers, and environmental advocates. The Massachusetts legislators did not visit the Juniper Ridge landfill or any wastewater treatment facilities that were affected by the 2022 Maine legislation that Massachusetts is looking to as models.

Although the omnibus PFAS Bill H.2450 contains provisions aimed at PFAS source reduction, it also includes language for "phasing out the use, sale, or distribution, or offer for use, sale, or distribution of sludge." In addition to affecting the beneficial use of biosolids, H.2450/S.1504 may intend to prohibit landfilling. The Massachusetts Water Environment Association (MAWEA) has been contacting legislators about that landfill issue and the implications of H2450 and the other bills.

There is concern not only about cost impacts but about increasing greenhouse gas generation as organics degrade in landfills or must be shipped long distances out of state. Any reduction of biosolids and sludge disposal outlets will have an immediate impact, further destabilizing the biosolids/sludge disposal market in the region. If any of these bills pass, an estimated 15,000 dry tons (13,600 dry tonnes) of sludges will have nowhere to go, according to MAWEA's Mickey Nowak. That is in addition to the projected 11,826 tons (10,728 dry tonnes) with no known outlet in 2028 (Residuals & Biosolids | Mass.gov) and the 10,300 dry tons (9,344 dry tonnes) of Massachusetts sludge that were going to the Hawk Ridge composting facility in Maine.

New York legislature proposed five-year moratorium to be taken up again in 2026

The Northeast region is concerned about a bill that is moving through the New York State Senate that would put a five-year statewide moratorium on the sale and use of biosolids. The purpose of A06192 was "to address the threat of PFAS contamination through sewage sludge, or biosolids, on New York state farmland and water supplies."

AO6192 started out as a bill to require testing and the establishment of a state task force to look at the issue. In early June, the bill was moved from the Environmental Conservation to Ways and Means Committee in the senate where it was stripped down to the basic five-year moratorium. It was referred to the Senate Rules Committee where it passed in mid-June by a vote of 48 to 11. The legislature ran out of time to vote on it so the bill was ordered to a third reading, meaning it will be back in the 2026 session.

Other local bans have been enacted or proposed in New York State in the last few years, including in Schoharie, Albany, Steuben, and Clinton counties as well as the towns of Thurston, Goshen, and Cameron. For the Northeast states, Massachusetts and Vermont would be affected if a statewide moratorium were to be enacted in New York.

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

Janine Burke-Wells, Executive Director
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For additional news or to subscribe to NEBRAMail, NEBRA's email newsletter, visit nebiosolids.org

YP Spotlight

Mabel Smith is an engineer at Apex Companies, LLC. based in Quincy, Massachusetts, working with clients in southeastern Massachusetts. She works on projects related to water and wastewater treatment and distribution including asset management plans for horizontal and vertical assets, construction administration for large treatment facilities, and more recently, water main design. Mabel holds a Bachelor of Science in Civil Engineering from the University of Massachusetts Amherst.

Journal *How did you find your way to this industry?*

Growing up my interests always gravitated to more math- and science-related topics. When I got to college at UMass Amherst, I was in a general engineering course and then found my way to civil engineering and things just clicked for me. I loved the practicality and the everyday applications and seeing what I was learning being used so much in my day-to-day life. I eventually found my way to water and environmental engineering and am learning more about the industry every day.

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

The most exciting parts of my job and involvement with NEWEA are seeing how vast this industry can be and how it expands to so many different sectors. There are so many of us and often we can lose sight of all the fascinating things we can do. I find it interesting and inspiring hearing about other projects and connecting with others in the industry.

■ *When did you first get involved with NEWEA?*

I had first heard about NEWEA during college when classmates would go for the poster competition, but I never attended. I was encouraged to attend the YP Summit in 2024 and it was such a welcoming environment. It was refreshing and inspiring to connect with other young professionals who are going through similar situations and just getting into this industry. I wish I had joined earlier but am glad I am here now.

■ *What's your favorite thing about NEWEA?*

My favorite thing about NEWEA is how welcoming the community is, how passionate this group of people are. There are people with so many different backgrounds, but we can all come together and share our experiences. I've also found that in an industry so big, it really is a small world and chances are you know more people than you think; it's amazing that NEWEA can bring us together.

Mabel Smith

■ *Tell us a fun fact about yourself.*

I love picking up new hobbies and learning new activities. Some that I've picked up in recent years are crocheting, skiing, sewing, and running. It's exciting to push myself mentally and physically and learn some new skills.

WEF Delegate Report

NEWEA's WEF delegates spend many volunteer hours participating in important activities of the international organization, advancing advocacy and professional opportunities in the water environment field nationally. They also bring ideas and information back to NEWEA for enhancing industry outreach and development locally.

NEWEA's influence on the national stage continues to shine. Some of the impressive accomplishments include the following:

- WEFTEC 2026 saw the conclusion of the successful WEF presidency of Howard Carter, longtime NEWEA advocate from Saco, Maine.
- NEWEA stalwart Peter Garvey was elected as WEF House of Delegates (HOD) speaker-elect, and he will assume the office of speaker for the 2026–2027 WEF year, leading the HOD member association (MA) interface with WEF into the future.
- Longtime NEWEA and WEF leader Jim Barsanti was awarded the coveted title of WEF Fellow in recognition of his technical expertise and years of mentorship as well as his dedication to advancing infrastructure, operator training, and inclusive leadership in the water sector.

As current WEF delegates, we congratulate and aspire to continue the work of these NEWEA and WEF leaders. Below are our individual reports about our recent national and local activities.

Nick Ellis

Since my last report, my time as a WEF delegate has been filled with meetings, activities, and interactions with the national organization that have further guided my participation in WEF and NEWEA. The HOD meeting at WEFTEC was well attended and eye-opening, and included updates from various committees and communities within WEF of which I was previously unaware. At this meeting I completed my participation in the Workforce Development for Operators work group, which produced an operator recruitment toolkit now available via the WEF learning center website.

This year, I joined a new work group focused on how artificial intelligence (AI) will affect our industry. First, how will AI affect the jobs of water professionals, positively or negatively? Will AI tools make us more efficient and effective, or will they result in a workforce that relies too much on computer-based intelligence rather than real-world skills and knowledge? Second, how will the water demand related to AI data centers and second-tier infrastructure, such as power plants, be provided, conveyed, and treated? Answering these and other questions will help guide us as an industry, from both a technical and operational perspective.

Finally, my experience at WEFTEC has made it clear to me that we as delegates could and should do more to inform NEWEA committee chairs and volunteers of WEF's myriad resources available to assist in creating technical content and engaging committee members. WEF communities exist not only to serve the national organization, but also to function as a clearinghouse of content for MAs and their technical committees that can be leveraged to enhance technical sessions and specialty conferences for most if not all NEWEA committees. More to come on this.

Emily Cole-Prescott

It's been an exciting few months for this WEF delegate. NEWEA's Deb Mahoney and WEF's Kelsey Hurst did a great job facilitating NEWEA's strategic planning event in early September. Then it was back to Maine for the Maine Water Environment Association annual conference at Sunday River, and though I couldn't make it for the full conference, it was great to see the strong golf turnout.

Also in September, the WEF MA eXchange (WEFMAX) Planning Committee simplified our guide for MAs about how to run a successful WEFMAX. I encourage you to attend a WEFMAX event, to connect with one another about best practices for a robust WEF MA. I've been to two WEFMAX events and learned a lot at each one. Dates for 2026 WEMAX events appear later in this article.

New England again had a great presence at this year's WEFTEC, one of the largest ever, with over 380,000 ft² (35,000 m²) of exhibition space and over 21,000 people in attendance. Chicago was buzzing with water folks! We're proud of our own Howard Carter, who completed his term as WEF president, earning a standing ovation during the opening session. Owing to WEF leadership, the budget has been balanced, and WEF is accelerating in a sustainable and productive direction. Collaborative partnerships such as the water–AI nexus have been launched with partners such as Amazon and the University of Pennsylvania.

NEWEA members completing their WEF terms this year are Janine Burke-Wells, fellow delegate and exemplary leader, and Susan Sullivan, who helped organize and propel WEF's Government Affairs Community. It was exciting to see Vanessa McPherson join the HOD and Nick Ellis continue in his second year there.

As a member of the WEFTEC Advisory Committee, I enjoyed taking first-timers through the HOD orientation tour. This advisory group also helps to make recommendations about future WEFTECs. The committee offered new and varied opportunities for busy attendees to relax on the exhibition floor with diversions such as building Legos. The hall was packed, and the exhibits looked great.

The WEF Government Affairs Community hosted several meetings throughout the conference where we discussed legislative, regulatory, and general updates. I hosted the MA conversation that included hot topics from across WEF member associations. Everything from permit backlogs to PFAS considerations, worker protections, and water reuse was discussed through the policy perspective lens. We're looking forward to continuing collaboration in 2026, as we plan the next webcasts and MA focus group connections. If you haven't already, please sign up to be a water advocate; it's an easy and effective way to make your voice heard.

It was an honor for me to attend WEFTEC and represent New England. Thank you for this opportunity.

Vanessa McPherson

It is an honor and pleasure to represent NEWEA as a new WEF delegate. My term started at WEFTEC in Chicago this fall, with several HOD meetings and interactions. Feeling fully immersed, but thanks to guidance from Peter Garvey, Janine Burke-Wells, Nick, and Emily (not to mention Howard!) I have been in capable hands and look forward to making the most of this opportunity to serve as a conduit between our MA and the national organization.

This year, I am a member of the Water Advocacy Committee, and the HOD MA and Community Leadership Council (CLC) Advocacy and Engagement work group.

The Water Advocacy Committee works to strengthen advocacy through local, state, and regional approaches, builds on research, and learns more about MA water advocacy programs. The committee also provides a platform to share MA advocacy efforts within the HOD and WEF, aiming to reach MAs that do not have water advocacy programs. NEWEA is familiar with this committee thanks to Peter Garvey's efforts over the years, and I'm proud to keep carrying this torch.

The HOD MA and CLC Advocacy and Engagement work group identifies actions and activities that advocate for the relationship among the MAs, HOD, and CLC. The HOD, and specifically its delegates, sit at MA board meetings and have direct contacts with MA committee leaders. In this role, we can advocate for MAs, the HOD, and the CLC to strengthen communities and identify opportunities for collaboration. NEWEA committee members, this means you! Please contact me to discuss how you already interact with WEF committees or thoughts about how we can help make this happen more regularly and seamlessly.

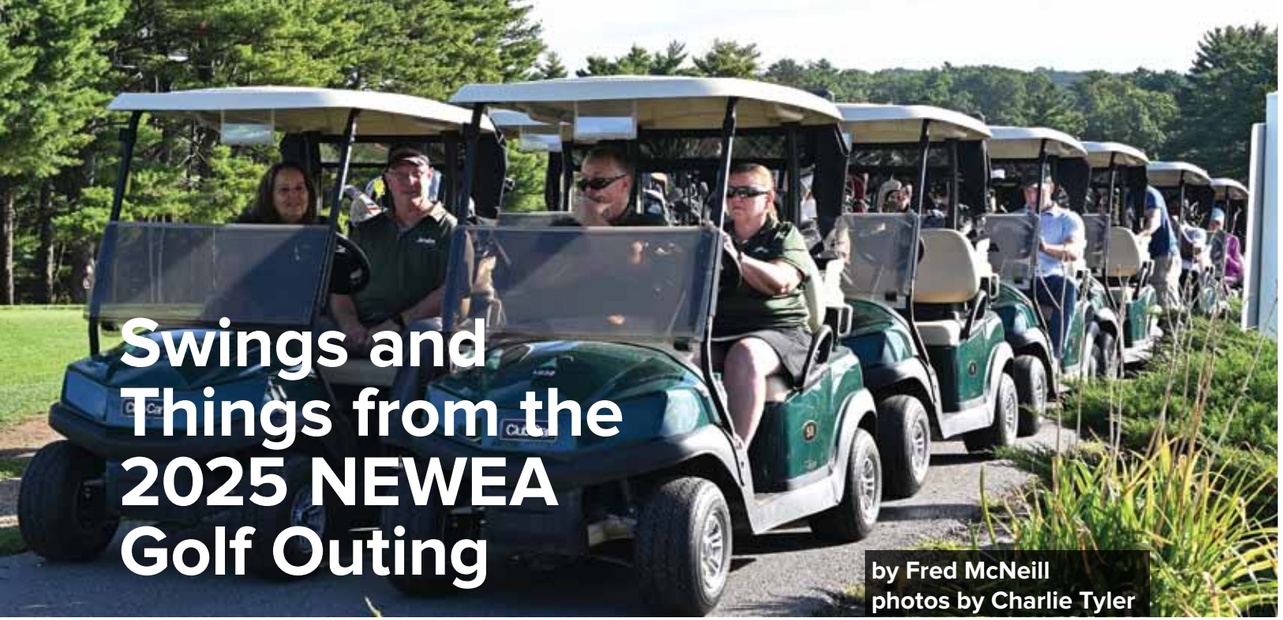
SAVE THE DATE FOR UPCOMING EVENTS

The National Water Policy Fly-In will take place April 14–15, 2026. On Tuesday April 14, attendees will gather to network and hear from key senior EPA and other government officials and round out the day with friends and colleagues at the 2026 Water Week Reception.

The WEFMAX lineup for 2026 is as follows:

- April 22–24, Hosted by Réseau Environnement in Montreal, Quebec
- May 6–8, Hosted by Pennsylvania Water Environment Association in Pittsburgh
- May 27–29, Hosted by Pacific Northwest Clean Water Association (Idaho, Oregon, and Washington), location to be announced.

All NEWEA and WEF members are encouraged to attend these events to strengthen our industry voice in the halls of government and to share ideas for professional improvement and outreach with MA members nationwide.



Swings and Things from the 2025 NEWEA Golf Outing

by Fred McNeill
photos by Charlie Tyler

On a cool but sunny September 27, with a hint of autumn in the air, NEWEA hosted its annual fall golf tournament at the Derryfield Country Club in Manchester, New Hampshire. This is the fifth year that Derryfield Country Club has hosted our fall golf event. Centrally located within New England and minutes off Interstate 93, this municipally owned golf course offers beautiful vistas, challenging terrain, and an inviting post-game deck that is a fan favorite for 19th hole libations.

As early morning guests from all corners of New England filled the parking lot, it was great to hear the clanking of clubs and the warm and playful greetings as old and new friends gathered for this annual event. While enjoying a continental breakfast, they had an opportunity to catch up with old friends, become familiar with new ones, and trade the latest in industry gossip. At 9 AM 84 players, composing 21 teams, mounted their carts for the big golf event.

In addition to the players, volunteers and leadership helped make the tournament a success. While NEWEA's longtime photographer, Charlie Tyler, cruised the course in his cart capturing all the fun and festivities, Executive Director Mary Barry joined us to cheer on the teams and engage with membership throughout the day. Meg Tabacsko and Mario Leclerc hosted the popular putting contest, where, after the 9th hole, each team stopped by the practice putting green to test its skills with three putts per member toward a challenging uphill cup placement. It was great to see the comradery as teams cheered each other on trying to sink that tough putt under the tutelage of Meg and Mario.

Established in 1932, Derryfield Country Club is a short but hilly course known for its tough uphill, side-hill, and downhill shots. In addition, the small greens are lightning fast. So, as the day progressed, each golfer's skills were put to a stern test over 18 holes. As the morning faded into a sunny afternoon the golfers completed their rounds and headed to the clubhouse to tally the scores and enjoy a hearty and well-deserved grilled steak lunch.

After lunch, there were presentations led by NEWEA Past President Fred McNeill with Mario Leclerc as his trusty sidekick. The fun started with skill prizes awarded for the putting contest, closest-to-the-pin, longest drive, and straightest drive. Next, in a heartwarming gesture of NEWEA support, the gathering took a moment to raise their glasses in a phone-captured toast of encouragement, get well wishes, and warm affection for former NEWEA President and WEF Delegate Ray Vermette as he continues his battle with an aggressive form of leukemia. While Ray could not join us for the event, he was certainly there in spirit during that thunderous toast.

Following our toast, the official tournament tally was presented. In third place with a stellar round of 10 under par was the CDM Smith team led by old friend Rich Davis. Coming in second place, also with 10 under par, was young gun Kevin Desjardins joined with a newly minted Jacobs team. The winner of NEWEA's 2025 fall golf tournament with an exceptional 12 under par 58 was the defending champion Methuen Construction team led by Jay Spooner.

Finally, tickets were drawn for the distribution of door prizes including drivers, hybrids, wedges, bags, and other golfing goodies. Among others, it was great to see old and new NEWEA leadership winning prizes. Past Treasurer Mac Richardson scored first prize, a new TaylorMade driver, and current Massachusetts State Director John Digiacomo won one of the hybrid clubs, while past New Hampshire Water Pollution Control Association presidents Mike Sullivan and Sean Greig each scored some sweet swag.

As always, we thank all our sponsors whose generosity and participation make this such a successful and fun-filled event for NEWEA, and we offer a final shout-out to NEWEA staff and all the volunteers who help to make this tournament great. We look forward to seeing all of our NEWEA golfers next year on Friday, September 25 (mark your calendar now) for NEWEA's 2026 fall golf tournament at the Derryfield Country Club.

1. Madelyn Dwyer, Joe Graham, Malcolm Bybee, and Lou Mammolette
2. Kevin Olson, David Pavlik, Jamal Jones, and Marc Moccio
3. Winning Methuen Construction Team: Jay Spooner, Patrick Castrogiovanni, Zack Thompson, and DJ Tanner, congratulated by Fred McNeill
4. Meg Tabacsko receives a grateful hug from putting contest participant Sean Fitzgerald
5. John Neal, Gage Moran, Andy Reid, and Justin Gould celebrate at the 19th hole luncheon
6. Andrew Butler, Gretchen Young, Dana Webber, and John Sykora

Annual Conference & Exhibit Preview

January 25–28, 2026 • Boston Marriott Copley Place, Boston, MA

This year's event theme is "Stronger Together: Planning for Our One Water Future." This theme emphasizes the importance of strategic planning and collaboration among the various sectors of the water industry, as well as of implementing the One Water approach to effectively manage and protect our water resources. With 37 technical sessions, a Student Poster Competition, a Tuesday Plenary Session, and two floors of exhibitors highlighting the industry's latest products and services, this year's program will address many elements of this theme.

The conference commences on Monday with the Opening Session at 11:00 AM. Attendees will hear from NEWEA and WEF leadership and our 2026 keynote speaker. Attendees can select from six concurrent morning and seven concurrent afternoon technical sessions on water industry issues. Undergraduate and graduate students will present their water quality research in the Student Poster Competition throughout the day. Students, young professionals, and experienced employees looking for a new role are invited to meet with water industry employers at the Career Fair from 1:00–4:30 PM. The afternoon winds down with the first of two Exhibit Hall receptions on the 3rd floor.

Tuesday offers another full day of exciting events. We celebrate and recognize operators by holding morning and afternoon Plant Operations technical sessions, as well as the lunchtime Operator's Reception. A Plenary Session on Strategic Planning will take place from 11:00 AM to 12:30 PM. Innovators will also showcase their technologies and foster discussions on water innovation in the 3rd Floor Atrium. The day concludes with an Exhibit Hall Reception on the 4th floor.

The final day features exhibits and morning and afternoon technical sessions, our lunch-time awards ceremony recognizing outstanding work in our industry, and the passing of the gavel to the 2026 NEWEA president, Scott Firmin of the Portland Water District. We hope you take advantage of all the 2026 Annual Conference has to offer and use this occasion to connect with and support your water industry colleagues.

We recognize the efforts of the Meeting Management Council and the Program, Registration, Exhibits, and Awards committees who make this conference one to look forward to each year. Thanks to the members of all the technical committees who review abstracts, moderate sessions, and provide the technical and subject matter expertise we need to do our jobs better. This conference would not be possible without the tireless efforts of the NEWEA office staff: Mary Barry, Janice Moran, Jordan Gosselin, and Heather Howard. Thank you for your dedication, energy, professionalism, new ideas, and patience in planning and coordinating this great event every year!

Deborah Mahoney, NEWEA President
Maureen Neville, NEWEA Program Committee Chair

Conference Events

SUNDAY, JANUARY 25

Registration (4th Floor).....9:00 AM – 4:00 PM
YP Summit (4th Floor).....10:00 AM – 4:00 PM
Special Showing of film: *Unless Something Goes Terribly Wrong* .....5:30 – 7:00 PM

MONDAY, JANUARY 26

Registration (4th Floor).....7:00 AM – 6:00 PM
Technical Sessions 1 – 6 .....8:30 – 10:30 AM
Student Program .....9:00 AM – 4:30 PM
Exhibits.....8:00 AM – 6:00 PM
Opening Session .....11:00 AM – Noon
Technical Sessions 7 – 13.....2:00 – 4:30 PM
Exhibit Hall Reception .....4:30 – 6:30 PM

TUESDAY, JANUARY 27

Registration (4th Floor).....7:00 AM – 6:00 PM
Innovation Pavilion Exhibitors .....8:00 AM – 4:30 PM
Exhibits.....8:00 AM – 6:00 PM
Innovation Pavilion Exhibitors .....8:00 AM – 4:30 PM
Technical Sessions 14 – 19 .....8:30 – 11:00 AM
Plenary Session .....11:00 AM – 12:30 PM
Technical Sessions 20 – 25.....2:00 – 4:30 PM
Exhibit Hall Reception .....4:30 – 6:00 PM

WEDNESDAY, JANUARY 28

Registration (4th Floor).....7:30 AM – 2:00 PM
Exhibits.....8:00 AM – 1:00 PM
Technical Sessions 26 – 31.....8:30 – 11:00 AM
Awards Luncheon.....11:00 AM – 1:00 PM
Technical Sessions 32 – 37 .....1:00 – 3:00 PM

Conference Exhibitors as of 11/8/2025

ABB - Measurement & Analytics
ABBA Pump Parts and Service
Access Systems USA
Aclarity Inc.
ADS Environmental Services
AECOM
Aqua Solutions, Inc.
Aquatic Informatics
Asahi/America, Inc.
Atlantic Fluid Technology Inc.
Avanti Control Systems, Inc.
Azuria - Underground Solutions, Inc. & Insituform Technologies, LLC
Barton & Loguidice
BAU/Hopkins
BioSafe Systems
BMC CORP
Boyson and Associates, LLC
Brown and Caldwell
C.N. Wood Enviro LLC
Caluwe, Inc. - Waste-to-Energy Solutions
Carl Lueders & Company
Carlsen Systems, LLC
Casella
Chadwick Baross Inc
Champlin Associates, Inc.
CleanWay Environmental Partners, Inc
Confined Space Rescue Solutions
CoreAqua
Corrosion Products and Equipment
Coyne Chemical Environmental Services
CSI Controls & Primex Controls
CUES, Inc.
Delta Electro Power LLC
Denali Water Solutions
Dewberry
DLVEWS, INC.
DN Tanks
Duke's Root Control
EJ-USA
Engineered Consultants Inc
EOSi (Environmental Operating Solutions, Inc.)
EST Associates, Inc.
F.R. Mahony & Associates
Flender Corporation
Flow Assessment Services LLC
Flow Tech, Inc.
Franzenburg Centrifuges
G.A. Fleet Associates, Inc.
General Control Systems
GeoTree (Geopolymer) Solutions
Green Steel Environmental
Hach Company
Hayes Group
Hazen and Sawyer
Heartland
Holland Company, Inc.
Industrial Flow Solutions
Inframark
JWB Company
Kimley-Horn and Associates, Inc.
LandTech Consultants, Inc.
M.A. SELMON COMPANY
Maltz Sales Company
Mass Tank / Eastern Reliability
Mechanical Solutions Inc
Metro Valve & Actuation
NASSCO, Inc.
National Water Main Cleaning Co.
New England Environmental Equipment
Oakson
Omya Inc
Orenco Water
Pump Systems, Inc.
RCAP Solutions, Inc.
Regal Systems Inc
Resource Management, Inc.
Rockwell Automation
Russell Resources Inc.
scavin equipment co. LLC
Schneider Electric
Sealing Systems, Inc.
SNF Polydyne
Soleno LLC
Source One Environmental
StormTrap
SULLIVAN ASSOCIATES/RITEC ENVIRONMENTAL
Synagro Northeast, LLC
Technology Sales NE
The Maher Corporation
Ti-SALES
Truax Corporation
UNITED CONCRETE PRODUCTS, INC.
United Rentals Fluid Solutions
University of Massachusetts Water and Energy Technology (WET) Center
USABLUEBOOK
Veolia
Water Works Metrology LLC
Waterline Renewal Technologies
Weber Scientific
Wescor Associates, Inc.
Williamson Pump & Motor
Xylem/Flygt
Xylem/Godwin

Conference Registration
View the Preliminary Program and more information about the conference at annualconference.newea.org
Register online: https://2026-annual-conference-exhibit.events.newea.org
Best Rate Deadline: Friday, January 2, 2026

Event Hotel: Boston Marriott Copley Place
110 Huntington Ave., Boston, MA 02116 • 617-236-5800
$234++ • Group rate deadline is January 2, 2026
Reserve online: https://book.passkey.com/e/51015057?utm_ source=249&utm_medium=email&utm_campaign=297 040961&trkid=596079539&linkid=3617613465

2026 Award Recipients

NEWEA Awards

Alfred E. Peloquin, CT ..... Jeffrey Bowers

Alfred E. Peloquin, ME ..... Philip Pickering

Alfred E. Peloquin, MA ..... Adam Yanulis

Alfred E. Peloquin, NH ..... Stephanie Rochefort

Alfred E. Peloquin, RI ..... Patrick McShane

Alfred E. Peloquin, VT ..... Ryan Peebles

Asset Management ..... David Michelsen

Biosolids Management ..... Charlie Alix

Clair N. Sawyer ..... Dr. James P. Malley, Jr.

Committee Service ..... Zach Henderson

Diversity, Equity, & Inclusion Leadership ..... Dr. Victoria Verlezza

E. Sherman Chase ..... David C. Bowen

Elizabeth A. Cutone Executive Leadership ..... Janine Burke-Wells

Energy Management Achievement ..... Torrington Water Resource Recovery Facility

Founders ..... John F. Hart

James J. Courchaine Collection Systems ..... Peter Connell

Operator, CT ..... Edward Abel

Operator, ME ..... Jeffery Warden

Operator, MA ..... Bradley Furlon

Operator, NH ..... Jamie Wood

Operator, RI ..... Richard Emery

Operator, VT ..... Dean Rheaume

Operator Safety ..... David S. Dane

Past President's Plaque and Pin ..... Scott Goodinson

Paul Keough ..... Michelle Clements

Wastewater Utility Management .. Town of Lexington, MA

Young Professional ..... Sara Vargas

Youth Educator ..... Stacy Thompson

Green Steps ..... Massachusetts Bay Transportation Authority

NEWEA Recognition (Stockholm Junior Water Prize)

CT ..... Dongeun Rhee

ME ..... Danha Park

MA ..... Yuxuan Zhang

NH ..... Aadi Kulkarni

RI ..... Donghyun Kang

VT ..... Kyle Ni

WEF (presented at WEFTEC)

WEF Fellow ..... James Barsanti

WEF Life ..... Steve Clifton

WEF Life ..... William Powers

WEF Operator Scholarship ..... Johnathon Whetton

WEF Operator Scholarship ..... Dustin Watkins

Water Heroes ..... Veolia North America Smithfield, Rhode Island

WEF—MA Awards

Arthur Sidney Bedell ..... Mary Barry

George W. Burke ..... Woodard & Curran, University of New England Biddeford, ME Wastewater Treatment Facility

Laboratory Analyst Excellence ..... Daniel Sullivan

2026 NEWEA Executive Committee*

*Proposed 2026 NEWEA Executive Committee—pending the election vote at the annual business meeting of the membership on January 25, 2026

PRESIDENT
Scott M. Firmin
Portland, ME

PRESIDENT-ELECT
Amy Anderson George
Wakefield, MA

VICE PRESIDENT
Daryl Coppola
Rockland, MA

TREASURER
Arthur Simonian
Cromwell, CT

PAST PRESIDENT
Deborah S. Mahoney
Andover, MA

EXECUTIVE DIRECTOR
Mary M. Barry

DIRECTORS—COUNCIL

Collection Systems and Water Resources
Matthew Dickson
Maynard, MA

Communications
Philip J. Tucker
York, ME

Innovation
Chi Ho Sham
Needham, MA

Meeting Management
Scott R. Neesen
Londonderry, NH

Management Review
Deborah S. Mahoney
Andover, MA

Public Outreach
Daryl C. Coppola
Rockland, MA

Treatment, Systems Operation and Management
Eric M. Spargimino
Milton, MA

DIRECTORS—STATE

Jeff D. LeMay
South Windsor, CT

Andre E. Brousseau
Springvale, ME

Peter Lyons
Andover, MA

Tracy Wood
Concord, NH

Laura R. Marcolini
Cumberland, RI

Jennie E. Auster
Burlington, VT

WEF DELEGATES

Peter Garvey
Chestnut Hill, MA

Emily Cole-Prescott
Saco, ME

Nicholas Ellis
Boston, MA

Vanessa McPherson
Middletown, CT

Upcoming Meetings & Events

On September 8, 2025, the NEWEA Small Community Committee in collaboration with the Sustainability Committee held a specialty conference on decentralized wastewater systems that included a tour of the Town of Sturbridge Wastewater Treatment Facility
See page 43 for more information

NEWEA EXECUTIVE MEETING (ALL CHAIRS)
Marriott Copley Place Hotel, Boston, MA
January 25, 2026

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

NATIONAL WATER WEEK / DC FLY-IN
Hilton Hotel/National Mall The Wharf, Washington, DC
April 14–15, 2026

NEWEA SPRING MEETING & EXHIBIT
Sea Crest Beach Resort, N. Falmouth, MA
May 17–20, 2026

AFFILIATED STATE ASSOCIATIONS AND OTHER EVENTS

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

MEWEA WATER PROFESSIONALS NIGHT—MAINE MARINERS VS. WORCESTER RAILERS
Cross Arena, Portland, ME
January 17, 2026

CTWEA SKI DAY
Stratton Mountain, VT
February 6, 2026

JOINT CTWEA/MAWEA SKI DAY
Stratton Mountain, Vermont
February 6, 2026

CTWEA OPERATIONS FORUM
AquaTurf, Plantsville, CT
February 20, 2026

NHWPCA LEGISLATIVE BREAKFAST
Concord, NH
March 5, 2026

NHWPCA/MEWEA SKI DAY
Saddleback, Rangely, ME
March 19, 2026

MAWEA QUARTERLY MEETING
Devens Conference Center, Devens, MA
March 25, 2026

GMWEA SPRING MEETING
Killington Grand Hotel, Killington, VT
May 21, 2026

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

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

New Members August–November 2025

Stephanie Alessandrini
Albany, NY (PRO)

Ashley Borys
City of Newport, RI
Newport, RI (YP)

Justo Cabrera
Mass Chaos
Agawam, MA (PWO)

Tulip Chakraborty
Veolia North America
Pittsford, NY (YP)

Joanuel Claudio
Mass Chaos
Agawam, MA (PWO)

Peter Cordeiro
Borden & Remington Corp
Rehoboth, MA (PWO)

Roberto Dabbas
Navitas, LLC
Winchester, MA (YP)

Nhut Dang
Suwanee, GA (YP)

Nicholas DaSilvia
Narragansett Bay Commission
Providence, RI (PRO)

Will Edgerton
Wright-Pierce
Burlington, MA (YP)

Angie Gabinetti
Infiltrator Water Technologies East
Lyme, CT (YP)

Conrad Gale
Town of Stafford WPCA Stafford
Springs, CT (PWO)

Isabelle Garand
Tighe & Bond
Worcester, MA (YP)

Connor Gauthier
Carlsen Systems
Woburn, MA (PRO)

Chris Goodwin
MWRA
Rochester, NH (PWO)

Melissa Holland
PW Tech
Essex, MD (COR)

Will Hurley
Northfield, NH (PRO)

Constantine Karos
West Hartford, CT (PRO)

Matthew Kennedy
Wright-Pierce
Marlborough, MA (PRO)

Paula Kulis
CDM Smith Inc
Boston, MA (PRO)

Molly Larsen
Brown and Caldwell
Andover, MA (YP)

Darren Lauletta
York Sewer District
York Beach, ME (PWO)

Sean McA'Nulty
GHD
Barnstable, MA (YP)

Tom Moore
CHP Clean Energy
Hampton, NH (PRO)

Kyle Mundorff
City of Saco
Saco, ME (UPP)

Emma Olson
Jacobs Engineering
Woburn, MA (YP)

Tiziano Roncone
East Providence, RI (PRO)

Michael Sacco
Northfield, NH (PRO)

Kyle Schultzki
Mass Chaos
Agawam, MA (PWO)

Josh Scotton
Water Industries
Rochester, NH (PWO)

Fatmata Sesay
Dartmouth College
Woburn, MA (STU)

Aidan Short
Hoyle, Tanner & Associates
Portsmouth, NH (YP)

Jill Stevens
Waterford Utility Commission
Waterford, CT (PRO)

Paige Sudore
Stantec
Boston, MA (YP)

Marike Tenawe
University of Rhode Island
Kingston, RI (STU)

Isaac Therrien
Fournier Industries Inc
Gorham, ME (PRO)

Daniel Tomasz
Town of Merrimac
Merrimac, MA (PWO)

John Tucker
Scarborough Sanitary District
Scarborough, ME (YP)

Scott Urban
Mass Chaos
Holyoke, MA (PRO)

Victoria Verlezza
Fuss & O'Neil
Hartford, CT (PRO)

Chris Villari
WSP USA
Queens, NY (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

Upcoming *Journal* Themes

Spring 2026—**Emerging Contaminants and Regulatory Updates**

Summer 2026—**Circular Water Economy**

Fall 2026—**Asset Management**

Winter 2026—**Innovative Solutions and Operator Ingenuity**

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

Charge
☐ Visa
☐ American Express
☐ 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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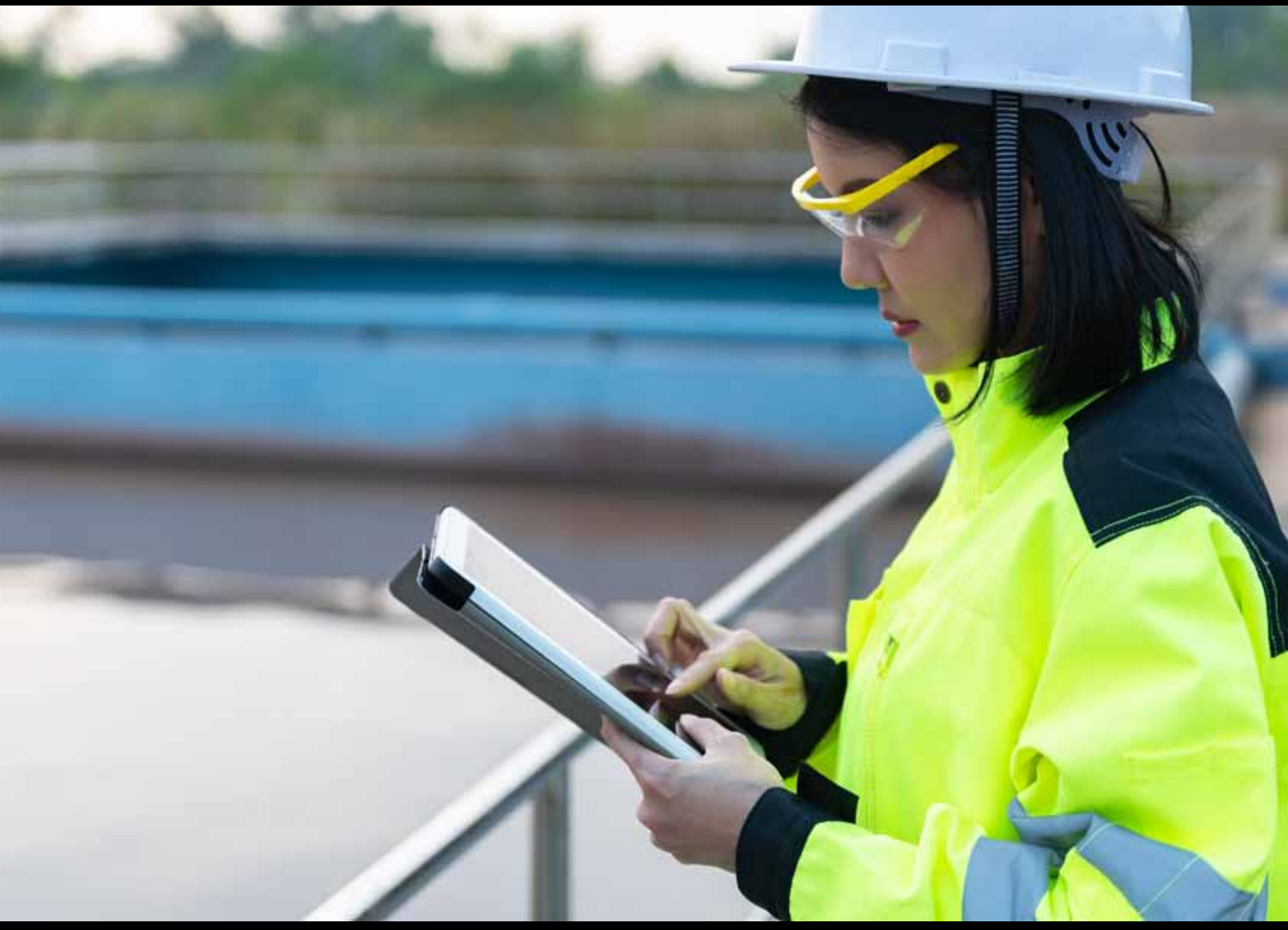

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Stantec

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stantec.com/water