JOURNAL

OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

VOLUME 53 NUMBER 3 / ISSN 1077-3002 **FALL 2019**

COLLECTION SYSTEMS

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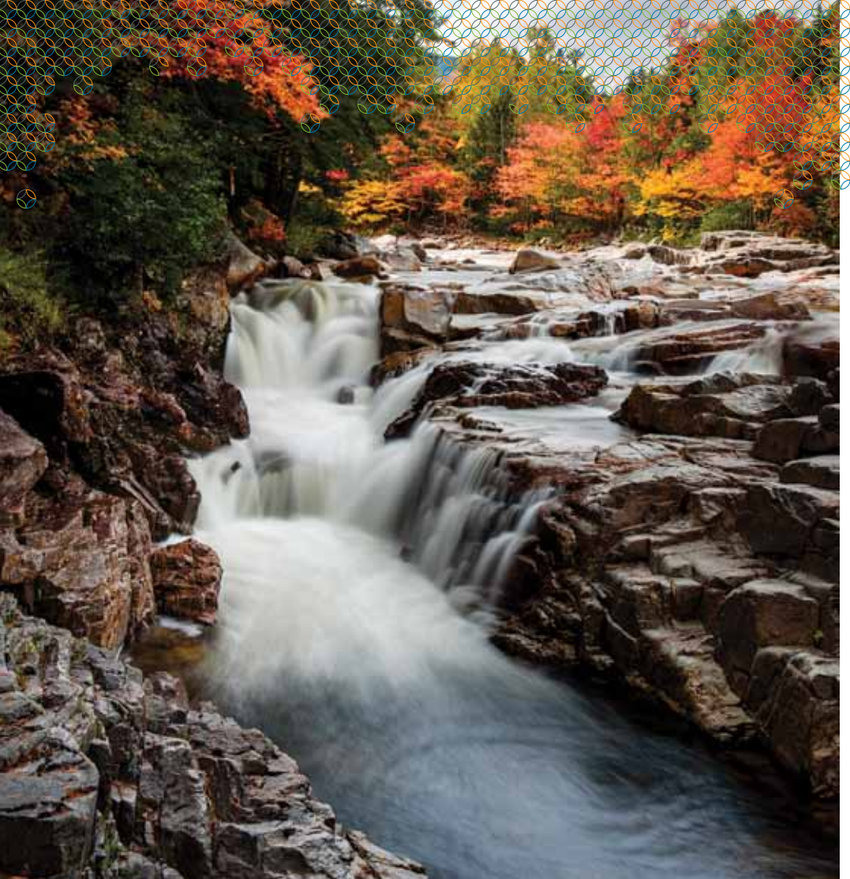
On the cover: The grease from cooked bacon, along with other fat, oils, and grease (FOG), is targeted as part of Worcester's implemented management program

Page 80: Measurement unit conversions and abbreviations



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

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

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Corporate	420
Regulatory	50
Academic	185
Young Professional	70
PWO	110
Dual	45
Student	15

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

The 2019 Spring Meeting is a June Portsmouth memory, and we could not be more pleased with its success. We had a great turnout of more than 300 attendees, and we even managed to negotiate for decent weather! Our opening session featured the Honorable U.S. Senator Jeanne Shaheen as our keynote speaker, discussing funding and the newest dirty word in our industry—PFAS (perfluoroalkyl and polyfluoroalkyl substances). Attendance at the session was standing room only! We also had a great turnout for Monday's golf tournament held at Breakfast Hill Golf Course in nearby Greenland. Around 20 foursomes enjoyed the day at the links before reconvening for the evening reception and the 5S induction ceremony where our own Charlie Tyler entertained the crowd at the expense of the inductees. Attendees also participated in our informative technical sessions, and many also watched the five enthusiastic teams compete for three national competition slots in the Operations Challenge event.

At the June 21 New Hampshire Water Pollution Control Association (NHWPCA) Summer Outing at Ellacoya State Park in Gilford, New Hampshire, I seized the opportunity to say a few words regarding the retirement of a dear friend and someone whom I have always admired for her years of dedication, Mary Jane Meier. "MJ" has for many years been instrumental in education, training, and certification for New Hampshire operators and has worked diligently to get worthy NEWEA programs accepted for state continuing education credits. MJ started with the New Hampshire Department of Environmental Services as an inspector in the Wastewater Engineering Compliance group before moving to the Wastewater Operations group where she served as the program manager of the Wastewater Operator Certification program for 15 years. She has also been integral to the vitality of the New Hampshire Wastewater and Drinking Water Management School that was first organized in 2010. Though

The annual Committee Member Appreciation event featured a Pints Against Pollution home brewing competition using water sourced from the nearby Merrimack River. Pictured are the nine brewers with friends and assistants. Entrants were James Callalhan, Patrick Gordon, Ryan Henley, James Hoyt, Patrick Lyons, Ben Stoddard, the team of James Plummer and Drew Youngs, and Paul Uzgirls. Mr. Callahan edged the competition, but every brewer received at least one first place vote, and everyone won!

we are sorry to see her go, we wish her the very best in her retirement.

As you may know, at June's Executive Committee meeting, after a presentation from Innovation Task Force Chair Howard Carter, the officers voted unanimously to merge with the New England Water Innovation Network (NEWIN). We are working on a memorandum of understanding and negotiating the next steps to finalize bringing NEWIN into our organization.

This year marked my first attendance at NEWEA's annual Member Appreciation Event, which for the past several years has been held at Kimball Farm in Westford, Massachusetts. I enjoyed the opportunity to meet a few of our active committee members for the first time, ate some great food and ice cream, and of course stepped forward to vote for my favorite homebrew at the event's Pints Against Pollution homebrewing competition. This year nine home brewers competed, using water sourced from the nearby Merrimack River—and each received at least one first place ranking from the enthusiastic NEWEA tasting crowd.

NEWEA's senior management team has asked Past President and NEBRA Executive Director Janine Burke-Wells to lead a task force to pull together all NEWEA's various workforce-development-related programs (including Water Warriors/Veterans Affairs, university and college outreach, Student Activities Committee recruitment, the NEWEA mentoring program, and our collaboration with the New England Water Works Association). The aim is to develop a comprehensive workforce reliability program for New England (similar to the BayWork program in California). A further addition could be NEWIN's program in Boston to engage inner city students to prepare for careers in water.

A task force will pull together all NEWEA's various workforce-development-related programs. The aim is to develop a comprehensive workforce reliability program for New England.

The task force is discussing focal coordination/collaboration and prioritization of efforts as opposed to any complex attempt at consolidation under one committee. Gary Zrelak, chair of the Utility Management Committee, was selected to attend the WEF/AWWA Transformative Issues Symposium on Workforce held in Washington, D.C., in early August, as his committee is preparing for a specialty conference later in the year on workforce sustainability. We look forward to reaping the benefits of these efforts.

I cannot believe I am over halfway through my year as president and that WEFTEC is already upon us. I am sure that our three New England Operations Challenge winning teams—Rhode Island's Ocean State Alliance, the Franken Foggers from Connecticut, and Force Maine—after practicing hard, will have competed well at the national event in Chicago. I wish all the best of luck and look forward to rooting them on!

From the Editor

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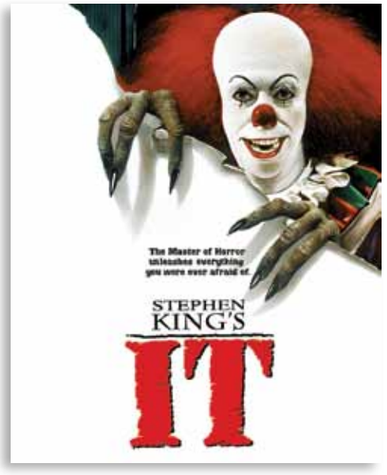
For the majority of the country and in other parts of the world, the discussion of collection systems truly is "out of sight, out of mind." Most of us are only reminded of these complex subterra systems when stepping over a manhole, watching the movie *It,* or—for those of us living in combined collection system communities—smelling rotten eggs after a large rain event. But the reality is that a tremendous amount of a community's resources, energy, and budget is dedicated to maintaining a collection system, and that's all for good reason.

Although New England collection systems are nowhere near as ancient as those first built in Persia, Greece, and Macedonia, they are still pretty stinking (pun intended) old! As New Englanders within the water environment profession, we truly understand the importance of maintaining and investing in our collection systems. From Maine to Connecticut, our earth freezes and thaws, harsh saline groundwater tables wreak havoc on our sewer pipes, and illicit connections in growing communities can inundate undersized systems. Major advancements in materials selection, sewer designs, construction methods, and holistic inspection programs have enabled our collection system professionals to create the most robust and resilient sewer systems that most effectively and safely transport sewage to their respective treatment facilities.



For this edition of the *Journal*, we solicited the help of NEWEA's Collection Systems Committee to identify articles focused on solving some of the most pertinent issues facing New England's collection systems. The first revisits the city of Worcester's 10-year-old fat, oils, and grease (FOG) management program in an attempt to best mitigate the detrimental impacts of excess FOG throughout the collection system (goodbye fatbergs!). Two of the articles present successes and challenges of various private inflow and infiltration (I/I) removal programs implemented throughout several New England communities: one spotlights the city of Revere's aggressive approach toward eliminating extraneous (and costly) flows to the Deer Island Wastewater Treatment Facility. The second private I/I removal article presents various best practices for developing and executing these types of programs. To complete the features, there is an article documenting the conversion of an inverted siphon to a gravity sewer in Framingham, Massachusetts.

The sheer size of NEWEA's Collection Systems Committee demonstrates the importance of the aging collection systems in our area and the work required to keep up with both population and economic booms (hello Boston's seaport). Collegiate environmental and civil engineering programs geared toward our industry seem to focus on wastewater treatment yet fail to stress the importance of collection systems, leaving an increased future vulnerability in the integrity of our systems. For this edition of the *Journal*, I had the opportunity to speak with two Young Professionals based in Lil' Rhody who have chosen a collection system operations career. I hope that their first-hand experiences working in their (surprisingly not so dirty) "dirty" jobs will invigorate the next generation of collection systems operations talent.

I cannot imagine leaving my Boston apartment for work 150 years ago, only to be greeted by my neighbor dumping the nightly contents of his chamber pot directly onto our busy street. Thanks to modern plumbing and the extensive system of force mains, gravity sewers, tunnels, and pump stations beneath our feet and out of sight, we have to tolerate only the occasional outcome of an irresponsible dog owner.

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Wastewater operators, utility and biosolids managers, engineers, researchers, consultants, regulators—it's a sure bet you all will learn something at this conference! Contact training hours will be awarded for operator and engineering re-certification in participating states. Join us for networking opportunities including a reception in the Tap Room at the new MGM Grand Casino. Check out the latest in residuals management, equipment and services—visit the vendor booths during breaks and in between technical sessions. It's a sure bet this conference will be fun and informative, you will see something new.

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NEWEA
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Kayaker on the Mystic River

Annual Report Card Shows Good Water Quality in Main Stem of the Mystic River

EPA, in collaboration with the Mystic River Watershed Association (MyRWA), announced its annual Water Quality Report Card on the Mystic River watershed for 2018. For the fifth year in a row, water quality monitoring data show that water quality in the main stem of the Mystic River, including the Upper and Lower Mystic lakes, is regularly very good and nearly always meets water quality standards, especially in dry weather.

"The Mystic River is a tremendous urban water resource for towns north and west of Boston," said EPA Acting Regional Administrator Deb Szaro. "Protecting the watershed is a priority for EPA. We are thrilled to see that the main stem of the Mystic and the lakes are generally in good shape, but we have work to do in the smaller streams that feed the river."

"The work of local, state, and federal governments and regional advocacy groups continues to have a positive impact on water quality within the Mystic River system," said Massachusetts Department of Environmental Protection (MassDEP) Deputy Commissioner Stephanie Cooper. "We look forward to the day when the river and all of its tributaries feature clean, fresh water that supports a variety of uses."

"I encourage community members to go out and boat on the Mystic and Malden rivers, and swim at Shannon Beach," said MyRWA Executive Director Patrick Herron. "It is a great resource, and we are so happy that it is clean and becoming even more accessible for community members with more public boat launches, canoe/kayak rental facilities, and even more connected paths and parks."

The report card gives grades to 14 segments of the Mystic River watershed, and it shows improvement in some segments in 2018, indicating that work to reduce bacterial contamination may be working.

While no single "overall" grade is generated for the Mystic River watershed, the data show that the main stem of the river is often safe for swimming and boating; however, bacterial levels in many of the tributary streams feeding the Mystic are high, and these areas often do not meet water quality standards. In 2018, some of these problem streams did improve though, especially Island End River in Everett and Chelsea.

Note: All EPA industry news provided by EPA Press Office

Background

The report card issued annually for the Mystic River by EPA is based on the level of bacterial contamination found in samples collected by MyRWA volunteers over the past year at 15 monitoring sites throughout the watershed, as well as data collected at numerous locations by MWRA. The grades are calculated using a three-year rolling average, allowing for a more complete and accurate assessment of recent water quality that addresses weather variability from year to year. For several years EPA, in partnership with MassDEP, has actively enforced sources of bacteria in the Mystic. Through innovative approaches to field testing and laboratory methods, EPA has identified sources of illicit discharges and requires communities to find and fix illegal connections. This work has prevented more than 43,000 gal/d (163,000L/d) of sewage from entering the Mystic River watershed.

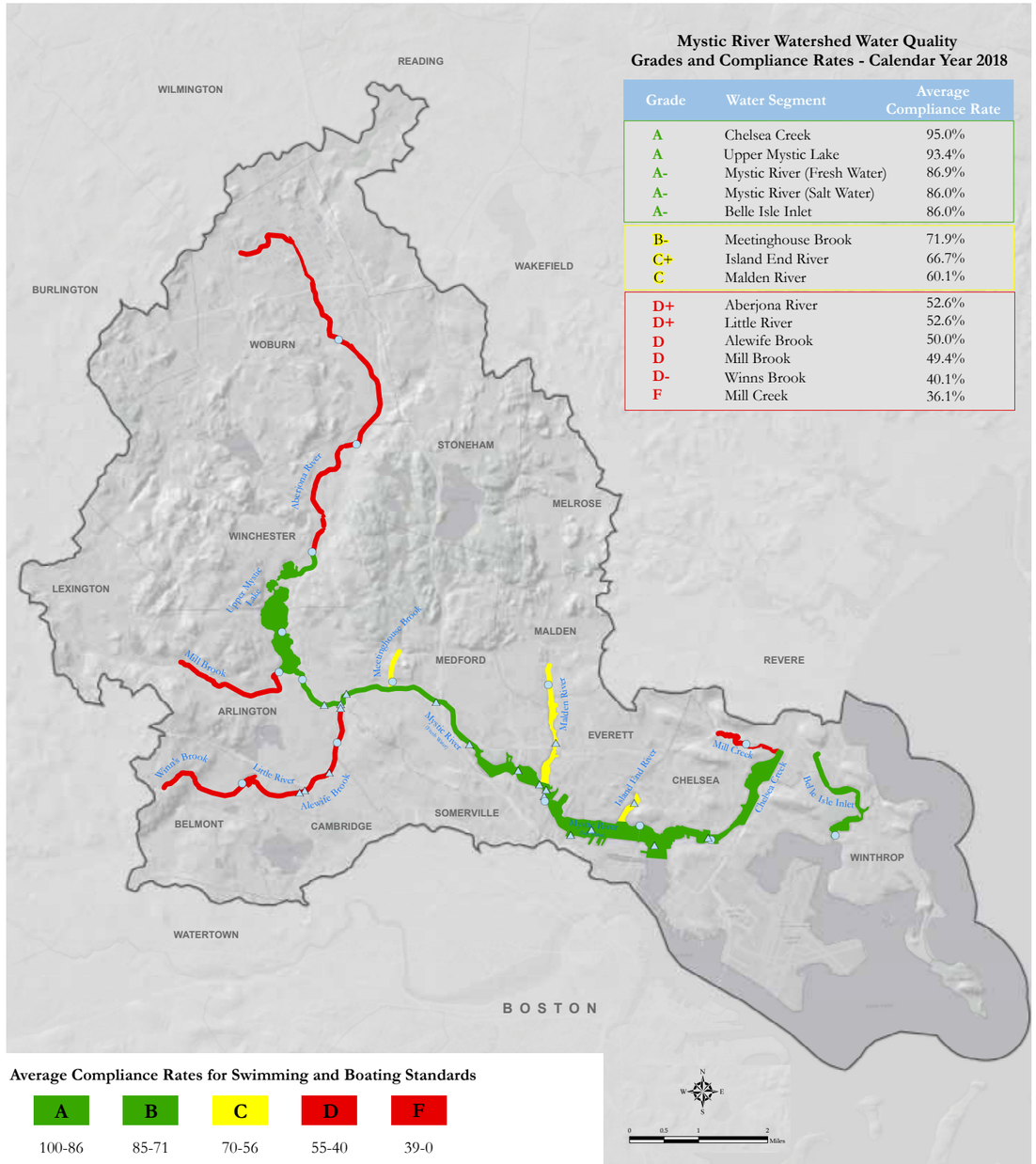
More work is scheduled for these tributaries. Many communities are investigating their discharges and completing repairs to their sanitary and storm sewer systems, which will prevent tens of thousands more gallons of sewage from discharging to the river during rain events.

In addition to bacterial contamination, the Mystic River watershed also suffers from excess nutrients, primarily phosphorus, entering the river from stormwater. EPA, MassDEP, MyRWA, and several other partner agencies are nearing the completion of a two-year study that will help determine how much phosphorus should be removed to meet water quality standards and the most cost-effective means of achieving this removal.

In support, EPA has deployed a water monitoring buoy in front of the Blessing of the Bay Boathouse in the city of Somerville that can measure—in real time—a host of water quality parameters including temperature, dissolved oxygen, pH, turbidity, conductance, and chlorophyll, and helps the agency track cyanobacteria (blue–green algae) blooms. Data from this buoy and from the Mystic River water quality sampling program that led to the grades in this report card can be found at epa.gov/mysticriver.

Mystic River Watershed Water Quality
Grades and Compliance Rates - Calendar Year 2018

Grade	Water Segment	Average Compliance Rate
A	Chelsea Creek	95.0%
A	Upper Mystic Lake	93.4%
A-	Mystic River (Fresh Water)	86.9%
A-	Mystic River (Salt Water)	86.0%
A-	Belle Isle Inlet	86.0%
B-	Meetinghouse Brook	71.9%
C+	Island End River	66.7%
C	Malden River	60.1%
D+	Aberjona River	52.6%
D+	Little River	52.6%
D	Alewife Brook	50.0%
D	Mill Brook	49.4%
D-	Winns Brook	40.1%
F	Mill Creek	36.1%



Average Compliance Rates for Swimming and Boating Standards

A	B	C	D	F
100-86	85-71	70-56	55-40	39-0

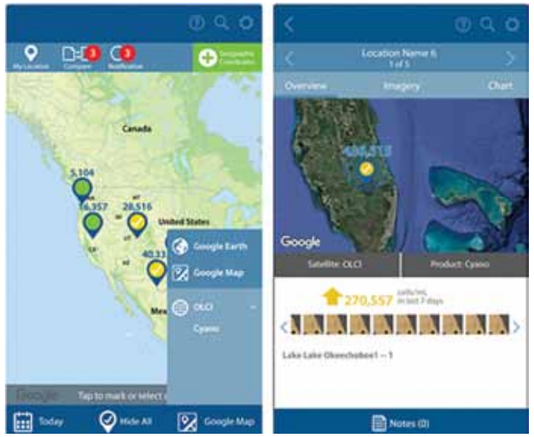
Monitoring Points

- Mystic River Watershed Association
- Massachusetts Water Resources Authority
- Mystic River Watershed
- Town Boundary

Data Sources: Mystic River Watershed Association, U.S. EPA, Massachusetts Water Resources Authority, MassGIS. Basemap: Canvas/World Light Gray Base © ESRI and its data suppliers. EPA Region 1 GIS Center map #12378, 6/18/2019

2018 Mystic River Watershed Report Card
(based on 2016-2018 bacterial data)

EPA Releases CyAN Mobile Application in the Google Play Store



On July 2, 2019, EPA released the Cyanobacteria Assessment Network (CyAN) mobile application (app), a tool that uses satellite data to alert users that a harmful algal bloom could be forming based on specific changes in the color of the water in more than 2,000 of the largest lakes and reservoirs across the United States.

"This mobile app is an important tool going into the summer months to help states and local communities track and manage harmful algal blooms," said EPA Principal Deputy Assistant Administrator for Science for the Office of Research and Development and EPA Science Advisor Jennifer Orme-Zavaleta. "The most effective way of protecting people, pets, and livestock from the impacts of harmful algal blooms is knowing ahead of time to avoid water containing cyanobacteria. EPA is focused on providing communities with tools like this that can make water quality monitoring easier and more efficient."

Cyanobacteria occur naturally in many bodies of water across the country. In small numbers, these algae are not a problem. But when cyanobacteria multiply, they can form potentially toxic, harmful algal blooms.

In partnership with the National Aeronautics Space Administration, the National Oceanic and Atmospheric Administration, and the U.S. Geological Survey, EPA has been developing this early warning system using historical and current satellite data to help lake managers, water quality managers, and people swimming, fishing, or boating in lakes to more quickly identify a bloom forming and avoid potential health impacts to people, pets, livestock, or the environment.

Satellite data, though having been available for years, have not typically been used in decision-making because of the complicated data formats and the time to process and access the data.

EPA's CyAN app enables users to easily assess satellite-derived cyanobacteria biomass concentrations occurring over larger lakes and reservoirs. This app reduces the need for scientific expertise in satellite data processing, analysis, and interpretation, and eliminates barriers to computer hardware requirements associated with satellite data files. In this easy-to-use, customizable interface, users can rapidly distill critical water quality information for their communities. The CyAN App is available for download in the Google Play store for Android devices.

Charles River Water Quality Earns a "B" for Bacterial Sampling Conducted in 2018

EPA has given the Charles River a grade of "B" for bacterial water quality in the river during 2018.

"The Charles River has been in the 'B' or better range for bacterial sampling for the last 18 years," said EPA's Ms. Szaro. "The Charles has seen big improvements in water quality thanks to a strong local partnership working hard to clean up the river, but there is more work to be done to see even more improvements in the future, and we are committed to that effort."

The EPA grade for water quality in the lower Charles River is based on bacterial sampling by the Charles River Watershed Association (CRWA) throughout 2018. CRWA collects monthly water quality samples at 10 monitoring sites from the Watertown Dam to Boston Harbor. In 2018 during dry weather, 94 percent of the Charles River samples met the state's bacterial water quality standards for boating, and 66 percent of the samples met the state's criteria for swimming. In wet weather, the percentage dropped slightly for boating to 91 percent and more significantly for swimming to 47 percent; it is primarily this low wet-weather swimming percentage that drove the grade down this year.

While the grade dipped this year, the river's overall water quality has improved significantly since the first report card in 1995, when the river was scored at a "D," and only met boating standards 39 percent of the time and swimming standards 19 percent of the time.

The water quality improvements are due to significant reductions in combined sewer overflow (CSO) discharges to the river over the past 24 years, as well as enforcement of water quality standards and removal of illicit discharges. Illicit discharges are the result of cracked and leaking sewer pipes or improper sewer connections to the storm drain system.

While bacteria levels in the Charles have declined over time, algae blooms have become a major problem in the river. These blooms—some of which include toxic cyanobacteria—are driven by excessive phosphorus in stormwater runoff. An updated Municipal Separate Storm Sewer System (MS4) permit for Massachusetts will encourage further progress to reduce harmful amounts of phosphorus. The new MS4 permit will build upon past work and update stormwater management across Massachusetts, better protecting rivers, streams, ponds, lakes, and wetlands across the commonwealth.

"The commonwealth is pleased to join all of the partners in celebrating these critical water quality improvements to the Lower Charles River," said MassDEP Commissioner Martin Suuberg. "We continue to support the important work that municipalities and stakeholders do as environmental stewards in this historic and vital watershed."

"For years, the Charles River has received consistently high grades for its water quality, enabling residents and visitors with an excellent opportunity to enjoy this incredible natural resource located in the heart of the greater Boston area," said Massachusetts Department of Conservation and Recreation Commissioner Leo Roy. "The commonwealth continues to foster strong working relationships with local and federal stakeholders, like the CRWA and EPA, to achieve mutual goals that directly benefit the public."

"The 'B' grade is a reminder that while the Charles is much cleaner than it was when the first grade was given—a 'D' in 1995—our work is far from over," said CRWA Executive Director Emily Norton. "Today the biggest challenges facing the river are stormwater runoff and extreme weather from climate change. We are pleased to be working with the municipal leaders in our watershed to implement nature-based solutions that reduce stormwater pollution while also building climate resilience as we experience more storms, more rains, more frequent drought, and more extreme heat."

"It is clear from the data that the Charles, like Boston Harbor, has become a great recreational asset for all to enjoy," said MWRA's Mr. Laskey. "We are pleased that the investments made by MWRA's ratepayers continue to pay dividends."

The grade for 2018 was measured by taking samples during both wet and dry conditions. During wet weather conditions, higher bacterial concentrations and poorer water quality due to sewer overflows and polluted stormwater runoff are more likely.

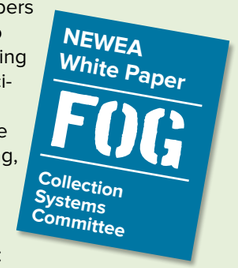
The year saw a continuation of the expanding use of the Charles River, with the Charles River Swim and continued advocacy for a permanent swimming area near the entrance to the Charles at North Point Park. Last July, nearly 300 swimmers took part in "City Swim" off the Esplanade docks.

As collaborative efforts among EPA, state and local government, private organizations, and environmental advocates continue, the goal of a consistently healthy river becomes closer to an everyday reality. For the fifth year, EPA launched a water quality monitoring buoy in front of the Museum of Science in the Charles River Lower Basin. This buoy measures water quality in near real time. The data are being streamed live on EPA's Charles River website as well as to a Charles River exhibit in the Museum of Science.

Citizens have been the driving force behind the Charles River Initiative, and they can continue to help improve water quality in the river while monitoring progress themselves.

NEWEA Collection Systems Committee Creates White Paper Summary

As one of the first activities for NEWEA's Collection System Committee (CSC) new leadership in 2017, a brainstorming session was hosted in March of that year with all committee members invited to identify key industry topics to focus on during the ensuing years. During the session, a group of members participated at the NEWEA offices in Woburn while others participated by conference call. After several hours of brainstorming, and after comparing the relative importance of more than 25 topics, the participants decided two topics merited focus for at least the next year: fats, oils, and grease (FOG), and private inflow.



The goals of the participants for these topics were as follows:

- The topics would be considered "hot topics" for the committee
- The topics would form at least a part of the focus for the CSC specialty conference scheduled for September 2018
- Abstracts/presentations on these topics would receive priority consideration for the Annual Conference program
- Two subcommittees would be formed, each developing and writing a "white paper" for one of the topics

All these goals were achieved. The most challenging was writing the white papers; these are now also complete. The following describes the general intent and content of the white papers that were written:

- Assessment of the magnitude of the issue across the NEWEA region
- Assessment of regulatory requirements associated with the issue across the NEWEA region and best practices from outside the region where available
- Investigation and identification of collection system owners across New England who had standard approaches, lessons learned, and best practices associated with these issues
- Identification of challenges with identification/mitigation, including the following: legal issues, political issues, technical challenges, cost challenges
- Identification and recording of best practices being implemented across the region and potentially in other regions
- Deliverables: two white papers that collate and present the information collected and analyzed so that stakeholders can clearly understand the private inflow and FOG issues

The white papers include safety and consider useful information to be posted to the committee website.

Each subcommittee was led by a chair and vice-chair, supported by a group of volunteers from CSC. The CSC chair and vice-chair were to be *de facto* members of the subcommittee, providing necessary oversight and guidance.

Many thanks to Peter Garvey, Charles Gore, Kara Keleher, Scott Lander, Frank Occhipinti, Shawn Syde, and all participants in planning and completing these white papers.

The white papers are available at the following links: (FOG) https://bit.ly/2IFNeLO and (private inflow) https://bit.ly/2IWBIB1.

Workforce Sustainability

Thursday, November 14 • Marriott Hartford Cromwell, Connecticut

2019 SPECIALTY CONFERENCE & WORKSHOP SERIES

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Workforce Sustainability is an important and current topic in the clean water industry for maintaining a consistent level of service to our customers. The clean water industry is responsible for delivering a vital service that protects human health and ensures a healthy environment. With unemployment low and the baby boomers retiring, maintaining a workforce requires strategic planning to avoid shortfalls in the future. The conference will start with a discussion on opportunities for introducing workers to the industry. We need to get them to better understand clean water work from all levels including high school to young professionals.

In the afternoon we will discuss programs and changes to build workforce sustainability and then discuss training and the future needs of the new workforce. Specifically, the conference will discuss opportunities for youth to experience the clean water industry as a career field. We will discuss creating a diverse workforce, providing career ladders for employees and filling the knowledge gap created by retirements in the first part of the program. Later in the program we will look at planning for changes to your workforce and keeping new employees involved. Training practices, and training needs for the next generation of employees are all going to be part of the agenda. This conference will highlight some of the ways that are being used to mitigate the “gray tsunami” that is affecting the clean water industry.

Who should attend: Executive Directors, General Managers, Plant Managers, Superintendents, Human Resource staff, Education Administrators, Regulators.

NEWEA
WORKING FOR WATER QUALITY

Trimming the fat—over a decade of handling grease in Worcester's sewer system

FRANK OCCHIPINTI, PE, Weston & Sampson, Worcester, Massachusetts
MATTHEW HOUGHTON, EIT, Weston & Sampson, Worcester, Massachusetts

ABSTRACT | In 2005, the city of Worcester aggressively began to update its grease regulations and implement a fat, oils, and grease (FOG) management program. Approximately 900 food service establishments (FSEs) were inventoried and inspected during the program, and the FOG ordinance in the city was revised for all FSEs. During the program, 53 percent of the grease traps/interceptors inspected were undersized, and 66 percent of the FSEs required additional traps/interceptors. Ten years after the program's implementation, grease-related blockages and maintenance issues increased in the city. As a result, Worcester implemented a second round of city-wide inspections in 2017. This article discusses the results of the city's FOG management program and explores the limitations of grease management systems, the consequences of improper grease management programs, and the benefits of implementing FOG regulations to protect wastewater collection systems.

KEYWORDS | Fats, oils, and grease (FOG), sanitary sewer overflows (SSOs), grease traps/interceptors, public outreach and education, sewer system preventative maintenance, city ordinances and regulations, inter-department collaboration, asset management.

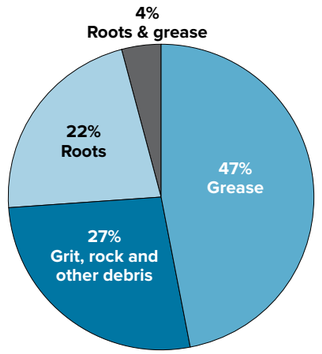
A dried section of a "fatberg" removed from the sewers of London

INTRODUCTION

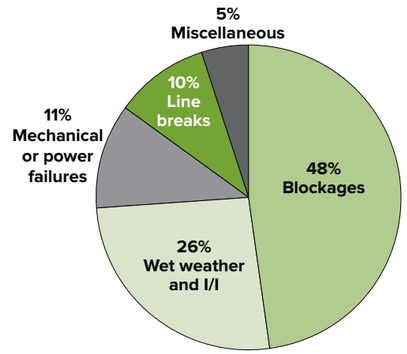
In 2017, the city of London made headlines when it encountered a 130-ton (118-tonne) blockage under the city. The blockage, known as a "fatberg," is a large mass of fats, oils, and grease (FOG) that builds up in sewer systems after FOG is introduced into the system from residential and commercial cooking. The fatberg in London was expected to take weeks to remove and was approximately the weight of a blue whale. The city reported spending an estimated $1.3 million a month removing FOG-related blockages from its sewer system.

WORCESTER'S NEED FOR FOG MANAGEMENT

London is only one example of the many municipalities that encounter FOG in their wastewater collection systems. In Massachusetts, the city of Worcester has encountered operation and maintenance issues in its wastewater collection system from FOG buildup. The city has more than 900 food service establishments (FSEs), many of which produce FOG. Numerous "FOG hotspots" throughout the city require frequent maintenance to reduce grease buildup. Since 1999, approximately 29 percent of Worcester's sanitary sewer overflows (SSOs) have been attributed to FOG buildup.

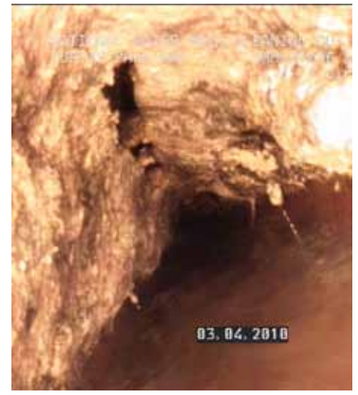


Causes of blockage events



Causes of SSO events

EPA estimates approximately 48 percent of SSOs are caused by blockages, and 47 percent of blockages are the result of grease build-up*



Grease buildup recorded during CCTV inspections in Webster Square

WHAT IS FOG?

FOG is produced as a byproduct of cooking. When FOG is disposed of directly into a wastewater collection system, it causes capacity reduction, blockages, and potentially SSOs in homes, restaurants, and municipal streets. In a report to Congress in 2004, EPA reported that grease buildup caused 47 percent of sewer blockages, which in turn caused 48 percent of SSOs (EPA, 2004). As a result, grease blockages account for nearly 23 percent of SSOs. SSOs caused from grease blockages may expose the public to harmful pathogens, damage the environment, and require costly remediation.

FOG MANAGEMENT TECHNOLOGIES

A variety of FOG management equipment has been used to reduce FOG entering wastewater collection systems. Two major technologies used in FOG-producing locations are grease traps and grease interceptors. According to the Massachusetts Uniform State Plumbing Code (248 CMR 10.00), interceptors use passive or automatic means to separate grease and other material from wastewater prior to discharge to the sewer system. Grease traps described in 248 CMR 10.00 are interceptors typically rated for flows under 50 gpm (3.15 L/s), while grease interceptors are typically rated for flows exceeding 50 gpm (3.15 L/s).

A passive interceptor is constructed with an inlet pipe, at least one baffle, and an outlet pipe. Passive interceptors use gravity to remove FOG and solids from wastewater. As wastewater enters the interceptor through the inlet pipe, a reduction in flow rate causes suspended solids to settle and grease to float. After the separation of the grease and solids, wastewater exits the trap. Automatic interceptors function similarly to passive interceptors but use mechanical equipment to remove grease from wastewater.

Grease traps/interceptors must be regularly cleaned to function properly. When the level of solids and grease exceeds 25 percent of the total water level, grease traps/interceptors stop functioning at full capacity and begin to introduce FOG into the wastewater collection system.

INTRODUCTION OF WORCESTER'S FOG PROGRAM

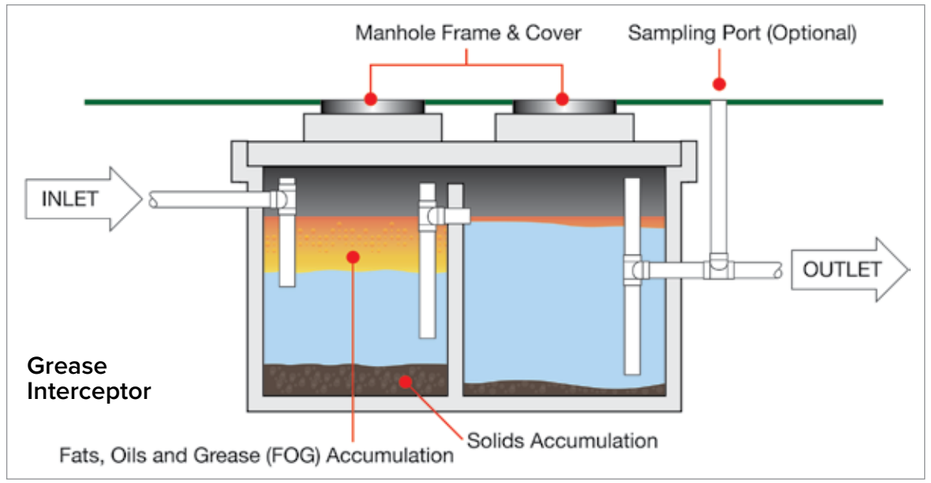
In 2005, Worcester received an administrative order (AO) from EPA. As part of the AO, the city was required to implement a FOG program to better control the discharge of FOG into the city's wastewater collection system. Among other tasks, the FOG program had to include the following:

- Requirements for the installation of FOG equipment at food service establishments
- Provisions for periodic grease trap/interceptor inspections by city personnel
- Modifications to the city's Sewer Use Ordinance to enforce regulations created under the FOG program
- Enforcement procedures for facilities found violating the city's FOG program
- Educational outreach for FOG facilities

Worcester implemented its FOG program in 2005, beginning with the revision of the city's Sewer Use Ordinance. Although the existing regulations prohibited the disposal of waste containing FOG and required the installation of grease traps, the regulations did not have a protocol to track or enforce compliance with FOG requirements.

In the updates to the Sewer Use Ordinance, Worcester adopted sizing requirements for grease traps/interceptors from the Plumbing and Drainage Institute Standard PDI-G101. In addition, the city adopted grease control requirements specified in 248 CMR 10.00 and the State Environmental Code, Title V (310 CMR 15.230), which include facility amenities required to discharge into grease traps

*Source: EPA Report to Congress: *Impacts and Control of CSOs and SSOs*. Washington, D.C.: GPO, 2004. Web. 2019.



(sinks exceeding 10 in. [25.4 cm] in depth, two- and three-bay sinks, dishwashers, work stations, etc.) and facilities requiring grease control (restaurants, cafeterias, hospitals, commercial kitchens, etc.). The Sewer Use Ordinance updates also included requirements for FSEs to maintain grease maintenance logs and regular cleaning schedules and allowed for city inspection of facilities to determine compliance with the Sewer Use Ordinance and FOG program. Under the updated ordinance, grease traps in the city must be inspected weekly and cleaned every month (every three months for grease interceptors), or when grease and solids in the trap exceed 25 percent of the total water height.

Another addition to the Sewer Use Ordinance was the requirement for all new FSEs to install grease interceptors. The interceptors are required under the ordinance to conform to 310 CMR 15.230 and have a minimum depth of 4 ft (1.22 m) and a minimum capacity of 1,000 gal (3,875 L). New FSEs that lack the required space to install a grease interceptor (particularly downtown) have been granted a variance and are often required to install indoor grease interceptors rated for flows up to 250 gpm (15.77 L/s).

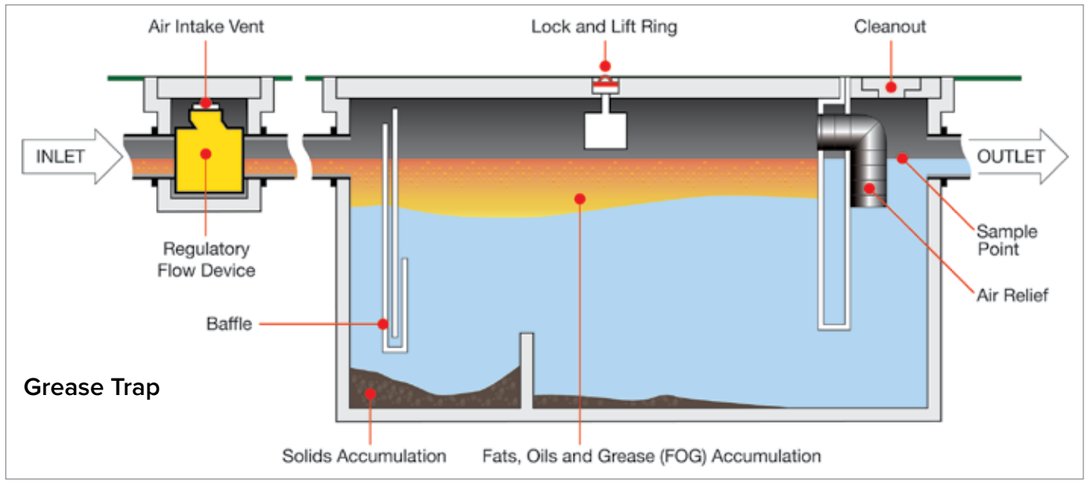
INSPECTIONS AND DATABASE DEVELOPMENT

The FOG program aimed to establish a baseline of the equipment and amenities present in FSEs across the city and to develop a FOG database to track facility information. Worcester's database can record facility information, amenities, and grease trap sizing requirements in accordance with PDI-G101, and document violations of the city's Sewer Use Ordinance. The database can also link with the city's water use and assessor's data. Using the database, the city can trace grease backups using GIS mapping to identify potential grease contributors.

After the development of the database, FSEs were inspected in cooperation with the city's Department of Public Works & Parks (DPW&P) and the Department of Public Health (DPH). Inspection crews had a grease trap measuring apparatus, tools to open grease traps/interceptors, and sink/grease trap signage. Each inspection included an inventory of all FOG-producing amenities, dimensions of all sinks, dimensions and locations of all grease traps/interceptors, and the amount of grease and solids present in each grease trap/interceptor. Results were documented in the city's FOG database to record


Outdoor grease interceptors are required under Massachusetts Title V regulations to have at least two access manholes


Indoor passive and automatic grease traps are typically installed near attached kitchen amenities



violations and eventually incorporated into the city's GIS database.

Public outreach was critical to the inspection process. For each inspection, FSE owners/managers were given mandatory signs for sinks and grease traps that informed employees to avoid disposing FOG into amenities connected to the sewer system. In addition, each FSE was supplied with a grease trap maintenance log, FOG information packets, and written instructions for proper grease trap maintenance.

2005 INSPECTION RESULTS

Under the FOG program, approximately 900 FSEs (with more than 800 grease traps/interceptors) were inspected. The results indicated that a significant number of FSEs were non-compliant with the newly implemented FOG program, and many of those were not even in compliance with the latest version of the Uniform State Plumbing Code. Approximately 53 percent of the grease traps inspected were undersized, and 66 percent of the FSEs required additional grease traps. Fifty-eight percent of grease traps (48 percent of grease interceptors) violated the cleaning requirements specified in the Sewer Use Ordinance.

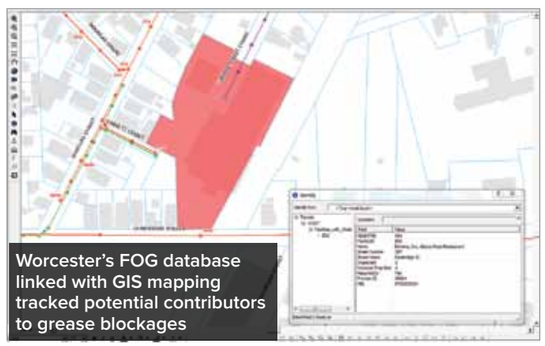
Following the first round of inspections, noncompliance with the Sewer Use Ordinance decreased significantly. Between 2005 and 2016, only 10 percent of FSEs required additional grease traps, and only 11 percent of grease traps were recorded as undersized.

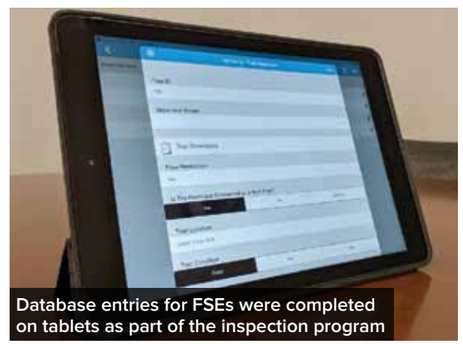
2017 FOG PROGRAM INSPECTIONS

Although the initial program was successful, Worcester recently began seeing an increased number of grease-related blockages. As a result DPW&P and DPH collaborated on a second round of city-wide inspections. Between August 2017 and October 2018, more than 900 facilities were inspected across the city. Inspections were recorded in the city's new asset management software to generate work orders between the two city departments for issuing notices of violation to FSEs. Public outreach was again critical to the inspection program, with each FSE given updated signage and education packets.

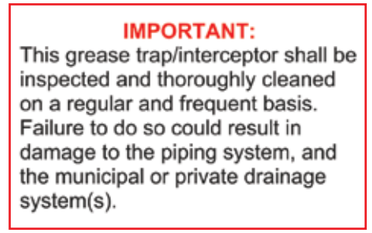
SECOND-ROUND INSPECTION RESULTS

The city's second round of inspections yielded surprising results. Although the number of missing traps was significantly lower than the first round


Worcester's FOG database linked with GIS mapping tracked potential contributors to grease blockages


Database entries for FSEs were completed on tablets as part of the inspection program

2017 Sink Sticker—the original sink sticker from the 2005 inspections was updated to include a visual



FSE owners/managers were provided updated grease trap signs—required under 248 CMR 10.00

of inspections (5 percent compared to 66 percent in the first round), the number of cleaning violations remained about the same (52 percent compared to 58 percent in the first round). In addition, 66 percent of FSEs were missing grease trap maintenance logs required under the city's Sewer Use Ordinance. Restaurant turnover throughout the city resulted in many FSEs being unfamiliar with the regulations in the Sewer Use Ordinance, and managers/owners often reported to inspectors that they were unaware of the required grease trap cleaning frequency. In addition, some FSEs were unaware of the presence of grease traps in their facilities and thus never had their grease traps/interceptors cleaned.

PROGRAM OBSERVATIONS

After almost 15 years, the Worcester FOG program has resulted in an extensive database of FSEs and FOG management equipment across the city. Many FSEs installed FOG management equipment to replace that identified as missing/undersized during the first round of inspections, while other FSEs failed to properly maintain their equipment. Although the number of missing and undersized traps decreased, FSEs still violated the required cleaning frequency. This issue highlights that even with comprehensive FOG management regulations, FSEs may often remain non-compliant with the regulations and continue to introduce FOG into the wastewater collection system.

WORCESTER'S PLAN FOR FUTURE FOG REMEDIATION

Worcester's FOG program addresses only commercial facilities and does not address the introduction of FOG into the collection system by residential homes and apartments. As a result, residential areas in the city do not directly benefit from the FOG program. Worcester has recently initiated public outreach programs to reduce residential FOG discharges into the wastewater collection system. The city provides residences with informative brochures in both English and Spanish to educate the public regarding proper grease disposal. In 2018, the city began providing the public with reusable grease can lids to store leftover cooking grease. In addition, Worcester recently began accepting and recycling cooking oil at its newly opened residential drop-off center as part of its residential FOG recycling program.

The grease program is limited to controlling discharges of tangible grease into the sewer system, but city sewers are also subject to countless less-measurable sources of grease. The city is considering other methods to mitigate grease accumulation in the system. To reduce grease buildup at FOG hotspots throughout the city (including pump stations), the city is implementing a chemical feed FOG treatment pilot program using a patented biodegradable digestive compound to break down grease buildups.

The second round of inspections found many FSEs in compliance with FOG requirements (left) and others violating the required cleaning frequency (right)

An open pit filled with grease found during one of the inspections

Grease trap not properly maintained between the two inspection periods

Walk-in freezer built over the floor unit grease trap, preventing maintenance

Clean grease trap with proper sizing and venting

CONCLUSION

Disposal of FOG in a municipality's wastewater collection system results in increased grease buildup, ultimately creating blockages, reducing system capacity, and possibly leading to SSOs. Municipalities, including Worcester, have approached the issue of FOG by implementing comprehensive FOG regulations in their Sewer Use Ordinances and, in some cases, developing inspection programs for FSEs with grease traps/interceptors. However, public outreach is vital to educate both FSE owners and residents about proper grease disposal and maintenance.

ACKNOWLEDGMENTS

Thank you to the Worcester Department of Public Works & Parks, the Worcester Department of Public Health, Paul Denaro (Protein Matrix), and Kara Keleher and Kin Wong (Weston & Sampson) for their cooperation and coordination throughout the project.

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- Matthew Houghton, EIT, is an engineer at Weston & Sampson. His experience includes planning and design of infrastructure projects including infiltration/inflow analyses, CSO mitigation, sewer rehabilitation, and sewer separation. He conducted more than 600 grease trap/interceptor inspections as part of the Worcester FOG program.

Worcester is providing residences with FOG brochures and reusable grease can lids in both English and Spanish

Private inflow and infiltration reduction in New England towns

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BRODY CAMPBELL, EI, Wright-Pierce, Topsham, Maine

ABSTRACT | Sources of inflow and infiltration (I/I) from private sources, such as floor drains, roof drains, and sump pumps, can contribute significantly to overall wet weather flow rates in municipal wastewater collection systems. Given the right circumstances, private I/I removal can be successfully implemented and can remove significant extraneous flows. Issues that must be addressed in removing private sources of I/I include access to and easements across private property, determining who pays for removal, and enforcement after work is completed. This article will discuss case studies of private I/I removal projects implemented in Cape Elizabeth, Maine; Berlin, New Hampshire; Baileyville, Maine; and Exeter, New Hampshire.

KEYWORDS | I/I, combined sewer overflows (CSOs), private sources, illicit connections, flow reduction, sump pumps

Figure 1. Conducting home inspections is key to identifying private I/I sources

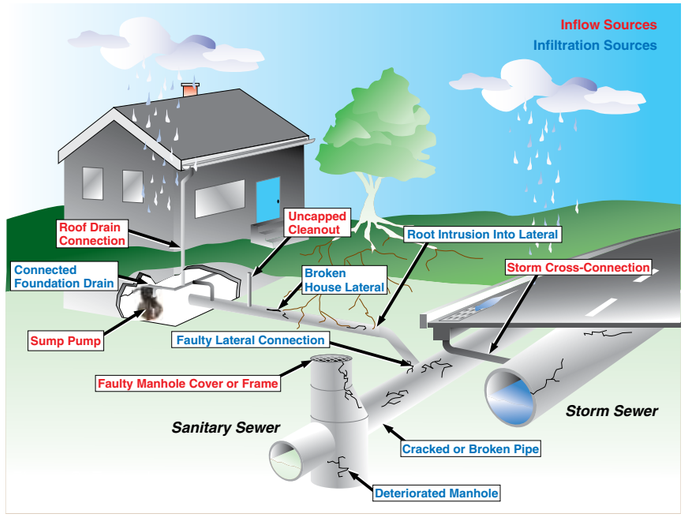
INTRODUCTION

Inflow and infiltration (I/I) bring unnecessary runoff and groundwater into sewer systems resulting in combined sewer overflows (CSOs), higher transport and treatment costs, and in some cases sanitary sewer overflows (SSOs). Some typical drivers for I/I removal include reduction of SSO and/or CSO volumes, reduction of wastewater transport and treatment costs, additional capacity within transport and treatment systems to handle peak flows, and assistance to facilities for meeting 85 percent removal during periods of high flows when influent biochemical oxygen demand (BOD5) and total suspended solids (TSS) are low. While most communities that target I/I removal initially focus on sources within the public right of ways, removing I/I sources from private property can significantly reduce wet weather flow rates in the public system.

INVESTIGATIONS AND INSPECTIONS

I/I removal projects are typically scoped after significant initial investigations, which usually include flow monitoring, smoke testing, and camera inspection of manholes and pipelines. However, these investigations can often indicate that replacing the sewer mainline or sewer manholes will have minimal impact on reducing I/I flow. In fact, mainline replacement can increase I/I if the leaky mainline sewer was acting as an underdrain and flows from private sources are retained in the new pipe rather than exfiltrating to the ground. Further, once replaced or relined, sewer pipes which in the past have acted to depress the groundwater table may allow groundwater levels to rise and leak into the laterals serving each home or business. So, while there are certainly many benefits beyond I/I removal to replacing public sewer pipes and manholes, reducing private sources, especially direct inflow sources, can greatly reduce I/I volumes and peaking factors.

In methods similar to mainline pipe camera inspection, sewer laterals can be closed circuit television (CCTV) inspected with smaller push cameras launched from the mainline crawler camera to avoid the need to enter a home and use a push camera from the individual private cleanout. Realistically, the only reliable way to identify private sources of inflow and potential removal options is to conduct a home inspection (see Figure 1). Home inspections can identify sources of I/I unknown even to the owner. Furthermore, discussions with the property owner can reveal how frequently a possible interconnection is active during wet weather, as the cost for removal may be weighed against the contribution of the inflow source. If the source is not obvious, such as a foundation drain, driveway drain, or roof leader discharging into a riser pipe, dye testing is sometimes completed during a home inspection to determine if there is interconnectivity to the public sewer system. As can be expected, many homeowners are concerned and suspicious about allowing representatives of the community or district into their homes, partly because no one wants to admit they may be in violation of an ordinance or pay for fixing it. However, most homeowners are more than willing to allow home inspections when they are told that any direct connections into sewer laterals downstream of traps mean their basement is directly connected to the sewer, allowing gases and sewer backups a pathway into to their homes. Public outreach about the importance of reducing extraneous flows to prevent the discharge of untreated wastewater to our waterbodies can also build support for the program.



TYPES OF ILLICIT CONNECTIONS

Typically, private sources of inflow include sump pumps, roof drains/leaders, floor/driveway drains, and foundation drains. Private sources of infiltration can also include leaking joints and faulty service connections. Figure 2 illustrates examples of I/I sources. Public sources of I/I include storm sewer cross-connections, faulty manhole covers or frames, and cracked or broken pipes.

FLOWS PER TYPE OF PRIVATE I/I CONNECTION

Volumes of private I/I vary depending upon many factors, including impervious area of the roof or driveway, age of sewer lateral, depth to groundwater, and effectiveness of the foundation drain system (how much is being captured vs. staying in the ground). Massachusetts Department of Environmental Protection has developed estimates of private inflow rates in its document "Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation Surveys," May 2017. These estimates are based on a 1-year, 6-hour design storm with a total rainfall of 1.72 in. (4.37 cm), as shown in Figure 3. Flow was calculated using the rational formula (from page 39 of the above-noted guidelines), and an average rainfall intensity of 0.29 in./h (0.74 cm/h) design storm.

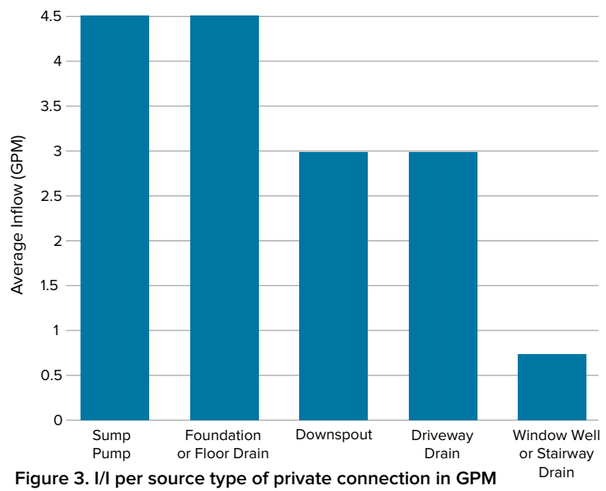


Figure 3. I/I per source type of private connection in GPM

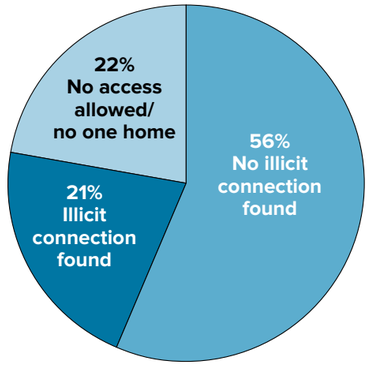


Figure 4. Preliminary home inspection results for Cape Elizabeth, Maine (188 Homes slated for inspection—78 percent allowed access)

Sump pumps and foundation/floor drains can contribute the highest amount of I/I into the sewer system. However, individual sources may be assigned different rates based on site conditions and best engineering judgement. These data show how removing just a few of these private I/I sources can significantly lower peak flows in the collection system.

REMOVAL OF PRIVATE I/I IN CAPE ELIZABETH, MAINE

Cape Elizabeth is a coastal community in southern Maine. Wastewater from the northern part of the town and a small area of neighboring South Portland causes CSOs at a pump station owned by the Portland Water District. A unique three-party permit was required for this CSO, which was originally installed as an emergency bypass. As part of the licensing of this CSO, Maine Department of Environmental Protection (MEDEP) required a CSO Master Plan (long-term control plan) to identify options to reduce or eliminate the CSO. The collection system evaluation resulted in no "smoking guns" or simple solutions for the overflows. Minor issues were found with the public infrastructure, but extensive sewer system evaluation surveys on the public infrastructure led to the recommendation to conduct home inspections as the first step in implementing the CSO Master Plan.

Figure 4 shows the number of homes inspected, success rate with gaining access, and percentage of illicit connections found. Illicit connections included 20 sump pumps, 22 floor drains, three yard drains, and five roof leaders. Some homes contained more than one illicit connection.

Following the home inspections, the removal project was broken down into three phases. Phases 1 and 2 were completed in 2015 and 2016, respectively, and improved the public infrastructure needed to allow private inflow removal, (addition/extension of stormwater lines). Phase 3, which was completed in 2018, separated the private inflow sources from the sewer and connected them to the stormwater drain.

Because the town wanted to remove as many illicit connections as possible, during the preliminary design of Phase 3, the engineer gained access to 36 of the remaining 42 homes not originally accessed during the home inspection prior to Phase 1. Four of those homes had illicit connections, raising the total number of homes with illicit connections to 44, or 24 percent of the homes in the service area.

As noted above, public infrastructure work was required to accommodate the redirection of floor drains, sump pumps, and other I/I sources. Cape Elizabeth conducted public infrastructure projects in 2015 and 2016 to install new storm drain lines, solve drainage issues, and upsize pipes. Additionally, a major cross-connection between the stormwater drain and sewer was discovered and corrected as part of the work in public right of ways.

Funding for the private part of the project considered several options. The town opted to fund the project to separate connections at these 44 homes by spreading the cost across the sewer user base. It decided to implement temporary public access easements for private properties and to hire a general contractor to complete all the separations under one contract. By funding the project out of sewer user rates and hiring a general contractor to complete the work, the town expeditiously removed 44 illicit connections, a process that otherwise could have taken years and potentially high legal costs to resolve.

Currently no flow rate results exist to share, but the results are expected to be significant with the separation of 44 illicit connections.

REMOVAL OF PRIVATE I/I IN BERLIN, NEW HAMPSHIRE

Located north of Mt. Washington and on the shores of the Androscoggin River, Berlin is a former mill town that was densely developed with clay pipe laid on bedrock to provide sewer service. The wastewater treatment facility (WWTF) treats on average 2 mgd (7.6 ML/d), has peak flows of 11.5 mgd (43.5 ML/d), and occasionally has CSOs when flows exceed 11.5 mgd (43.5 ML/d). To make way for new sewer flows from a medium-security federal prison, the New Hampshire Department of Environmental Services required the removal of I/I to offset this increase in sewered flow. The Federal Bureau of Prisons contributed funds toward the I/I removal work. This policy resulted in a city ordinance that required users generating more than 50,000 gpd (189,000 L/d) to fund I/I removal projects to target flow removals similar to the flow added by the development.

Figure 5. Sump pump discharging fresh water to sanitary sewer

Figure 6. Service cleanouts at floor level act as floor drains

An initial investigation in 2007 that included flow monitoring and smoke testing preceded additional investigations in 2010 and 2012. In 2010 and 2012 sewer, manhole, and home inspections were conducted. These inspections set the stage for three separate projects. These projects included sewer relining, manhole replacements and repair, new mainline sewer, storm drain work, and private I/I removal. One unusual approach to these projects was to reuse old laterals and sewer pipe as private inflow storm drain while installing new laterals and a new parallel sewer main to remove sanitary wastewater.

Overall, 50 percent of homes had illicit connections. This shows the importance of private I/I removal for this community. Some homes even had multiple sources of private I/I. Figure 5 shows a sump pump discharging fresh water into the sanitary sewer.

Funding for the work on public property used the balance from a prior U.S. Department of Agriculture (USDA) Rural Development loan and grant combination. Work on private property, which was not eligible under this USDA Rural Development loan and grant combination, was funded by the Federal Bureau of Prisons. The city viewed the private work of removing illicit discharges to be the most technically and economically feasible solution to reducing flows.

Phases 2 and 3 included manhole repairs, repaving of streets, and a cross-country sewer replacement in addition to the cost to remove illicit connections. The total project costs as related to per-connection removal costs are discussed later in this paper. With this project, a 2 to 6 gpm (8 to 23 L/m) reduction per private inflow source removed was expected with 100 to 200 gpm (380 to 760 L/m) of inflow removed in three small drainage areas.

REMOVAL OF PRIVATE I/I IN BAILEYVILLE, MAINE

Baileyville, Maine, is a rural, Downeast mill town. The WWTF treats on average 0.3 mgd (1.1 ML/d) and has peak flows of greater than 3 mgd (11 ML/d). The WWTF is rated for a peak flow of only 2.7 mgd (10.2 ML/d). Violations of BOD5 and TSS occurred between 1998 and 2003 because of insufficient clarifier capacity. The town evaluated expanding the treatment capacity or installing a holding tank in 2004, but MEDEP suggested I/I mitigation first.

Private basement, home, and property inspections identified sources of private I/I. Two hundred eighty-four properties were inspected with 90 properties (32 percent) containing illicit connections. The basements tended to be wet, and some properties had more than once source of inflow (e.g., a sump pump and perimeter drain). More than 30 sump pumps were identified during the inspections. Other common illicit connections included floor drains and uncapped service cleanouts acting as gravity drains (see Figure 6).

Two project phases were completed to remove the illicit connections. One hundred eighteen sources were removed from the sanitary sewer system

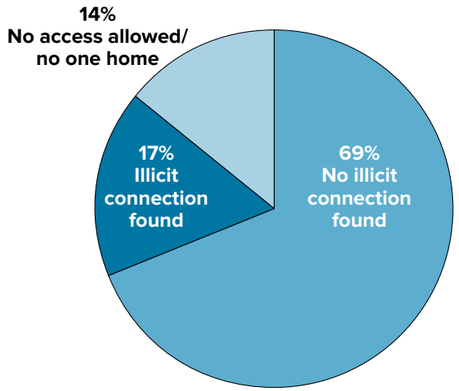


Figure 7. Home inspection results in Exeter, New Hampshire (195 homes slated for inspection—86 percent allowed access)

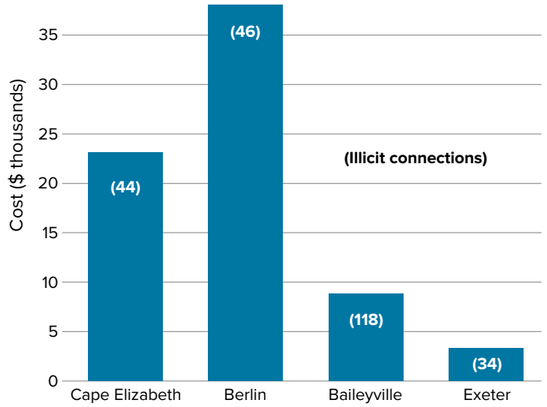


Figure 8. Cost per illicit connection removed

and redirected to other stormwater outfalls. This included extending storm drains and converting gravity connections to sump pumps and directing the sump pump discharge to the storm drain. In many cases, sump pumps had to be replaced and electrical services upgraded from 60-amp to 100-amp.

Funding came from a local loan for work on private property and a Maine State Revolving Fund (SRF) loan for work within the public right of way. A sewer user fee was created to pay for the work. Wastewater services in the town had previously been funded by general taxes.

The 118 illicit connections were removed at an average cost of $9,000 per illicit connection. No data are available on I/I reduction, but the town resolved its consent agreement with MEDEP, and the facility upgrade and holding tank were not required.

REMOVAL OF PRIVATE I/I IN EXETER, NEW HAMPSHIRE

Owing to high peak flow events, the town of Exeter was issued an administrative order from EPA to reduce CSOs. The town conducted a study in the Jady Hill area, which included 195 homes, to identify sources of I/I. Private services in the area had a total length of 3,200 linear feet (975 m) and tended to be in poor condition. Access was gained to inspect 168 of the 195 homes in the area. In those 168 homes, 86 sump pumps were present with 34 of those connected to the sewer (see Figure 7).

A combined water and sewer project was completed in the Jady Hill area to replace both the water and sewer pipes. This was to improve both the water quality and service for its residences, as well as to reduce I/I into Exeter's wastewater system. The town replaced 7,500 linear feet (2,290 m) of sewer main and 3,150 linear feet (960 m) of private sewer.

To fund the project, homeowners paid to remove illicit connections from the system as well as other fixes within private property. The maximum out-of-pocket cost to the homeowner was $1,000. The town paid 100 percent of the cost to replace the sewer within the right of way and any additional work within private property that cost more than $1,000. The average cost per illicit connection removed was $3,350. Target I/I reduction rates (peak and total volume) for both dry and wet weather conditions were achieved and, in most circumstances, exceeded.

COMPARING REMOVAL COSTS

For the four case studies discussed above, Figure 8 presents the costs for illicit connections removed. The total costs in Cape Elizabeth, Berlin, and Baileyville, respectively, were $987,000, $1,751,000, and $1,054,000. The data do not show any economy of scale for communities that separated more illicit connections. Projects that simply repiped a sump pump to discharge to daylight in a yard were the least expensive whereas communities that required sump pump replacement, electrical service upgrades to meet code, installation of new stormwater service laterals, and work in the public right of way had higher private I/I removal costs. For example, in addition to the connection removals, the Berlin project improved the streets significantly and the Cape Elizabeth project greatly improved public infrastructure. Data from Baileyville and Exeter more accurately depict the per-connection cost of removing illicit I/I connections only.

FUNDING OPTIONS FOR PRIVATE I/I REMOVAL

As discussed in the examples above, a major aspect of removing private sources of I/I is determining who is going to fund the work. Projects in which the costs are spread across the entire sewer rate-payer base are generally the most successful and expeditious. For example, in Maine, USDA Rural Development and MEDEP will not fund work inside a home or business. USDA Rural Development will fund sewer lines on private property only if the community or district gets a permanent easement and owns the pipe. Because MEDEP understands that private I/I removal is critical to minimize CSOs, it will loan SRF monies to districts or municipalities to remove sources of private I/I with only a construction easement. Additionally, the Maine SRF will loan money to districts or municipalities to set up a local fund to allow private residents/businesses to hire a contractor to complete the separation themselves. In our experience, projects in which little to no financial burden is placed on the home or business owner have the most success both in the time to complete the project and the number of private owners willing to grant construction easements.

LESSONS LEARNED

Pitfalls during the private I/I removal projects discussed above led to several lessons learned. Work in private basements can and does lead to addressing various electrical and plumbing code violations which can increase the project cost; replacing under-sized circuit breaker panels and providing plumbing vents are just some of the code problems that can be encountered. In projects in which sump pumps will replace foundation drains that flow by gravity into the sewer, the reliability of power and the need for backup power should be considered. No utility wants to explain to a homeowner why his or her basement flooded because a sump pump would not operate during a power outage when it used to drain by gravity. Back-up batteries can be provided to operate sump pumps and prevent wet basements in case of power failure; however, these add to the cost of the project and they can only operate the sump pump for the first few hours of an outage.

Where work outside the basement on private property is required, significant landscaping to meet the homeowner's requirements can be expensive. Finally, when work on private property is required, rather than allowing private owner challenges to dominate a project scope, it is better if possible to roll the private work into a related, mainly public project that will attract larger contractors who can more readily adapt to private property complications involved in the work.

CONCLUSIONS

Removing sources of private I/I can significantly reduce peak flow events during wet weather and help prevent SSOs and/or CSOs from occurring. The cost of removing private I/I sources varies by community, but the long-term benefits of removing I/I at the source instead of building storage tanks or increasing the capacity of pump stations and wastewater treatment facilities can be justified for certain communities. For a private I/I removal project to be successful, access needs to be gained to inspect private properties. Public outreach that stresses the importance of reducing private I/I sources can often improve success in gaining access and securing necessary construction easements. Any community looking at a potential private I/I project should develop a well-prepared inspection strategy, be diligent in gaining access to private property, educate residents on the benefits of disconnecting clean water sources from the public sewer, and ensure that residents are happy with the outcome.

REFERENCES

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ABOUT THE AUTHORS

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Reconfiguration of an inverted siphon in Framingham, Massachusetts

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JULIE LIU, PE, Framingham Public Works Department, Framingham, Massachusetts

ABSTRACT | The Lanewood Avenue inverted sewer siphon was installed under the Massachusetts Water Resources Authority (MWRA) Weston Aqueduct in the late 1950s to provide sewer service for several growing residential neighborhoods in northwest Framingham. Owing to its unconventional piping configuration and limited access, the inverted siphon posed a significant sanitary sewer overflow (SSO) risk and required constant maintenance from collection system operations personnel. In addition, the planned elimination of a nearby ejector station and replacement with a deep gravity sewer enabled the inverted siphon to be replaced and made convertible into a gravity sewer.

KEYWORDS | Inverted sewer siphon, redundancy, maintenance, capital planning, adaptable design

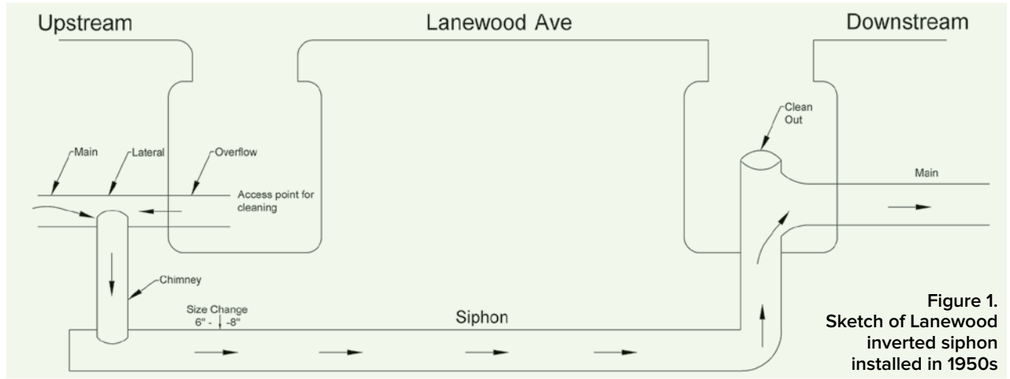

Figure 1.
Sketch of Lanewood inverted siphon installed in 1950s

BACKGROUND INFORMATION

The city of Framingham, Massachusetts, in greater Boston, is the 14th largest municipality in Massachusetts by population (approx. 70,000). The city's wastewater system is managed by the Framingham Department of Public Works and comprises 51 pump stations, 226 miles (364 km) of gravity sewers, and 18 mi (29 km) of force mains. Approximately 10 mgd (37.85 ML/d) of wastewater is generated in Framingham and conveyed to the Massachusetts Water Resources Authority (MWRA) collection system.

PROJECT INTRODUCTION

The MWRA Weston Aqueduct, commissioned around 1903, is a utility barrier to many regions in the city including the Pheasant Hill neighborhood in western Framingham. In response to the post-World War II population boom and rapid infrastructure expansion, an inverted sewer siphon was installed to service the residential neighborhoods north of the aqueduct and south of Callahan State Park. Despite design records showing an 8-in. (200 mm) cast iron (CI) pipe installed within a steel casing with manhole access on either end, the siphon had no casing, and access was limited to a vertical pipe connection in the base of the downstream manhole as illustrated in Figure 1.

Approximately 300 ft (91.4 m) downstream of the Lanewood siphon is the force main discharge from the McQuinn sewer pump station. The McQuinn sewer pump station is a small ejector style station and was identified in the city's Comprehensive Wastewater Management Plan (CWMP) as a candidate for replacement with deep gravity sewer. The project area is shown in Figure 2.

The city set out to design a replacement siphon that provided adequate maintenance access, minimized SSO risk, and offered synergy with the capital plan to eliminate the McQuinn pump station. In addition to design challenges associated with future pump station elimination, geotechnical issues had to be considered because of the excavation depth (greater than 20 ft/6.09 m) and sensitivity of the active concrete aqueduct.

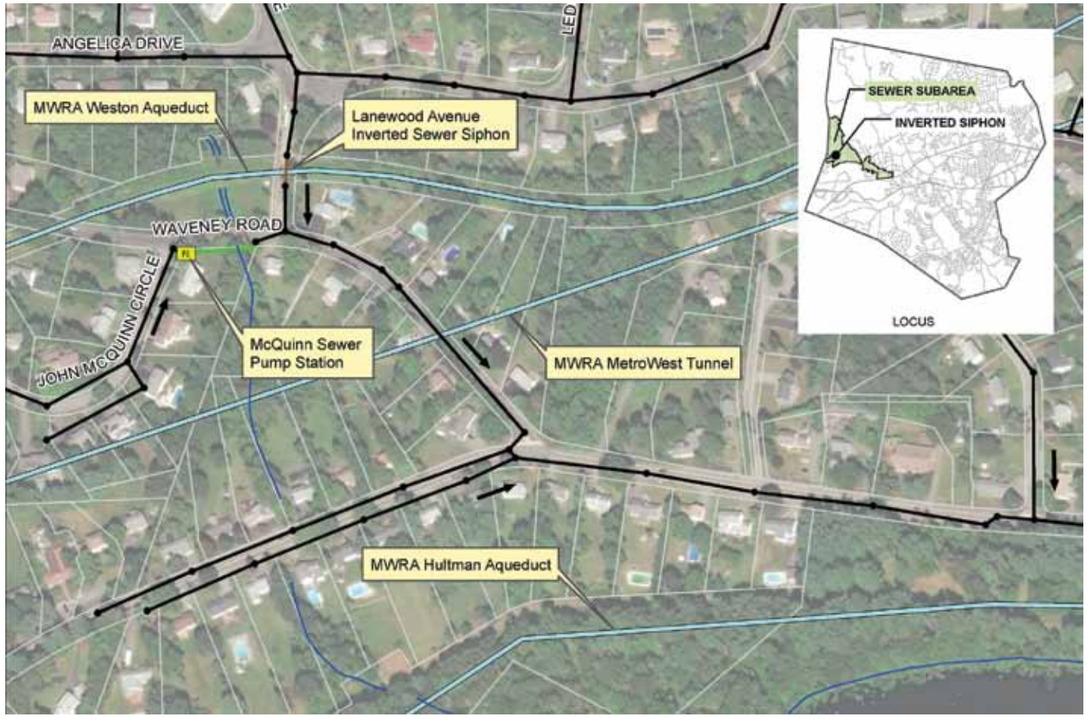

Figure 2.
Project area in western Framingham

PROJECT APPROACH

During the planning and design phases, the following tasks identified the desired long-term and sustainable solution:

- Downstream Sewer Planning – Determine preliminary design characteristics for reconfiguration of the gravity sewers downstream of the siphon including elimination of the McQuinn pump station and gravity sewer lowering
- Hydraulic Analysis – Determine existing and future flow scenarios and select proposed pipe sizes and siphon elevation differential to optimize hydraulic performance
- Piping Configuration – Determine a piping configuration that would provide ease of maintenance access and suitable redundancy
- Geotechnical Investigation – Confirm the suitability of the recommended casing installation method (jacking) and dewatering requirements

DOWNSTREAM SEWER PLANNING

Concurrently with the design of the Lanewood inverted siphon replacement, the city evaluated eliminating and replacing several pump stations with deep gravity sewer. The McQuinn pump station is immediately downstream of the Lanewood inverted siphon and was included in this evaluation.

Based on the design flows and the pump station inlet pipe elevations, the city determined that the McQuinn pump station could be eliminated by installing approximately 2,600 ft (793 m) of 12 in. (300 mm) sewer on Waveney Road and Pleasant Street at increased depths of 1 to 2 ft (0.3 to 0.6 m), compared to existing conditions.

Table 1. McQuinn pump station replacement gravity sewer summary

	Length ft (m)	Existing Diameter in. (mm)	Proposed Diameter in. (mm)	Existing Average Capacity gpm (L/s)	Proposed Average Capacity gpm (L/s)
New gravity sewer (replace force main)	250 (76)	n/a	8 (200)	n/a	297 (18.7)
Replacement sewer at increased depth	2,600 (793)	8 (200)	12 (300)	385 (24.3)	876 (55.3)

Comparison of the pipeline elevations for the McQuinn pump station elimination option to the Lanewood inverted siphon elevation determined that conversion of the inverted siphon into a gravity sewer would drive the downstream gravity sewer lower by an additional 1 to 2 ft. (0.3 to 0.6 m). Future lowering of the downstream sewer was determined feasible and the design of the Lanewood siphon should accommodate future conversion to a gravity sewer. Minimizing the pipeline depth under the aqueduct was therefore a primary design consideration to reduce the downstream gravity sewer depth and replacement distance.

HYDRAULIC ANALYSIS

Design Flow

Flow through the siphon was estimated by accounting for approximately 365 tributary residential connections, inflow/infiltration (I/I) rates from the city's metering program, and future buildout of the sewer subarea. Table 2 summarizes the flow rates. Flows were used to design the pipeline as both an inverted siphon and a gravity sewer.

Table 2. Lanewood inverted siphon flow rates

	Average Daily Flow (ADF)		Peak Hourly Flow (PHF)	
	gpd (L/d)	gpm (L/s)	gpd (L/d)	gpm (L/s)
Existing	120,450 (455,952)	84 (5.30)	824,983 (3,122,900)	573 (36.15)
Future	152,570 (577,540)	106 (6.69)	883,190 (3,343,237)	613 (38.67)

Table 3. Lanewood inverted siphon hydraulic performance

	6 in. (152 mm) Barrel		8 in. (203 mm) Barrel		12 in. (305 mm) Barrel	
Flow Condition	**Headloss ft (m)**	**Velocity ft/s (m/s)**	**Headloss ft (m)**	**Velocity ft/s (m/s)**	**Headloss ft (m)**	**Velocity ft/s (m/s)**
Existing ADF	0.15 (0.05)	0.94 (0.29)	0.04 (0.01)	0.53 (0.16)	0.01 (0.003)	0.23 (0.07)
Existing PHF	5.88 (1.79)	6.42 (1.96)	1.64 (0.50)	3.61 (1.10)	0.28 (0.09)	1.60 (0.49)
Future ADF	0.23 (0.07)	1.19 (0.36)	0.06 (0.02)	0.67 (0.20)	0.01 (0.003)	0.30 (0.09)
Future PHF	6.70 (2.04)	6.87 (2.09)	1.87 (0.57)	3.87 (1.18)	0.32 (0.10)	1.72 (0.52)

Inverted Siphon Hydraulics

New England Interstate Water Pollution Control Commission's *TR-16 Guides for the Design of Wastewater Treatment Works* (TR-16) recommend that inverted siphon velocities reach a minimum of 3 ft (0.92 m) per second under average daily flow conditions and that inverted siphons be no less than 6 in. (150 mm) in diameter. Additionally, the inverted siphon inlet and outlet elevations must provide sufficient differential head to account for head losses under average flow conditions. Table 3 summarizes the hydraulic performance of various siphon barrel diameters on Lanewood Avenue.

As shown, the minimum permissible size barrel of 6 in. (152 mm) provides a pipe velocity of 0.94 fps (0.29 m/s) under existing average daily flow conditions, less than the TR-16 recommended minimum of 3 fps (0.9 m/s). Diurnal flow variations were estimated to increase the 6 in. (152 mm) barrel velocity to approximately 2 fps (0.6 m/s) during daily high flow periods. To maintain the MWRA required minimum 18 in. (457 mm) vertical separation from the aqueduct bottom, the elevation differential between the inlet and outlet of the siphon was set at 1.8 ft (0.54 m). This minimum value of 1.8 ft (0.54 m) is greater than the head loss in a 6 in. (152 mm) barrel under average flow conditions.

To maximize average daily flow velocities and minimize maintenance, a primary barrel diameter of 6 in. (152 mm) was selected. The second barrel therefore had to accommodate two critical design requirements:

- Future peak hour flow as an inverted siphon without significant surcharge
- Future peak hour flow as a gravity sewer including 20 percent reserve capacity

At the peak future flow rate of 613 gpm (38.6 L/s), head loss in the primary 6 in. (152 mm) barrel will increase to approximately 6.7 ft (2.04 m), significantly greater than the 1.8 ft (0.54 m) siphon elevation differential. Surcharge during peak flow events was limited to 1 ft (0.3 m) by diverting flow over a concrete weir within the siphon inlet structure to the larger secondary barrel. The hydraulic grade line in the upstream siphon inlet structure will reach the weir crest at a flow of approximately 310 gpm

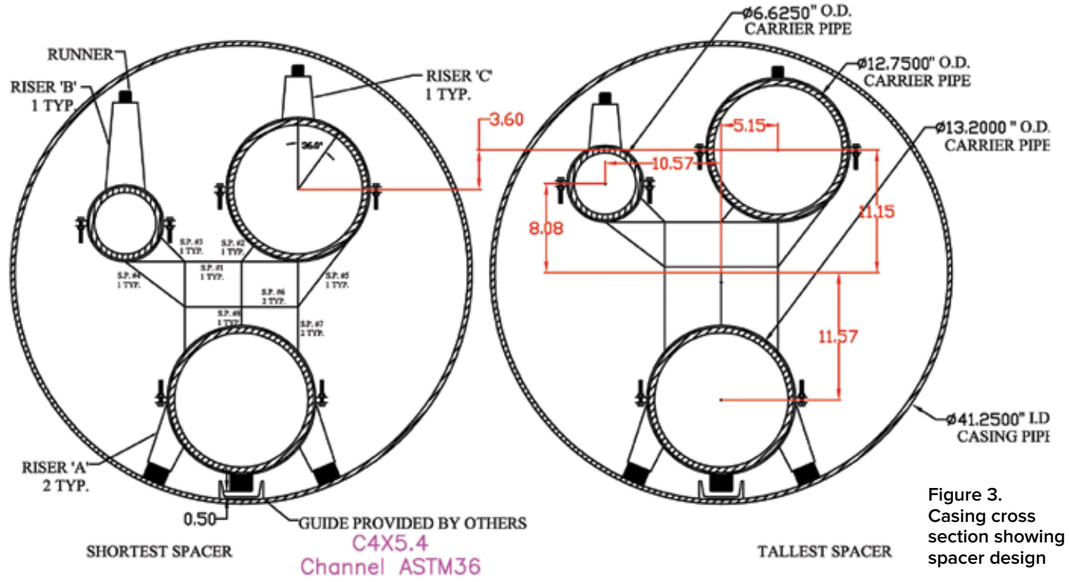

Figure 3. Casing cross section showing spacer design

(19.5 L/s). A 12 in. (305 mm) barrel was selected as the secondary barrel, which has a capacity of approximately 1,600 gpm (100 L/s) before head losses exceed the 1.8 ft (0.54 m) elevation differential between siphon inlet and outlet. During peak flow events, the 1 ft (0.3 m) surcharge depth upstream of the siphon will not exceed the invert of the nearest upstream manhole and will not affect any sewer service laterals.

Gravity Sewer Hydraulics

To convert the 12 in. (305 mm) barrel into a gravity sewer, it was designed to be installed at a .025 percent slope within the 42 in. (1,067 mm) steel casing, providing a capacity of approximately 750 gpm (47 L/s). In addition to the two inverted siphon barrels, a 12 in. (305 mm) water main was installed within the casing to take advantage of the new aqueduct crossing. Coordination with the casing spacer manufacturer was required to confirm that all three pipes could be accommodated, including the strict slope tolerances of the gravity sewer (Figure 3).

Future extension of the 12 in. (305 mm) barrel will lower the gravity sewer at the intersection of Lanewood Avenue and Waveney Road by approximately 3 ft (0.9 m). Extension of the 12 in. (305 mm) sewer east on Waveney Avenue and Pleasant Street at a slope of 0.0035 ft/ft (3.5 mm/m) will result in convergence with the 8 in. (203 mm) sewer elevation near the intersection of Red Coat Road, a distance of approximately 2,600 linear ft (792 m). Figure 4 shows a schematic of the future sewer reconfiguration and improvements.

INVERTED SIPHON CONFIGURATION

The selected double-barrel configuration allows a single barrel to be taken offline for maintenance via stainless steel slide gates in the siphon inlet manhole.

The design uses 45-degree bends to lower the pipe elevation below the aqueduct within the 42 in. (1,067 mm) casing. The casing was designed with 18 in. (457 mm) of clearance from the bottom of the aqueduct per MWRA requirements.

In addition to the double-barrel configuration, intermediate access manholes (Figure 5) were designed at the siphon low points on each side of the aqueduct. Each access manhole provides dual quick-connect fittings, isolated by gate valves. These intermediate access points enable the city to evacuate the siphon by vactor and flush from the inverted siphon low point. The intermediate access manholes also provide the key to the siphon's ability to be converted into a gravity sewer. Conversion can occur by cutting out the hard piping through the intermediate manholes and replacing it with open-channel brick inverts. The upstream intermediate manhole has a high elevation stub for a future external drop connection.

GEOTECHNICAL INVESTIGATION

Five subsurface borings were completed in November 2015 that generally indicated that soils are sandy gravel, with some silts, numerous cobbles, and some boulders. To better understand the soil conditions and observe the boulders encountered, two test pits approximately 18 ft (5.48 m) in depth were excavated in June 2017 in the jacking and receiving

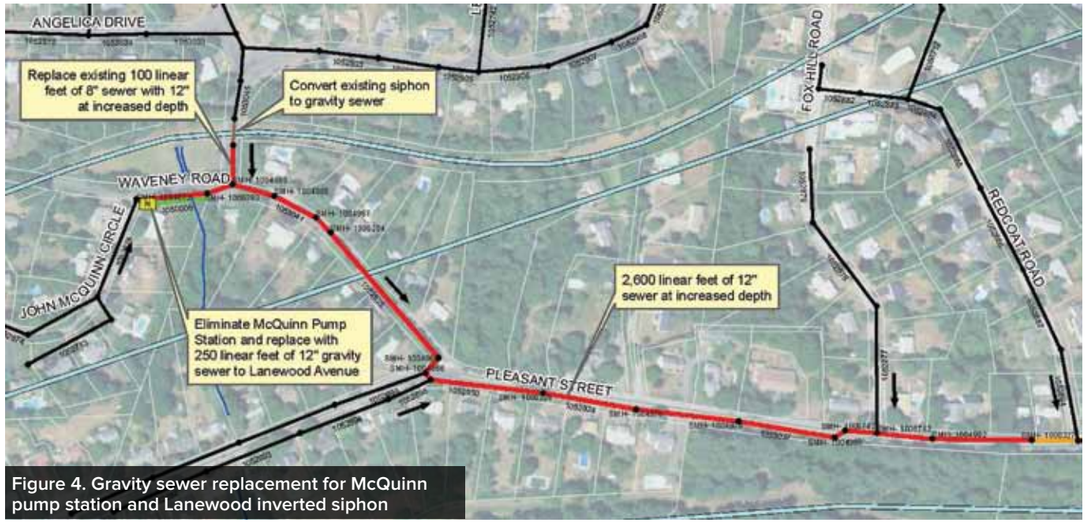

Figure 4. Gravity sewer replacement for McQuinn pump station and Lanewood inverted siphon

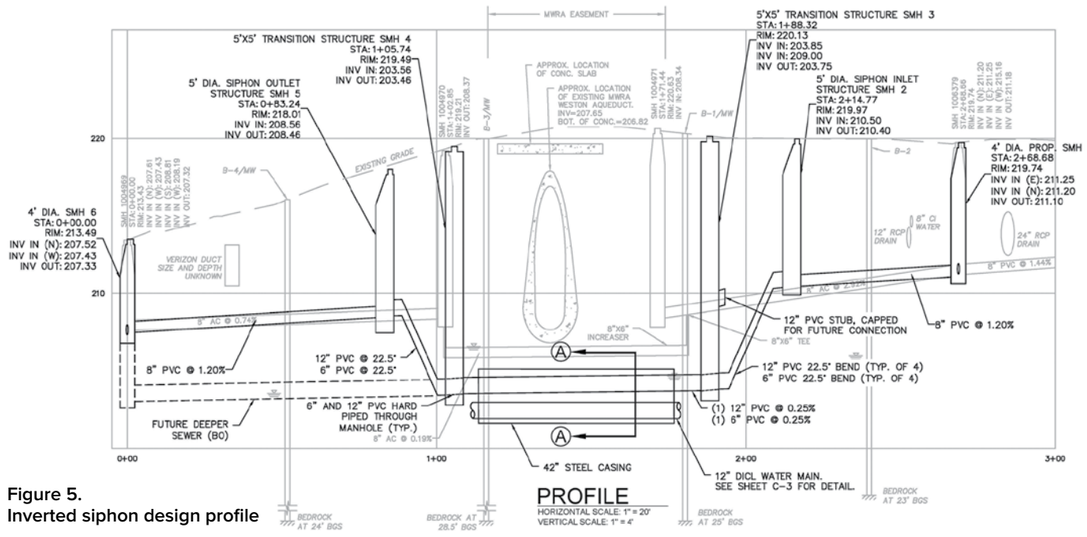

Figure 5.
Inverted siphon design profile

pit locations. The test pit observations confirmed that the selected casing installation of pipe jacking was appropriate. Bedrock within the sewer replacement area was observed in the borings at depths between 23 and 28 ft (7.0 and 8.5 m). Groundwater was observed in the borings and test pits at depths ranging from 12 to 16 ft (3.66 to 4.88 m).

Excavations up to 21 ft (6.4 m) deep were anticipated to construct the jacking and receiving pits for the 42 in. (1,067 mm) diameter carrier casing and the two intermediate access manholes at each end of the carrier casing. At this depth, the excavations would extend at least 7 ft. (2.13 m) below the groundwater table. Dewatering was required to maintain the groundwater level at least 2 ft. (0.6 m) below the bottom of the pits and always beneath the invert of the carrier casing. Another concern was the range of fine content of the soil at the bottom of the excavations at 5 percent to 10 percent, indicating a relatively pervious soil and the potential for a "running sand" condition in excavations and jacking faces.

Minimum design requirements to support excavation at the jacking pits were provided by soldier piles and timber lagging. Driven sheet piles were not expected to be practical for this site based on the cobbles and boulders observed in the test pits. Soldier piles would be installed in drilled holes including a minimum drill depth of 5 ft (1.52 m) into bedrock.

Typical soil conditions

Installed 42 in. (1,067 mm) casing

Casing spacers and triple pipe arrangement

CONSTRUCTION PROCESS

Daily construction challenges included coordination with MWRA, monitoring of construction vibrations at the aqueduct, and dewatering discharge disposal. Construction progress was expedited by 24-hour road closure and detour around the work area.

To confirm that construction vibrations would not affect the integrity of the aqueduct, a vibration threshold of 0.25 in./s (6.35 mm/s) was established at the aqueduct spring line. Seismic monitors connected to a visual alarm alerted construction personnel of any activities causing vibration above the threshold.

The Lanewood inverted siphon is within the riparian zone of Angelica Brook, a tributary to the Foss Reservoir, located approximately 1 mi (1.61 km) south of the project site. Owing to the designation of the Foss Reservoir as an Outstanding Water Resource, dewatering discharge from the jacking and receiving pits was directed to an on-site constructed infiltration basin. Dewatering was ultimately minimal and sufficient groundwater depths were maintained by deep sumps at both the jacking and receiving pits.

The replacement of the inverted siphon was completed in March 2019 and placed into service on April 19. All siphon piping and connecting manholes were tested and approved prior to the final connection that brought the siphon online.

Ultimately, the siphon was designed to be eliminated and converted into a gravity sewer along with a future pump station elimination. This final phase of the project will be the most significant improvement, reducing maintenance of both an inverted siphon and a pump station.

ABOUT THE AUTHORS

- Ryan Allgrove is a project manager at Environmental Partners Group with 15 years of experience in civil engineering and construction management. He holds a civil engineering degree from the University of Vermont and is a registered professional engineer in Massachusetts. Since joining Environmental Partners Group in 2015, he has worked on a range of projects including sewer pumping station replacements, sewer collection and water distribution system design, and water supply improvements.
- Julie Liu is a senior project manager at Framingham Public Works with 15 years of experience in project management and environmental engineering. Since she joined the city, she has managed numerous municipal infrastructure projects including water distribution and sewer collection, and water pumping station improvements and replacement.

CONCLUSION/SUMMARY

Inverted siphons are among the most maintenance-intensive components of any sewer collection system. In 2019, the city of Framingham replaced the Lanewood Avenue inverted sewer siphon that had very limited access and no redundancy. The new double-barrel inverted sewer siphon provides two access points on each side of the Weston Aqueduct and full redundancy for all future flow conditions.

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Creation of an urban private inflow inspection and redirection program

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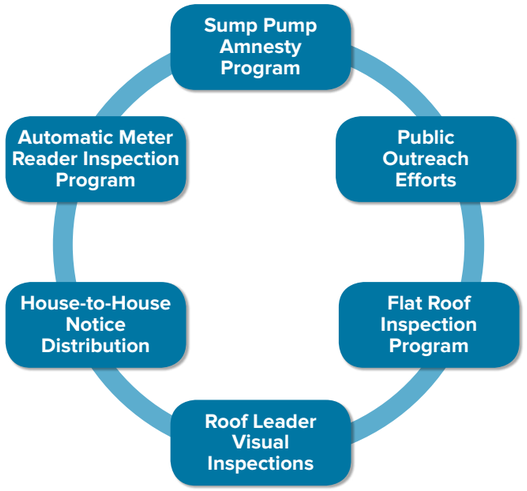
NICHOLAS RYSTROM, PE, City of Revere, Massachusetts

ABSTRACT | The city of Revere created the Sump Pump Amnesty Program and has inspected 10,500 properties. This large inspection program has removed approximately 450 illegal private inflow sources from the sewer system, including sump pumps, flat roof drains, roof leaders, and driveway drains. The investigation program was successful for several reasons: amnesty, public outreach, flat roof inspections, roof leader visual inspection/house-to-house notice distribution, and automatic meter reader inspections. Since the investigations began, the city has bid more than $10 million in construction contracts annually that target inflow removal.

KEYWORDS | Private inflow removal, sump pumps, I/I removal, amnesty program



The program utilized a multi-component approach

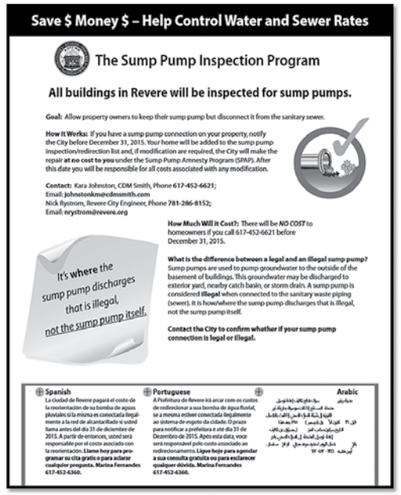
INTRODUCTION

The city of Revere, just north of Boston, has focused recently on identifying and removing illegal private inflow in the city's separate sewer system, a requirement of the city's consent decree with the U.S. Department of Justice for violations of the Clean Water Act. To do so, the city created a Sump Pump Amnesty Program, inspecting 10,500 properties to identify illegal private inflow sources connected to the sewer system, including sump pumps, flat roof drains, roof leaders, and driveway drains.

SUMP PUMP AMNESTY PROGRAM

The city-wide Sump Pump Amnesty and Inspection Program (SPAP) identifies and redirects sump pumps and roof drains located on commercial, public, and private properties. In creating the SPAP, in February 2013 the city amended local sewer ordinances that enforce illegal discharges of unpolluted water into the city sewer system. The amendments require building owners to redirect any illegal sources from the sewer system. These sources include sump pumps, roof drains (gutter downspouts), yard drains, driveway drains, and patio drains.

The SPAP let residents notify the city before December 31, 2015, if they had an illegal sump pump on their property. Through the SPAP, sump pumps and private inflow sources were inspected, and if a sump pump or inflow source was illegal, a redirection plan was designed during the inspection. These properties were then added to a database of


Save $ Money $ – Help Control Water and Sewer Rates

The Sump Pump Inspection Program

All buildings in Revere will be inspected for sump pumps.

Goal: Allow property owners to keep their sump pump but disconnect it from the sanitary sewer.

How it Works: If you have a sump pump connection on your property, notify the City before December 31, 2015. Your home will be added to the sump pump inspection/redirection list and, if modification are required, the City will make the repair at no cost to you under the Sump Pump Amnesty Program (SPAP). After this date you will be responsible for all costs associated with any modification.

Contact: Kara Johnston, CDM Smith, Phone 617-452-6621;
Email: johnstonkm@cdmsmith.com
Nick Rystrom, Revere City Engineer, Phone 781-286-8152;
Email: nrystrom@revere.org

How Much Will it Cost?: There will be NO COST to homeowners if you call 617-452-6621 before December 31, 2015.

It's where the sump pump discharges that is illegal, not the sump pump itself.

What is the difference between a legal and an illegal sump pump? Sump pumps are used to pump groundwater to the outside of the basement of buildings. This groundwater may be discharged to exterior yard, nearby catch basin, or storm drain. A sump pump is considered illegal when connected to the sanitary waste piping (sewer). It is how/where the sump pump discharges that is illegal, not the sump pump itself.

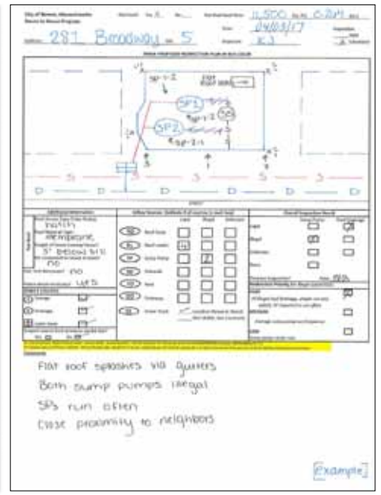
Contact the City to confirm whether if your sump pump connection is legal or illegal.

Spanish
La ciudad de Revere pagará el costo de la reorientación de su bomba de aguas pluviales si la misma es conectada ilegalmente a la red de alcantarillado e usted llama antes del día 31 de diciembre de 2015. A partir de entonces, usted será responsable por el costo asociado con la reorientación. Llame hoy para programar su cita gratis o para aclarar cualquier pregunta. Marina Fernandes 617-452-6360.

Portuguese
A Prefeitura de Revere irá arcar com os custos de redirecionar a sua bomba de água fluvial, se a mesma estiver conectada ilegalmente ao sistema de esgoto da cidade. O prazo para notificar a prefeitura é até dia 31 de Dezembro de 2015. Após esta data, você será responsável pelo custo associado ao redirecionamento. Ligue hoje para agendar a sua consulta gratuita ou para esclarecer qualquer dúvida. Marina Fernandes 617-452-6360.

Arabic

Flyer advertising the SPAP



Inspection and sketch form

Tablet application created to document inspection findings

illegal sources. The city is making the necessary redirection(s) at no cost to the homeowners for those properties eligible under the SPAP.

The SPAP was updated in July 2017 to help a greater number of property owners. The update extended the SPAP for single-family properties or owner-occupied rental properties that are three units or smaller. Any properties with an illegal inflow source that falls under these categories will now be considered part of the amnesty program. Commercial properties and larger rental properties will not be included in the amnesty program.

OUTREACH PROGRAM

Under this program, the city relied on property owners to call and schedule an inspection. For many reasons, residents are wary of the city entering their homes and conducting such an inspection. Because of this, residents and business owners must be provided information to help them better understand the importance of inflow removal. The city developed an outreach program that encouraged owners to register for the program.

The city advertised the program in the *Revere Journal*, and all buildings received an informational flyer in all their quarterly water/sewer bills. The flyer described the program and asked residents to schedule a sump pump inspection. Flyers were published in several languages, including English, Spanish, Portuguese, and Arabic. Other outreach included the city's website, the mayor's newsletter, and advertising at public events such as Revere Sand Sculpting and Spring Clean-Up. The city also published periodically the latest list of participating residents in the SPAP so that other residents might feel compelled to participate as well.

INSPECTIONS

Inspections are scheduled for 30 minutes and performed by two inspectors carrying photo identification. The inspections cover both the interior and exterior of each property. Inspectors observe and document any yard drains, patio drains, driveway, sidewalk, or stairwell drains, roof downspouts, and window well drains on the outside of each building. Inspectors note roof leaders entering the ground as well as those that splash onto the ground adjacent to a driveway drain. Inside each building, inspectors look for and document the presence of any sump pumps, floor drains, roof leaders or foundation drainpipes coming in from outside, and sewer cleanout caps. Inspectors also document if potential sources are connected directly to the building's sewer service. If it is not evident whether a potential source of inflow is connected to the sewer, the owner is consulted, and the connection is verified through dyed water testing where feasible.

13.08.640 Discharge of Unpolluted Waters

No person shall discharge or cause to be discharged any drainage, unpolluted water, groundwater, roof runoff, subsurface drainage including from sump pumps, uncontaminated cooling waters, live steam or unpolluted industrial process waters, directly or indirectly into the public sewer.

REVERE, MASSACHUSETTS, MUNICIPAL CODE OF ORDINANCES ART. II § 13.08 (2013)

During inspections, all illegal private inflow sources are evaluated, and a potential redirection plan is noted on each sketch. Digital photographs are taken of each confirmed inflow source. All confirmed inflow sources are summarized and mapped to show their location. A master list of property owners is compiled showing contact and inspection status including time, date, and method used for each attempt to contact each property owner.

Sump pump ice hazard

Sump pump connection drain trench

Direct drain manhole connection installation

Inspection crews use a sketch form as well as an electronic tablet application to document findings. The tablet application (app) developed for these inspections contains the Revere GIS database with features including sewer pipes, drainpipes, sewer and drain manholes, and catch basins. Buildings are color-coded by inspection results. The parcel information, including parcel ID, homeowner name(s), and any previous smoke testing results for the building, is preloaded into the app from the city assessor's information. Through the app, inspectors also take note of the infrastructure in the street, the ground type surrounding the building on the property, roof type, house type (single family, multi-family), house color, etc.

This app is widely used by inspectors as well as by city staff. It tracks inflow sources but also allows city staff to easily view water, sewer, and drain infrastructure.

Flat roof inspections

In December 2014, the SPAP widened its focus to include flat roof drains as an inflow source. This separate category was created and tracked due to the nature of flat roofs, which could contain one or more central drains discharging to the building sewer. Approximately 1,200 properties with flat roofs were identified throughout the city using the Revere GIS database. Mailings were sent to all properties with flat roofs according to the city assessment information database.

Dye testing is conducted on commercial flat roof properties or residential flat roof properties in which roof drainage discharge is undetermined from the initial inspection. During a dye testing field event, city staff access the roof of the building and place color dye and water into the roof drain while other inspectors observe downstream drain and sewer manholes for evidence of dye.

Roof leader visual inspection/house-to-house notice distribution

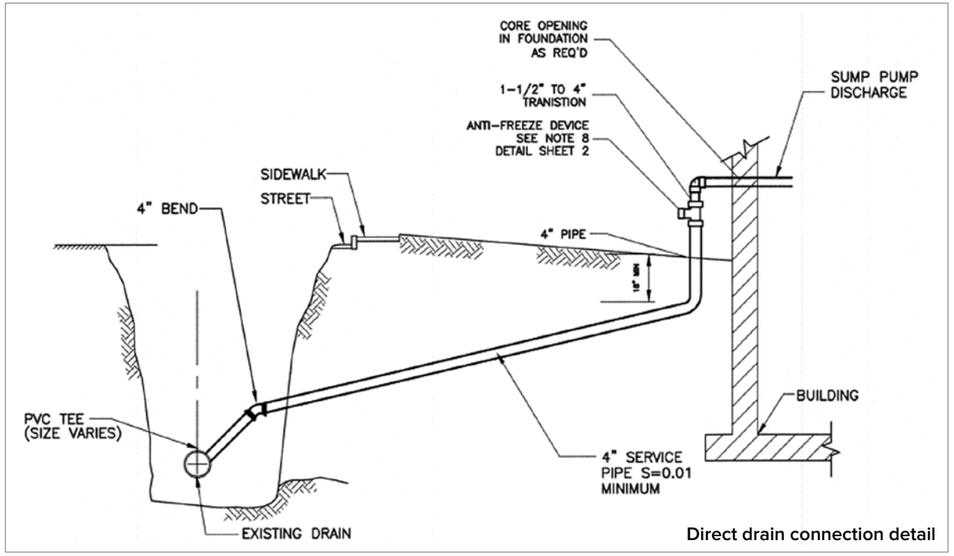
To further advertise the city's amnesty program, the city began a house-to-house notice distribution program to distribute flyers throughout the city, notifying residents of the ongoing inflow removal program and a preliminary exterior inspection of the building for potential inflow sources. The goal of this task was to identify roof leaders that were discharging into the ground as a red flag or potential source of inflow to be further evaluated.

This approach increased awareness of the program and increased the number of calls from homes in each respective area. The hotline operators of the SPAP noticed a substantial increase of calls of participants directly after the field staff were out notifying a certain section of the city.

AMR inspection program

The city has implemented an Automatic Meter Reader (AMR) installation program, using a private contractor to enter each building in the city to replace water meters. The SPAP team coordinated with the city and the private contractor to include a house inspection for inflow sources during each meter replacement.

Residents scheduled appointments for the new meter installations through the city; also, during these appointments an inflow inspector performed an inspection and informed residents about the



Direct drain connection detail

inspection results. This allowed residents to ask questions about the program and enabled the city to inspect many more properties that had not previously responded to the program.

If a city representative was not present for the AMR installation appointment, AMR installers were required to identify and document all sump pumps in the properties they entered in their daily reports.

Because AMR installers inspected only the interior of these properties, the daily install report dataset was combined with the roof leader visual inspection dataset to determine the property's full inspection status. By combining these two sets of data, to date roughly 7,100 properties that would otherwise still be awaiting inspection have been added to the inspection program.

Table 1. Inspection Results	
No Sump Pump	5,871
Legal	1,599
Illegal	727
Requires Follow-up	1,806
Redirected	508

INSPECTION RESULTS

The SPAP allowed the city to inspect more than 10,500 properties. Table 1 provides the results of the city's inspections.

CONSTRUCTION CONTRACTS AND REDIRECTION SOLUTIONS

The city has learned that the bidding on the removal of inflow sources is most cost-effective and practical if it is itemized. This approach allows the designer to tailor the solution for each property. For example, piping, coring, cut and splash systems, outside trenching, and connection to catch basins, street drains, or leaching basins are all separate items.

Installation of an infiltration basin

This allows the contractor to be paid for the actual work performed in association with each solution rather than calculating a lump sum per property. This approach minimizes change orders due to unforeseen circumstances or changes in the design during construction.

Several considerations are made when identifying the most feasible redirection plan for a private inflow source. The city needs to assure the property owner that the redirection will not lead to future maintenance problems such as erosion, icing, ponding, or other issues that can create public safety and health hazards. The city considers several factors when designing redirections, including the location, proximity to adjacent properties, waterways, ground elevation, and frequency of use.

Table 2. Contract and potential inflow removed

Contract	Potential Inflow Removed	Private Inflow Sources Awarded	Status
Inflow Removal Contract (2012)	845 gpm (53 L/s)	10 Buildings with Illegal Roof Leaders 1 Flat Roof Drain 1 Sump Pump 10 Yard Drains	Completed. Final Construction Cost: $267,0344
2013 Inflow Removal Contract (2013)	258 gpm (16 L/s)	14 Buildings with Illegal Roof Leaders 1 Sump Pump 15 Driveway Drains	Completed. Final Construction Cost: $303,659
Dix Street Wastewater Pump Station & Revere Beach Parkway Drainage P.S. (2014)	1,326 gpm (84 L/s)	1 Parking Lot Disconnection from Sewer on Revere Beach Parkway	Completed. Construction Cost: $540,604
House Sump Pump Removal Program/Inflow Removal Project Contract 1A (2015)	429 gpm – 875 gpm (27 L/s – 55 L/s)	135 Sump Pumps 3 Flat Roof Drains 150 Roof leaders	Completed. Construction Cost: $731,605
House Sump Pump Removal Program/Inflow Removal Project Contract 1B (2016)	302 gpm – 606 gpm (19 L/s – 38 L/s)	89 Sump Pumps 1 Driveway Drain 1 Stairwell Drain 33 Connections to Drain Dye tested 57 Roof Leader Properties (One redirected) 600 ft. (183 m) Drain Extension	Completed: Construction Cost: $1,288,147
House Sump Pump Removal Program/Inflow Removal Project Contract 2 (2016)	407 gpm – 818 gpm (26 L/s – 52 L/s)	113 Sump Pumps 3 Buildings with Illegal Flat Roof Drain Dye Tested 154 Roof Leader Properties	Completed. Construction Cost Awarded: $1,407,857
Revere Housing Authority Inflow Removal Project (2016)	221 gpm – 460 gpm (14 L/s – 29 L/s)	69 Sump Pumps 3 Flat Roof Drains	Completed. Construction Cost Awarded: $718,755
Inflow Removal Program Contract 3A (2017)	117 gpm – 234 gpm (7 L/s – 14 L/s)	84 Sump Pump Properties 983 ft. (300 m) Drain Extension	Completed. Construction Cost Awarded: $1,044,197
Inflow Removal Program Contract 3B (2017)	88 gpm – 177 gpm (5 L/s – 11 L/s)	59 Sump Pumps 0 Flat Roof Drains 80 ft (24 m) Drain Extension	Completed. Construction Cost Awarded: $578,621
Inflow Removal Program Contract 3C (2018)	TBD	134 Sump Pumps 18 Flat Roof Drains 865 ft (264 m) Drain Extension	Ongoing. Construction Cost Awarded: $1,566,050
Inflow Removal Program Contract 4 (Flat Roof) (2018)	TBD	10 Sump Pumps 30 Flat Roof Drains	Ongoing. Construction Cost Awarded: $865,603
Inflow Removal Program Contract 5A (2018)	TBD	39 Sump Pumps	Ongoing. Construction Cost Awarded: $632,794
Inflow Removal Contract 6A (2019)	TBD	41 sump pumps 1,360 ft (415 m) Drain Extension	Ongoing. Construction Cost Awarded: $1,175,044

The city considers four options when redirecting a private inflow source:

1. Splash setup to the surface
2. Infiltration basins
3. Direct drain connection
4. Drain extension with direct drain connection

Each option has advantages and disadvantages. With splash setups, the discharge location must be carefully assessed as ice buildup is a major concern. The infiltration basins require additional evaluation of the flow direction of groundwater and the potential impact to neighbors. Direct drain connections are often the most effective but are more costly. Storm drainage systems are not always available in the city, so often a drain extension is needed to provide a discharge connection for the private inflow redirections.

RESULTS

The city's identification and elimination of private inflow sources to the sewer system have removed a lot of extraneous flow to the sewer system. The city has awarded 13 private inflow removal contracts since 2012. The construction costs for redirection have ranged from approximately $6,500 to $12,500 per property, depending on the type of redirection implemented. Table 2 includes each contract and the potential inflow removed from each contract.

NEXT STEPS AND LESSONS LEARNED

Revere plans to continue with private inflow removal with the goal of removing extraneous flow from the sewer system and complying with its consent decree. The city will perform flow monitoring soon to identify its progress in private inflow removal and other infiltration/inflow (I/I) removal projects. Among the lessons learned on this large-scale private inflow removal project are the following:

- The splash setups and infiltration basins worked in some parts of the city but were not effective in every area. The city declared "no splash zones" where only drain connections were permitted under inflow removal contracts to prevent public safety hazards or groundwater being moved to a neighbor's property.
- Drain connections required drainage structure and pipe cleaning and rehabilitation in some cases to properly discharge the new flow from the inflow sources.
- In marketing the program, encouraging homeowners to participate in helping control water and sewer rates is beneficial. Stronger language (e.g., emphasizing potential fines) encouraged some wary homeowners to participate. Advertising in multiple languages also led to increased participation.
- Using the city's reverse 911 resident phone notification system before door-to-door flyer distribution increased call volume.
- Training inspectors on how to speak with residents and commercial owners about the project and how to create a preliminary design during inspection is important.
- Data tracking and efficiency was incredibly important. An electronic folder was kept for each property with scans of all correspondence. Linking results to GIS allowed the city to evaluate different areas and locate trends.

Redirection via a direct drain pipe connection

ABOUT THE AUTHORS

- Kara Johnston, PE, is a civil engineer with CDM Smith in Boston. Ms. Johnston has experience in I/I removal, wastewater planning, utility rehabilitation and replacement, project construction/bidding services, and environmental compliance. She has a Master of Science in Environmental Engineering from Northeastern University and a Bachelor of Science in Civil and Environmental Engineering from UMass Amherst.
- Nicholas Rystrom, PE, has been Revere's city engineer for eight years and has helped the city to navigate through a consent decree, including more than 20 I/I removal-related construction projects. Mr. Rystrom has a Bachelor of Science in Civil Engineering from Tufts University.

REFERENCES

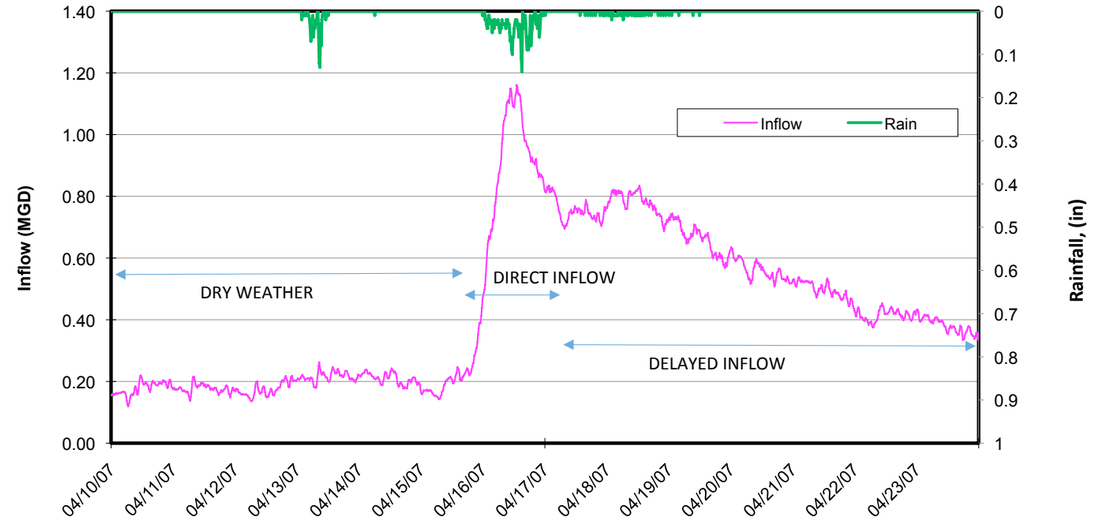
- Massachusetts Department of Environmental Protection. Guidelines for Performing Infiltration/Inflow (I/I) Analyses and Sewer System Evaluation Surveys (SSES). 1993, Revised May 2017.

Private inflow—best practices for access and source identification

STEVE PERDIOS, PE, Dewberry Engineers, Boston, Massachusetts

ABSTRACT | This article discusses the of the key features of a private inflow inspection program. It generally follows the Massachusetts Department of Environmental Protection's *Guidelines for I/I Investigation and Reductions,* 1992 (updated 2018). In addition, it gives examples of how best to collect data, safety concerns to watch out for, how to manage the data once collected, and examples of what inspectors might encounter.

KEYWORDS | Private Inflow, Inflow and Infiltration (I/I)



Direct versus indirect inflow

Table 1
Direct Connections
Roof leaders
Yard drains
Catch basins
Sump pumps
Cellar/foundation drains
Surface drains
Drains from springs and swampy areas
Cross-connections from storm drains
Indirect Connections
Defective manhole covers and frame seals
Leaking tide gates
Other inlets

As municipalities continue to attempt to track down and eliminate inflow and infiltration (I/I), identifying specific sources can be frustrating and meticulous. One particularly elusive source can be private inflow. Investigators can be thwarted in this area in many ways. A good plan and attention to best practices can increase the chance for success.

WHY AND WHEN IS PRIVATE INFLOW A PROBLEM?

Massachusetts Department of Environmental Protection's (MassDEP) *Guidelines for I/I Analyses and Sewer System Evaluation Survey, updated 2018*) defines many terms relevant to private inflow. As defined by MassDEP, inflow is the extraneous wastewater discharged into a sewer system from sources other than groundwater or domestic, commercial, or industrial wastewater. Inflow normally occurs when rainfall enters the sewer system through direct or indirect connections, examples of which appear in Table 1.

Inflow differs from infiltration in that it is the result of direct connections of extraneous flow sources into the collection system and, generally, is not linked to fluctuations in the groundwater table. Inflow is largely the result of wet weather (stormwater) influence on the sewer system.

During a storm event, inflow may rapidly affect the sewer system causing the wastewater flow to increase. This increase may stop a short time after the storm event recedes, or it may influence the sewer system for a prolonged period, depending on the type of inflow sources in the system. It is not uncommon for inflow to elevate wastewater flows for a number of days following a rainfall event. Sewer systems in or near coastal areas may also be subject to tidal inflow.

Direct inflow is the portion of the sewer flow that peaks quickly after a rainfall's peak and subsides quickly after the storm event ends. Sources of this direct inflow can include catch basins, area drains, or roof runoff.

Delayed inflow volume is the portion of total inflow volume generated from indirect connections to the collection system or connections that produce inflow after a significant time delay from the beginning of a storm.

Delayed inflow sources include sump pumps, foundation drains, indirect sewer and drain cross-connections, etc. Metering data shows that rainfall-induced infiltration cannot be distinguished from delayed inflow. Therefore, by definition, it is included as part of delayed inflow. Delayed inflow sources exert a gradual stormwater impact on the collection system. They produce an inflow hydrograph that decreases gradually upon conclusion of the rainfall event, well after the peak inflow caused by direct connections.

A private inflow source is an inflow source emanating from private property and discharging to a public sewer. Excessive private inflow into a sewer collection system can have three negative impacts. First, any extraneous water into the sewer system can be expensive. More water in the collection system will cause more wear and tear to the system, thereby requiring more capital improvements. Any sewage lift stations in the collection system will require more energy to pump that water. The extraneous flow will require the municipality to bear an additional cost in treating it.

The second negative impact from private inflow relates to health issues. A sewer pipe has a fixed capacity. During storm events, extraneous flow can take up a large percentage of that capacity. Once the pipe is full, wastewater with high amounts of bacteria can back up onto streets and into basements of homes. This greatly increases the risk of human contact with this bacteria, thereby increasing the risk to human health.

Last, the occurrence of sewer backups violates the federal Clean Water Act, thereby triggering regulatory reporting and additional unwanted attention from state and federal regulators.

PRIORITIZING REGIONS BY SEVERITY OF ESTIMATED I/I

The MassDEP guidelines provide step-by-step procedures for estimating inflow to a metered sewer collection system area. Flow meter and rainfall data should be analyzed to identify wet weather periods when inflow may be expected. Flow meter data during the wet weather period (generally over several days) should be compared to flow meter data during a selected dry weather period (usually a period immediately preceding the storm), provided this period represents similar groundwater conditions and diurnal flow conditions. The rate and volume of an inflow tributary to a subsystem can be computed by subtracting the dry weather flow data from the wet weather flow data.

Impact of inflow—flooded basements and gushing manholes

When multiple sewer subsystems are metered, their flow characteristics can be compared to one another. The guidelines suggest prioritizing those metered areas accounting for 80 percent of the cumulative inflow calculated for all areas. These metered areas can be further prioritized by the areas with the greatest amount of inflow per inch diameter of pipe and mile of length.

The type of inflow should inform the field investigation program. Public catch basins improperly connected to the sewer collection system typically contribute significantly to direct inflow. This is similarly true for roof drains and area drains.

Two types of roof drains exist, both of which rapidly increase sewer flow (direct inflow). Roof drains (or gutters) along the lowest point of a pitched roof can be connected to a sanitary sewer

Example of GIS in private inflow inspections

Unsafe inspection condition due to hoarding

underground. A flat roof can have a roof drain that enters the interior of the building and connects to the internal plumbing. Both require inspection and redirection. An external roof drain can easily be disconnected and redirected to the ground surface. The drain pipe into the ground is then capped. A drain from a flat roof may require extensive alterations to a building's internal plumbing.

Delayed inflow—a noticeable increase to the sewer flow for a prolonged period after the storm subsides—is typically a telltale sign of sump pumps or foundation drains. Public sources of inflow are typically easier to access, test, and correct because they do not affect private property owners. Private inflow sources are significantly more difficult.

SCHEDULING INSPECTIONS

The biggest obstacle to private inflow inspections is gaining access to the interior of a home or building. The first step typically includes mailing a letter to all homeowners describing the program and why allowing access is in the homeowner's best interest. A description of what extraneous water is and how it is detrimental to the community is helpful. The letter should come from the municipality. Some communities are comfortable with a more demanding letter, using the municipality's legal right to inspect as a lever point, while other communities prefer a lighter touch, with a more cooperative tone to the letter.

Each property owner targeted for inspection should be notified of the plan for and purpose and extent of the inspection. Public notification should be determined case by case, depending on the municipality, public safety officials, and governing bodies. The notification program may include the publication of information about the planned inspections in the following:

- Local newspapers
- Radio
- Telephoned messages
- Social media
- Door-to-door leaflets

The program should aim to improve property owner cooperation.

The next step should be outreach from or to the homeowner. Either way, an appointment must be made to gain access. For some homeowners, one letter and a phone call are all that is needed to make this appointment. For others, multiple phone calls, follow-up letters, or a door hanger flyer are necessary. Often the municipality does not have the correct mailing address for the homeowner, or the original letter does not reach the correct person. Nevertheless, making the appointment with the homeowner is the most important (and difficult) step in completing a building inspection. It can often take tenacity and patience. Creative ways of reaching out to homeowners are encouraged.

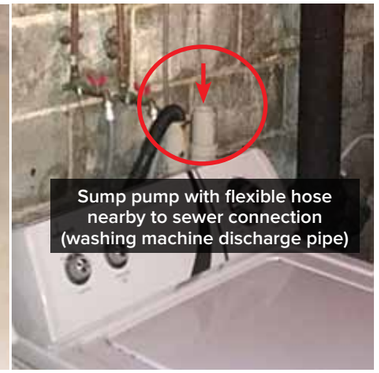
If the first few phone calls to a homeowner result in messages left with no returned call, additional calls should be made at different times of the day or on a weekend. If multiple attempts have been made to contact a property owner without successful access, or if access is refused, the sewer authority may have a process for notifying the owner of the authority's legal right to an inspection, citing any penalties for non-compliance. If a property owner will not allow an inspection, the municipality should be made clearly aware of this so that it can determine whether future action to inspect that building is warranted.

DATA MANAGEMENT

Standardized inspection forms are recommended so that the information collected at each property will be consistent and to ensure no critical data are overlooked. The inspectors should decide early which data are most important and then make sure they collect it. During the inspection there can be much to think about, so having a short list of photos to take is critical.

The form should be in electronic format on a tablet. That way data can be collected directly into the tablet and record photos can even be taken with

Sump pump connected to sewer system



Sump pump that can be connected to the washing machine discharge piping

the tablet. Once the inspector returns to a place with internet access, the form and photos can be automatically uploaded to a central database. Several free or inexpensive software applications are available that can assist with this.

Often approximately 500 homes are in a 25,000 lf (7,620 m) stretch of sewer subsystem in a suburban neighborhood. With so many structures to inspect, keeping track of who received a letter, which houses have been inspected, how many times each homeowner has been called, and, most important, the inspection results can be difficult. GIS tables and color-coded maps can help keep track of the data. Automating the downloading and updating of the data can make data management smoother and more efficient. It can also help to eliminate errors introduced each time the data are transcribed from one medium to another (e.g., paper to spreadsheet).

SAFETY DURING INSPECTIONS

The safety of the inspector while on private properties should always be the top priority. Simple precautions can ensure this. All inspectors should pay attention to their own instincts and be attuned for potential problems. There should be a cautious apprehension to any situation that is not completely expected and ordinary. Inspectors should have appropriate personal protective clothing. A hard hat is not typically necessary but should be available to the inspector. An inspector can perform an inspection alone, but it would be safer in a team of two. If an inspector is performing inspections alone, he or she should inform the authority before and after entering a private property, by phone, email, or text. Some communities will provide a police detail to accompany the inspector. This should be encouraged.

The area to be inspected should be clear, free from debris, and safe to access. Homeowners with hoarding tendencies should be avoided or approached with skepticism. The path the inspector needs to walk on should be on firm ground, without having to step on anything owned by the tenant. Appliances or other obstacles should not be climbed on. The inspector also should look overhead for pipes and loose items and stay away from broken glass or other sharp objects. Lighting is important, so the inspector should also carry a bright flashlight.

Also, homeowners or tenants may not be comfortable with a stranger entering their home. Thus, watching for signs of anxiety from the person letting you in is important. If he or she seems uneasy, the inspector may be able to abridge the inspection by only taking photos of the most critical items (such as the sump pump and pump discharge location) and then record notes after vacating the property.

EXAMPLES OF PRIVATE INFLOW OBSERVATIONS

When beginning an inspection, the inspector should carry a letter of authorization and photo identification. He or she should also carry a copy of the section of the municipality's regulations that addresses its inspection powers. Before beginning an inspection on private property, the inspector should introduce himself or herself to the owner or tenant of the building, explain the purpose and extent of the inspection, and ask permission to begin. The investigation should cover the entire property, both interior and exterior of the building.

Private inflow inspections are typically performed to identify four potential extraneous flow sources: (1) sump pumps, (2) area drains, (3) roof downspouts, and (4) flat roof interior drains. Other sources may be of concern, but they are less frequently encountered. If it is not evident where a potential source of inflow drains, the property owner should be consulted and any information on discharge locations should be verified through dyed-water testing, if feasible.

Many homes may not have a sump pump or one that is infrequently used for drying a basement. Pumps sitting on shelves and clearly not active are

Properly installed sump pump system

not usually of concern. The inspector should look for a sump pump near an electrical source, in a sump, or connected to discharge hosing or piping. These are more likely to become active on short notice.

If a home does have an active, easily accessible sump pump system, it should be determined where the sump pump discharges to—anyplace except to the sanitary sewer system is usually acceptable. Preferably the discharge will not be to a driveway or walkway that could ice over in cold weather. The best scenario is that the discharge runs underground and connects to an adjacent public storm drain, but this is infrequently the case.

Roof drain connected underground

Area drains can drain lawn or paved areas, such as driveways. Their discharge piping is underground so ascertaining where the collected water flows can be difficult. It may be necessary to dye test this structure by placing a dye tablet in the drain and running water into it while someone observes the downstream sewer and drain manholes. These structures are not common.

Roof downspouts or gutters are often easy to see from the sidewalk. Any that extend underground should be dye tested as described above. If connected to the sewer, it is typically easy and inexpensive to disconnect it from the underground piping, patch up the hole with concrete, and direct the downspout to the ground surface.

Any flat-roofed building without exterior gutters should be investigated to determine if rain drains off the roof via the building exterior or enters the building via a roof drain connected to interior plumbing. If roof drainage is via interior plumbing, this internal piping should be inspected. Occasionally it is easy to see a separate roof drain piping system that extends from the roof to the basement and exits the building at a different location from the building's sanitary wastewater piping system. When this is not easy to see, the roof drain must be dye tested. Access to the roof is often required when an interior cleanout is not accessible.

Redirecting a roof drain that also collects the building's sanitary sewage can be difficult. Each case will be unique and require a specialized solution to separate the wastewater from the stormwater. This could involve new internal plumbing from the roof to the basement, a new roof vent for the sanitary sewer system, and repair of the affected roof, ceilings, and walls.

Private inflow can account for a lot of extraneous flow in a sewer system. To properly locate the problem sources, a detailed plan should be developed. This plan should include, at a minimum, attention to safety, determination, and an openness to creatively inspecting internal pumps and piping of homes and buildings. For more information on private inflow, refer to the Private Inflow white paper (https:// bit.ly/2lWBlB1) recently authored by the NEWEA Collections Systems Committee.

ABOUT THE AUTHOR

Steve Perdios is a project manager for Dewberry Engineers in Boston. He is working on the I/I reduction project for the city of Beverly, Massachusetts.

NEBRA Highlights

The Mid-Atlantic Biosolids Association symposium included a tour of the Rahway WRRF, where engineered food slurry is fed into anaerobic digestion to generate biogas, electricity, and heat, offsetting energy costs substantially. The director there says, "Why wouldn't any facility do this? It just makes so much sense."

Clean Energy Center Sludge Study

NEBRA recently completed a final draft report for the Massachusetts Clean Energy Center (MACEC) about wastewater solids generation and management in Massachusetts. Thanks to all the NEWEA members who helped us by responding to our survey request. The report is still under review, but its basic findings can be shared here. NEBRA compiled data from a survey responded to by 85 of the 120 water resource recovery facilities (WRRFs) that produce wastewater solids in Massachusetts. Respondents represented 96 percent of the average daily wastewater flows at Massachusetts WRRFs, including all the largest facilities [greater than 5 mgd (19 ML/d)].

The survey found that sludge production has increased since the last sludge survey and that incineration has surpassed biosolids composting/recycling and landfilling as the most-used option for sludge disposal. The options for wastewater solids management involve major energy and operational costs. Solids treatment and disposal are among the largest expenses in a WRRF's capital and operating budget.

Finally, the study evaluated the potential of regional facilities for solids handling. The report will be made available on our website once approved and finalized by MACEC. Here is a preview:

- Massachusetts WRRFs treated total average daily flows of 666 mgd (2,521 ML/d).
- Half of the WRRFs have specialized advanced treatment systems for removing extra nutrients from their effluent.
- Ninety-three percent of the solids produced in Massachusetts are from WRRFs with active industrial pretreatment programs, which help to protect the quality of the effluent, sludge, and/or biosolids.
- Only a few facilities indicated their staff managed the end use and disposal of their facility's solids in 2018; wastewater solids are mostly managed by private contractors and public or private facilities that complete the end use or disposal of the solids.
- Solids management and disposal are among the largest costs for a WRRF. Only 71 WRRFs responded to this survey question, but together they spent around $43 million for solids disposal in 2018. The calculated costs per dry U. S. ton averaged $784 ($864 per dry tonne).
- Most biosolids generators expect to see new technologies in their facilities and for the cost of solids management to increase by 20 percent to 100 percent in the next 10 years.
- Owing to the costs associated with solids handling and decreasing options, most respondents were interested in regional wastewater solids management outlets in Massachusetts. The report makes recommendations to MACEC regarding regional facilities.

PFFUND

NEWEA continues to support NEBRA's work around perfluoroalkyl and polyfluoroalkyl substances (PFAS). NEBRA kicked off the PFFUND (NEBRA's fund dedicated to its PFAS research, tracking, and information gathering and dissemination) in early 2017. Our first contribution was $500 from a Canadian company, and since then NEBRA has received contributions of $111,000 from 58 organizations around the northeast region and across the country. Generous and in a few cases unexpected contributions came in from various state and municipal agencies. NEBRA has also received great support from two of our sister biosolids organizations: the Mid-Atlantic Biosolids Association and Northwest Biosolids. Some organizations are making annual donations, and some have contributed on behalf of a specific project such as the modeling of PFAS transport for land-applied biosolids in Maine. Donations range from $100 (contributed personally by one NEWEA state director) to $5,000. Many thanks to NEWEA, which contributed $2,500 and pledged another $2,500 for 2020.

NEBRA has grown the PFFUND to support the study of PFAS impacts on biosolids, exchange information with entities affected, develop guidance for sampling and data collection, write reports, and lobby for sensible legislation. NEBRA's PFAS web page compiles information about PFAS in biosolids. The issue has seemingly exploded around the region and is growing nationwide, and there is so much work to do; much data and modeling work are needed, and we seem to be playing catch-up. It puts regulators, operators, and especially biosolids recyclers in vulnerable positions.

NEBRA's goal for the PFFUND for 2020 is $70,000. If realized, NEBRA plans to continue offering bi-monthly webinar updates on PFAS and compiling PFAS information on our "Member Only" website (also available to non-member PFFUND contributors). NEBRA will continue to track PFAS-related legislation and assist members with testimony or letters to support reasonable regulatory approaches. NEBRA will provide at least two workshops and/or webinars for biosolids and residuals management stakeholders. Our staff is available to provide timely responses to questions and requests for information. NEBRA continues its PFAS advisory group, convening meetings at least monthly due to the rapidly developing nature of the PFAS issue. NEBRA also would like to collaborate with other organizations working on PFAS issues and help to develop, advance, coordinate, and support appropriate research on the topic and on residuals and biosolids application to soil. This collaboration would include coordination with the USDA W4170, Beneficial Reuse of Residuals and Reclaimed Water: Impact on Soil Ecosystem and Human Health (a long-standing multi-state research project supported by numerous organizations including the Hatch Multistate Research Fund and the National Institute for Food and Agriculture—more on the NEBRA website).

PFAS Updates

Since January 2017, NEBRA has provided members and an expanding list of biosolids professionals across the continent with current science and legislative and regulatory developments related to PFAS in biosolids and residuals. NEBRA has engaged with national water associations and other biosolids organizations to understand the implications of the fast-moving developments in PFAS policy, especially at the state level where the northeast region has seen a lot of activity. Some of these developments have disrupted biosolids management programs, especially in the states where land application is more prevalent. NEBRA is helping members by collecting relevant information about the liabilities, potential costs, latest testing methods, and more related to compliance with new PFAS standards. NEBRA has also compiled sampling guidance and has held training sessions for personnel tasked with sampling biosolids for PFAS concentrations.

Some consider incineration the solution to the PFAS problem. Certainly, incineration is becoming a bigger and bigger outlet for biosolids for several reasons. It is one of three main options (and we need every single one). However, it is good to remind ourselves of why we recycle biosolids to the soil: recycling lowers net greenhouse gas emissions, uses local resources, closes the nutrient and carbon loops, increases community sustainability, replaces fossil fuel-based fertilizer, and helps local agriculture.

For NEBRA members in states that have established or are considering establishing regulatory limits affecting biosolids, NEBRA has supplied letters and testimony. In part at the request of the Maine Water Environment Association (a PFFUND donor), NEBRA initiated modeling for the transport and fate of PFAS in land-applied biosolids. NEBRA has also tested at dairy farms to supplement sampling by the state.

NEBRA continues to host regular webinars with the PFAS advisory group and the national PFAS and biosolids/residuals stakeholders.

Northeast Residuals & Biosolids Conference Exhibit and Tour

October 16 – 18, Sheraton Springfield Monarch Place, Springfield, Massachusetts

NEBRA has been busy working with NEWEA's Residuals Management Committee and staff to finalize plans for this year's annual conference in Springfield, Massachusetts. For this event, planned for the new MGM Grand Casino (at the very cool Tap Room), we adopted a gambling-themed title, Sustainable Biosolids: A Sure Bet! This annual conference is a must if you deal with biosolids in these challenging times of PFAS.

NEBRA works closely with NEWEA's Residuals Management Committee—ably chaired by Natalie Sierra of Brown & Caldwell—to develop and produce a top-notch training and networking event for clean water professionals dealing with biosolids. This year's conference will cover the regulatory landscape, biosolids program planning, and end uses (all three options are alive and well in New England, at least for now). The big bets are on as to what will happen as a result of the most recent contaminant of emerging concern, the class of chemicals known as PFAS. Odds are high that it will change how biosolids are managed. The last day of the conference will be dedicated to PFAS.

In addition to the networking reception in the exhibit space on Thursday and the reception at the casino, there will be other opportunities for networking and learning. NEBRA has its annual membership meeting during breakfast on Thursday. Also, NEWEA's Young Professionals Committee is organizing a Poo & Brew event; thanks to the Westfield WRRF for hosting a tour for conference attendees on Wednesday to be followed by the "brew" part at a local craft brewery.

Wastewater operators, utility and biosolids managers, engineers, researchers, consultants, regulators—it is a sure bet that all will learn something.

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

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

nebra North East Biosolids & Residuals Association

Spotlight: **Young Professionals**

The two Young Professionals (YPs) Dan Paolozzi and Phil Rattenni are highly regarded by their collection systems colleagues. They are dedicated to maintaining their systems to help ensure that all wastewater flow is successfully conveyed to their respective treatment facilities—it is all in a day's work of maintaining Rhode Island's esteemed coastline for these hardworking YPs. Mr. Paolozzi is an experienced collection system inspector for the Warwick Sewer Authority in Warwick, while Mr. Rattenni is a skilled Collection System Operator 2 for the Scarborough Wastewater Treatment Plant in Narragansett. The *Journal* asked these YPs about their day-to-day "dirty" jobs and why claiming a career filled with this dirty work can be so fulfilling.

Journal How did you come to enter the clean water profession?

Dan: I started in the clean water profession about five years ago. I started working for National Water Main Cleaning Company on a sewer lateral lining crew. We would use closed-circuit television (CCTV) and clean main lines as well as laterals.

Phil: I was previously working in a sales role, and it wasn't very fulfilling. The schedule was also very hard, often involving nights and weekends. A family member (in the clean water profession) told me about his job and the industry; that's when I decided to try it out. Aside from it being fulfilling, I enjoy the stable Monday–Friday schedule (with only a few overtime shifts scattered throughout).

Phil Rattenni

■ *You have both been working in the industry for some time. What has surprised you most about this industry that you might not have been aware of when you were fresh out of school?*

Dan: When I first started at the Warwick Sewer Authority I really wasn't aware of the whole treatment process at the plant. As an inspector for the sewer authority, I rarely spend time in the plant. We are always on the road inspecting drain layers, doing Dig Safe mark outs, responding to odor complaints/grinder pump issues, jetting lines, CCTVing main lines for condition control, maintaining pump station wet wells, running the vacuum truck, and cleaning out the wet wells (there's a lot to be done). Being in the field has allowed me to see the process from beginning to end; this has proved very interesting and has made me want to learn more. It truly is an amazing process to see what comes into the plant and what is ultimately discharged. It makes you wonder, "How is this even possible?"

Phil: The cleanliness of the job! You think of wastewater as being a dirty job; of course there are dirty parts of the job, no doubt, but the lack of smell at the plant was a pleasant surprise to me. I know it's not because I'm used to the smell, because we have a recent hire who also can't smell anything! We have a well-working process. I've also learned to appreciate the science behind all of the processes. It's really cool to see how the gross water enters and how clean it looks like when it leaves.

■ *How long have you been in the water environment field and why did you decide that this work would make a good long-term career for you?*

Dan: I knew that I needed a stable career. When I started at the Warwick Sewer Authority I got along with everyone almost immediately. Everyone here is willing to help with everything and answer any questions that I've had. That's one important thing: I have never been afraid to ask a question, because everyone I work with knows that's how you learn!

Phil: I've been in this position for just over two years. My anniversary was in June. After a few weeks of training and getting some experience being on the job, I knew it was a good fit for me. A major part of this are the guys that I work with—we get along very well. This is a long-term career because wastewater isn't going anywhere, and that makes me comfortable to know that I will always have a job.

■ *Do you talk with people outside the profession about what you do for work? What kind of reactions do you typically get from those outside the profession?*

Dan: When my friends and family found out where I work there really wasn't much of a surprise to them just a lot of smart remarks and jokes, which you'd expect when working at a wastewater treatment facility! Even my 3-year-old son makes jokes by asking, "Dada, did you drive the big poop truck today?"

Phil: When people ask me what I do for work, I'm proud to tell them what I do. Now that I've been here for two years, I see how important the work we do is. It's so important that we have clean water leaving the facility, particularly being located next to Scarborough Beach. At first most people raise their nose and make an "Ew, that's gross" response, but as you explain the entire process of treating water, they always become more interested and the conversation lasts longer.

■ *What benefit do YPs gain from being involved in NEWEA?*

Dan: NEWEA's *Journal* and emails provide members with a lot of information. The trade shows allow us to meet and mingle with different vendors in the industry. Having good connections with vendors is key because we do so much business with them; it's how you keep a well-oiled machine (collection system) running.

Phil: The ability to meet so many established professionals through NEWEA is so important for YPs. These established professionals have years of industry knowledge that can be passed down to those newer to the industry.

■ *What challenges do you see for the water environment profession in the near future? How do you see the industry changing in response to these challenges?*

Dan: A challenge that I foresee in the future is the growth of our human population and the capacities of collection systems and wastewater treatment facilities. The infrastructure in some of our old, New England cities is already reaching its life span and some have fallen (or are quickly falling) into complete disrepair. As a field inspector for said infrastructure, I've also noticed significant issues with hydrogen sulfide gases. There must to be a way to keep these nuisance gases under control as populations continue to grow into the future.

Phil: There seem to be a lot of "established" and "seasoned" industry professionals. The retirements of these seasoned professionals coupled with the lack of youth joining the industry poses a challenge for the future. Keeping up with technology advancements is also challenging for professionals. Continuing education and keeping up with technology is allowing us to adapt and inspiring younger staff to join into the profession.

Dan Paolozzi

■ *What advice would you give to students or young people considering a career in the environmental field?*

Dan: I highly support young and upcoming individuals who are willing to work and learn from this industry. I have been training staff in this field on all subjects about being an inspector, including special trainings with our new vacuum truck and camera truck and all the needed general knowledge. It's a great industry to work in and there will always be a need and demand for people to keep this process running well, forever.

Phil: Young people should understand that an entry-level position within the environmental field can lead to other opportunities, including management positions, leadership roles, and a diverse day-to-day workload. It also presents the immediate opportunity to help the community that you live in, promoting safety and progression over time.

■ *Thinking back, was there a particular person who helped you feel welcome in the field or served as a mentor to help your progress?*

Dan: Thinking back there is not just one person who has served as a mentor to me in the field—I consider everyone that I work with as a mentor to me. We all continue to learn from each other and continue to learn every day as a team.

Phil: There is not one person, but every person that I've worked with has been so welcoming. Mainly, Peter Eldridge (my boss), Dan Johnson, Dan DiScuillo, and Steve Card have all been tremendous teachers and mentors. They have taught me about not only the job but about the industry as a whole. All of the guys have been great teachers and mentors.

■ *What is a fun fact about you that your professional network may be surprised to learn about you?*

Dan: I ride BMX bikes outside of work. It's something that I've been doing since childhood—I just can't seem to shake it! As a father to my son, it's something that I get to pass onto him. My son comes to the skatepark and dirt jumps with his little bike and tries to follow in my footsteps. Who knows, maybe one day I'll be training him on our vacuum truck!

Phil: I'm an avid golfer, but I'm pretty sure everyone that knows me already knows that. In my spare time I'm a varsity basketball coach at Narragansett High School. Go Mariners!

The Stockholm Junior Water Prize

This year's state winners from New England

SIWI STOCKHOLM JUNIOR WATER PRIZE

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

New Hampshire

Kavya Phadke
Nashua High School North
Nashua, NH

Use of Vanadium Organic Complex to Remove Ethanol from Water

Plastic water bottles have become extremely convenient but may have hidden dangers, since bottles are now developed using polyethylene terephthalate (PET) where the metalloid antimony is leached into the drinking water. Two plastic bottles and two stainless steel bottles containing 200 ml of water were stored at 43 and 25 degrees C for seven days each. The heartbeat of *Daphnia magna* was used as a bioindicator to detect the presence of antimony in each sample of water and observed under a microscope. A negative control of 200 mL drinking water and a positive control of 200 mL drinking water with 0.0012 mg antimony, the U.S. Food and Drug Administration (FDA) permitted level in drinking water, were also tested. After comparing the heart beats per minute of each *Daphnia* under different water conditions, *Daphnia* tested in a plastic bottled water under 43 degrees C had a similar heart rate as *Daphnia* under the control with antimony. Therefore, plastic bottled water at high temperatures may contain the limit of antimony permitted. Future work includes conducting plasma mass spectrometry to quantify antimony or obtaining a larger sample of *Daphnia*.

Vermont

Esther Koo
South Burlington High School
South Burlington, VT

Can Dialysis Be Used to Treat Lead Poisoning?

This study examined the effectiveness of dialysis on lead removal from the body. It was hypothesized that if potassium phosphate binds to lead nitrate, it will precipitate out of solution in the form of lead phosphate. Also, if bicarbonate is added to the solution, it will speed up the dialysis process, because studies have shown that passive lead (Pb) transport is strongly stimulated by $HCO_{3(-)}$. In this experiment, two 0.1 M solutions of lead nitrate and potassium phosphate were created. Ten milliliters of lead nitrate was then poured into a strip of dialysis tubing. The tubing was submerged into a beaker of potassium phosphate. Each trial was analyzed using a coffee filter to measure the percent of lead that was precipitated and removed. A bicarbonate solution was also made and added to the potassium phosphate to determine if it increases the efficiency of the reaction. Trials without bicarbonate resulted in average precipitation of 0.12 grams of lead phosphate. Trials with bicarbonate had an average of 0.18 grams. Lead was observed to have precipitated on both sides of the tubing. The lead nitrate and the potassium phosphate were supposed to precipitate out of solution together in the form of lead phosphate; however, the precipitate was mostly found on the inside of the tubing. Bicarbonate trials had a higher precipitation rate, which shows that adding bicarbonate actually causes lead to move across membranes more quickly. Through this experiment, potassium phosphate was determined to affect lead nitrate removal from the blood.

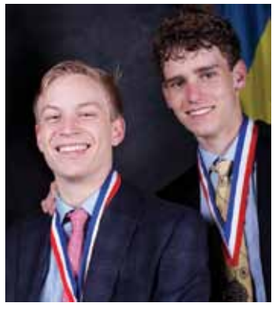
Massachusetts

Benjamin Dwyer
Wachusett Regional High School, Holden, MA

Business is Blooming—Optimizing Phosphorus and Carbon Content to Maximize Growth and Lipid Production in an Algal Photo-bioreactor

Algae is a renewable energy source when lipid and biomass are maximized for biofuel conversion. This experiment was designed to maximize this in *Nannochloropsis oculata* via added nutrients. It was hypothesized that added carbon and phosphate would increase growth and lipid levels. Carbon is involved in photosynthesis and lipid synthesis. Phosphate was hypothesized to increase these more significantly as seen in rapid algal blooms. *Nannochloropsis* and growth media were subdivided into four conditions: 100 percent added carbon, 100 percent added phosphate, 100 percent both nutrients, and control with no additional nutrients. These were grown in a scale-model algal photobioreactor with optimized lighting, aeration, and temperature to mimic an industrial setting. Growth was measured periodically, and lipid was measured after around 40 days. Biomass indicated that each nutrient significantly increased growth, individually and cumulatively. Phosphate increased lipids, whereas carbon's effect was less clear. This suggests that added nutrients, especially phosphate, can be optimized to maximize algal output industrially. As a project extension, a plasmid was designed to compare genetic alterations related to these improvements, and *Chlamydomonas* growth conditions were optimized for this innovation.

Connecticut



Brooks Ferguson and Colin Mulshine
Brunswick School
Greenwich, CT

Development of an Algae-based Buffer System to Mitigate Excess Nitrogen and Acidification in Marine Environments

Over the last several decades, marine biome ecosystems have undergone extreme destruction from ocean acidification and hypoxia. This study combats these problems by examining how different species of marine algae could regulate levels of acidity (by the absorption of CO_2 through photosynthesis) and nitrate concentration (by extracting it from the water and converting it to living tissue) in a manipulated seawater environment. It was hypothesized that *Gracilaria debilis*, a species of red algae, would be most effective overall in absorbing the provided CO_2 and nitrates. To ensure there were enough samples to run multiple tests, 11 algal species were cultured in a seawater medium. The six species (two of each green, red, and brown) that showed the most efficient growth rates after three weeks were selected to move on to the experimental process. The samples were then placed in a new environment with CO_2 bubblers, where pH levels would be observed for a week. For the nitrate experimental portion, a similar process was followed, except two drops of "plant food" fertilizer were added to the medium. Using proportions between algal mass/growth and final values of pH change/nitrate absorption, we could not determine a clear outlier, although our results suggest that marine algae may be an effective, organic buffer to combat increasing acidity levels and nitrate concentrations in our oceans.

Maine

Marina Mohawass
Bangor High School
Bangor, ME

Use of Vanadium Organic Complex to Remove Ethanol from Water

In the past two decades, ethanol production has increased significantly due to the demand for ethanol-blend fuels. With a current annual production of 15.8 billion gal (60 billion L) in the United States, ethanol has become the largest-volume hazardous substance transported by rail, raising the potential of ethanol incidences. Methods for removing ethanol from water (i.e., using dispersants and skimmers) are costly and inefficient; thus, there is a demand for a more efficient technology. When synthesizing and studying some metal acetylacetonate (acac) compounds (Co, Cr, Cu, Fe, Mn, VO), a difference in the behavior of $VO(acac)_2$ compared to the other metal-acac compounds was noted. $VO(acac)_2$ solubility and ultraviolet–visible spectroscopy (UV–Vis) absorption was tested in acetonitrile, acetone, dimethyl chlorine, ethanol, methanol, n-pentane, and water. A bathochromic shift (red shift) in lambda max of 86 nm suggests that the ethanol binds to the $VO(acac)_2$, in an aqueous solution. This new use of the $VO(acac)_2$ compound shows promise at removing ethanol from a water solution and at rapidly identifying trace amounts of ethanol in water.

Rhode Island

Brooke Newbury
St Mary Academy – Bayview
Riverside, RI

Using Aloe Vera to Purify Water

Access to clean water is a growing problem throughout the world. Water scarcity is especially problematic in Africa, where one in five people do not have access to safe water. Most of the water used in Africa is surface water, which can become contaminated with fertilizers. An experiment determined if a common plant could be used to treat water contaminated with iron, copper, and potassium phosphate, byproducts of fertilizers commonly used in Africa. The goal of this experiment was to use aloe vera gel to purify contaminated water. Three different contaminants were used: potassium phosphate, cupric sulfate, and iron sulfate. Each pollutant was added to separate batches of distilled water to create solutions with specific concentrations. The phosphate concentration needed to be 10 mg/L, so 10 mg of potassium phosphate powder was added to 1,000 mL of distilled water. The copper concentration needed to be 4 mg/L, so three supplement tablets—2 mg of copper per tablet—were added to 1,500 mL of distilled water. The iron concentration needed to be 50 mg/L, so one supplement tablet—60 mg of iron per tablet— was added to 1,200 mL of distilled water. Five 20 mL test tubes of each sample were prepared, and one test tube of each sample was left untouched as the control sample. Added to the other four tubes of each sample was 0.320 g of aloe vera gel. These samples were then tested every 24 hours using testing systems specific to each pollutant. The testing lasted for four days. The experiment concluded that aloe vera gel removed 65 percent of the potassium phosphate, 87.5 percent of the cupric sulfate, and 10 percent of the ferrous sulfate. While the aloe vera gel was essentially ineffective in removing the ferrous sulfate from the solution, the gel did remove the potassium phosphate and cupric sulfate from their solutions effectively. This shows that aloe vera gel could be an effective water purifier in underdeveloped countries that do not have access to clean water or commercial water purifiers.

New Jersey high school student wins 2019 U.S. Stockholm Junior Water Prize, recently represented the U.S. in international competition

Sonja Michaluk has won the 2019 U.S. Stockholm Junior Water Prize (SJWP), the nation's most prestigious youth competition for water-related research.

Ms. Michaluk, a student at Hopewell Valley Central High School in Pennington, New Jersey, explored DNA barcoding to measure the health of waterways with larval *Chironomidae* (order *Diptera*), the most widespread macroinvertebrate family. She won $10,000 and an all-expenses paid trip to Stockholm to represent the United States at the international competition in late August.

Students from 45 states and Puerto Rico competed in the national finals June 15 at the Ohio State University in Columbus, Ohio. The SJWP aims to increase students' interest in water issues, research, and careers as well as raise awareness about global water challenges. The competition is open to projects on water quality improvements, water resource management, water protection, and drinking water and wastewater treatment.

The two U.S. runners-up were Noel Lange of Alabama and Ankush Dhawan of Indiana, who each received $1,000. Haley Jostes of Minnesota received the Bjorn von Euler Innovation in Water Scholarship Award from Xylem Inc. Mehaa Amirthalingam of Texas received the James L. Condon Recognition for Environmental Stewardship.

"The health and future of our global water environment depends on the kind of ingenuity and innovation the SJWP competition showcases," said WEF Executive Director Eileen O'Neill.

Ms. Michaluk's winning project, "A Novel Method of Monitoring the Health of our Global Fresh Water Supply using DNA Barcoding of *Chironomidae (Diptera)*," emphasized a forecast that 66 percent of the U.S. population will experience water scarcity within a decade, leaving residents more dependent on surface water for drinking. Current surface water monitoring methods rely on expensive and technically challenging manual identification of biological samples. "DNA barcoding," Ms. Michaluk noted, "results in more accurate and precise waterway health data, adding significant value for monitoring scarce water resources."

The judges commented, "Beyond the very impressive research Sonja performed in her study of *Chironomidae* DNA barcoding to determine water quality health, she also applied her knowledge to a local non-profit water institute to improve her own community watershed. These students are creating solutions to improve communities across the world, and the SJWP is a testament to the importance of investing in the future of our industry. The diversity of students and ideas this year demonstrated solutions for our world's water challenges will come from young people of all backgrounds."

New Hampshire State Director Report

by Steve Clifton
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This year has been challenging for New Hampshire water professionals but has shown that we are and will be the leaders of a sustainable, environmentally friendly world.

New NH PFAS Standards

Perfluoroalkyl and polyfluoroalkyl substances (PFAS), historically used by industries to make everyday products resistant to stain, heat, oil, grease, and water, are now understood to be prevalent in groundwater as legacy chemicals. The toxicity of PFAS is now being addressed. At a July 18 meeting of the New Hampshire Joint Legislative Committee on Administrative Rules, New Hampshire adopted new drinking water and groundwater standards for the PFAS chemicals displayed in the adjacent table.

The new regulations are anticipated to be effective as soon as September 30. Regulated public water systems and groundwater discharge facilities will have to test their water quarterly over the next four quarters to determine compliance. According to New Hampshire Department of Environmental Services (NHDES), about 10 regulated public water systems are affected by these new regulations, with treatment cost impacts in the $190 million range. Estimates also suggest that 9 percent of private drinking water wells may also exceed the standards. Although private wells are not regulated to meet these new standards, you can bet that if owners can afford it, they will want to remove PFAS from their water. Private well treatment costs are estimated at $71 million.

Drinking water & groundwater standards	
PFAS Compound	**Reporting Limits**
Perfluorooctanoic acid (PFOA)	12 ppt (ng/L)
Perfluorononanoic acid (PFNA)	11 ppt (ng/L)
Perfluorohexanesulfonic acid (PFHxS)	18 ppt (ng/L)
Perfluorooctanesulfonic acid (PFOS)	15 ppt (ng/L)

New Hampshire's own Shelagh Connelly (RMI Recycles) and Ned Beecher (NEBRA) are leading the charge on the wastewater side to make sure good science is used in setting limits. NHDES has already prepared a draft Water Quality Standards plan to address PFAS. The future will be very challenging.

NHWPCA Trade Fair

Bruce and Paula Jo Kudrick

The New Hampshire Water Pollution Control Association (NHWPCA) annual trade fair took place on Friday, April 5, at the Radisson Hotel in Nashua. Hosted by President Kurt Robichaud, the event was highlighted by a special environmental Public Outreach Award to the Hooksett Sewer Commission, and Bruce and Paula Jo Kudrick were also applauded for Mr. Kudrick's 46 years of environmental service to the commission. Mr. Kudrick has weathered difficult wastewater treatment facility (WWTF) situations that took hard work, courage, and perseverance. Throughout the years, he has always acted professionally and responsibly to achieve the best results.

Thanks to the NHWPCA board for pulling off another successful trade fair. Two technical sessions were offered. The first session was put on by Laurie Perkins, Wright Pierce, that covered data collection and defect coding for pipeline, manhole, and lateral assessments. Sam Mcleod, Rite-Way Compliance Group, presented on FOG best management practices. The formal luncheon and awards ceremony completed the day. The proceeds from the event support all NHWPCA events.

New Hampshire's Operations Challenge team—Seacoast Sewer Snakes in action at the NEWEA Spring Meeting

NHDES Clean Water and Drinking Water State Revolving Loan Training

NHDES put on a full-day training program for water professionals on April 19 covering the State Revolving Loans and the Drinking Water and Groundwater Trust (DWGWT). The new Water Division director, Thomas O'Donovan, introduced the program. New Hampshire has a significant opportunity ($276M) to address water needs throughout the state with the DWGWT providing funds to address these issues. The trust is supporting the longevity of the funds by accumulating interest, repayments of low-interest loans, and other investment returns. NHDES also has a State Aid Grant Program (SAG) that offers a 20 percent or 30 percent grant to eligible applicants. This state-funded program has been in a "defer and delay" mode, but each year an effort is made to re-fund part or all of the program.

NEWEA 2019 Spring Meeting

The NEWEA 2019 Spring Meeting in New Castle, New Hampshire, attracted water professionals from all the New England states. Hosted by NEWEA President and New Hampshire wastewater television celebrity Ray Vermette, the event at Wentworth by the Sea was a huge success. Mr. Vermette, who was once featured in a video on wastewater that was widely distributed throughout the industry, played host to this event, which featured New Hampshire Senator Jeanne Shaheen as the keynote speaker.

New Hampshire was proud to host an Operations Challenge team with new blood this year. Our four young operators, training with Coach Patty Chesebrough and seasoned veteran Operations Challenge champion Mike Carle, put on an excellent show, reaching high marks for the process event with precious little training time. The Seacoast Sewer Snakes Operations Challenge team consists of Dan Tanzella, Mike Patrick, Dave Jones and Phil McHenry. Look for big things in the future from this eager team of young water professionals.

NEWEA Operator Exchange

The New Hampshire NEWEA Operator Exchange program is with Connecticut this year. Connecticut has been contacted, and the schedule is to have the Connecticut operator tour New Hampshire WWTFs on September 11, 12, and 13. The NHWPCA board has charged Rob Robinson from Manchester and Mike Carle from Hampton with hosting the Connecticut operator. Dover WWTF operator Casey Mitchell will head to Connecticut to meet with Bill Norton, Virgil Lloyd, and the Connecticut operators on November 19, 20, and 21.

Other NHWPCA Events

The NHWPCA Golf Tournament was held on August 1 at Beaver Meadows Golf Course in Concord, and the NHWPCA Fall Meeting took place on September 13 at the North Conway Water Precinct. The NHWPCA Winter Meeting is scheduled for December 13 at the Exeter WWTF, showcasing the four-stage Bardenpho process that provides low-level total nitrogen treatment.

Be sure to check NHWPCA.org for current dates of all upcoming events.

Finally, I want to acknowledge the contributions, hard work, and positive energy person (PEP) of Mary Jane Meier from the NHDES Wastewater Engineering Bureau. Ms. Meier organized the operator training programs for more than 15 years, administering the wastewater education and certification functions. Always thinking of ways to improve operator training, she was key in developing the Manager's Candidate program, energizing the NHWPCA newsletter committee, and contributing to the NEWEA Collection Systems Committee. As the liaison between the Environmental Services Department and the Operators' Association, her care and concern for the well-being and career betterment of the entire operator community was evident and appreciated throughout the state. Ms. Meier recently retired from NHDES to bring her PEP to other areas of her life. We wish her well.

If you are not already a member of NEWEA, please consider joining to enhance your growth as a professional in the industry. As the NEWEA New Hampshire state director, I can be reached at sclifton@underwoodengineers.com or at 603-436-6192. Please feel free to contact me with any NEWEA questions. I will do my best to serve the NHWPCA and NEWEA community.

Maine State Director Report

by Jeffrey McBurnie
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As I write this during the sweltering dog days of summer, I cannot help thinking, somewhat ironically, about how happy I was to see the passing of the winter vortex and the oncoming spring mud and blackfly seasons. Weather never seems to be perfect; this is, at times, a pretty good analogy for life as a water quality professional. There is more to do than time and resources allow, yet we persevere and, yes, at times see actual progress. That is what I appreciate about the Maine Water Environment Association (MEWEA), a small but talented, tenacious, and passionate group. What follows is a sampling of what has gone on and what is going on in Maine.

PFAS and the Maine Governor's Task Force: Pfascinating, Pfrustating, and by no means Pfun

Established on March 9, the Maine perfluoroalkyl and polyfluoroalkyl substances (PFAS) task force has been working diligently to identify priorities and strategies to address concerns about potential public health and environmental impacts from exposure to PFAS. The MEWEA representatives on this task force are Andre Brousseau from Sanford Sewerage District (representing wastewater operator interests) and Jeff McBurnie from Casella Organics (representing biosolids management interests). Other task force members represent an environmental advocacy group, the pulp and paper industry, public drinking water professionals, public health professionals, and regulatory designees from the following departments: Environmental Protection; Health and Human Services; Agriculture, Conservation and Forestry; and Defense, Veterans, and Emergency Management. Dr. Meredith Tipton chairs and facilitates the task force. Its first meeting on May 22 was primarily an introductory, goal-setting meeting with PFAS status presentations by the regulatory representatives or their designees. The next two meetings (June 26 and July 29) were more substantive, with the individual stakeholders defining the priorities for their specific organizations or agencies. The intent was to help the task force focus on areas of highest concern/importance to optimize the use of the state's limited resources. The primary topics were as follows:

- Need for land application as a method of biosolids management and alternatives should this beneficial use option be eliminated
- Data gaps that affect the development of strategies
- Regulation of PFAS either as a category of compounds or as individual chemicals
- Assistance, either actions or resources, that the state should be requesting from the federal government

Currently being considered is the cessation of land application of biosolids as a management option, despite its being a minor component of the issue and that there has been no link between responsible biosolids recycling and any health or environmental problems in Maine.

Washington, D.C. Fly-In

On April 3–4, MEWEA sent a delegation of members and a municipal official to Washington to participate in policy discussions and engage Maine's Senators and Representatives (and their staffs) in their offices. Representing Maine were Rhonda Irish, town manager of Wilton; Stacy Thompson, 2019 MEWEA president; Michael Guethle, MEWEA 1st VP; Scott Firmin, NEWEA Government Affairs vice chair; and Jeff McBurnie, NEWEA Maine state director. We met with both Senators and all the Maine Senate and House staffs. We delivered an informational packet to each office and had lengthy discussions related to sustainable infrastructure funding, work force concerns, and the looming PFAS crisis.

MEWEA Clean Water Week Poster Contest

Alex Buechner, poster contest coordinator, reported on the Spring "Why Water's Worth It to Me" poster contest. In 1983, the Maine legislature designated the first full week of June as Maine Clean Water week to celebrate how far we have come in improving the quality of Maine's waterways and to increase the public's awareness of the important role that wastewater treatment plays in protecting public health and the environment. Over 20 years ago MEWEA began hosting a poster contest during this week to encourage teachers and parents to talk to students and children about clean water and the role we all play in protecting it. Students from grades 1 through 12 across the state are invited to participate; the association members vote on their favorite posters at the spring conference, and the top 12 entries have their posters included in the Maine Clean Water Week calendar.

We recently concluded another successful year of the contest. We received almost 300 posters from students all over the state. Based on the number of entries and the understanding and appreciation that was shown in the students' work, this program continues to be a valuable tool to get people thinking more about water in a fun and interesting way.

Maine Takes Third Place at the NEWEA Operations Challenge Competition

Coach Vivian Matkivich reported on the recently concluded Operations Challenge. Force Maine represented MEWEA at the NEWEA Operations Challenge during the Spring Meeting in June 2019 and held out against strong competitors for a place as one of three NEWEA-sponsored teams going on to WEFTEC. Our team placed third and will travel to Chicago along with the Connecticut Franken Foggers and the first-place Ocean State Alliance of Rhode Island. Force Maine 2019 members Dan Munsey of Brunswick Sewer District, Captain Riley Cobb of Saco Water Resource Recovery Department, Shelby Carver from Kennebunk Sewer District, and Coach Vivian Matkivich will be joined in Chicago by alternate Rob Pontau of Brunswick Sewer District. Nate Melanson of the Lewiston-Auburn Water Pollution Control Authority has recently been offered a new job and cannot join the team. We all wish Mr. Melanson the best in his new position, and we thank him for his contributions of many volunteer hours and hard work for the team.

We at MEWEA are grateful for the opportunity to participate in Operations Challenge; it is a great example of the value of association involvement: a highly esteemed operator training and networking program supported locally by volunteer team members and their employers, promoted regionally by all six state operator associations and NEWEA, and hosted nationally by WEF at WEFTEC, this year in Chicago. We hope to see you there at the national competition, where we will be rooting for our own Force Maine!

Maine's Management Candidate School

Leeann Hanson, training coordinator for Maine's Joint Environmental Training Coordinating Committee, reported on the most recent management training class. Maine's 10th Management Candidate School (MCS) class of 19 students concluded with graduation on September 12 during the MEWEA Fall Convention at Point Lookout in Northport. Each graduate received a diploma and a commemorative pin to recognize his or her achievement. Maine's management program was the first in New England to bring together both wastewater operators and drinking water operators to share experiences and gain instructional information to prepare for managerial and supervisory roles as water quality professionals. The curriculum consists of monthly classroom meetings, self-study assignments, a day of job shadowing, and participation in MEWEA's Fall Convention as well as the Maine Water Utility Association's (MWUA) February show. After September's ceremony, Maine's MCS cumulative alumni include 194 graduates. Many graduates have already been promoted to management positions throughout Maine.

MEWEA President Stacy Thompson (2nd from right) with Water Week poster contest winners and some of their parents

New NEBRA Executive Director Tours Maine Facilities

On July 16, NEWEA Past President and new NEBRA Executive Director Janine Burke-Wells ventured north of the Big Green Bridge to explore part of the biosolids landscape in Maine. She saw a variety of wastewater solids generation, processing, and treatment technologies, and she also learned about the challenges and concerns (yes, PFAS again) that the Maine biosolids industry faces. Many thanks to our gracious hosts for opening their facilities to the tour. Hosts included George Belmont, Hawk Ridge Compost Facility; Mac Richardson and Travis Peaslee, Lewiston-Auburn Water Pollution Control Authority; Scott Firmin and Dustin Price, Portland Water District East End Plant; and Andre Brousseau, Sanford Sewerage District.

MEWEA's 2019 Fall Convention

On September 11, the Annual MEWEA Golf Tournament in Rockland kicked off the 2019 Fall Convention at Point Lookout Resort in Northport. It was followed by two days of exceptional technical sessions and a top-notch trade show. The highlight of the technical sessions was the PFAS Summit (ironically(?) on Friday the 13th), which presented perspectives on PFAS concerns at both the state and federal levels. Presenters included state and federal regulators as well as content experts. As always, it was a great educational experience but an even better networking opportunity.

Connecticut State Director Report

by Bill Norton
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Washington D.C. Water Week Fly-in

Water week was held in Washington, D.C. March 31–April 6, 2019. The NEWEA Fly-In took place on April 3 and 4, and Connecticut was well represented. Sid Holbrook and Tom Sgroi of the Greater New Haven Water Pollution Control Authority, Art Simonian of the Mattabassett District, Connecticut Association of Water Pollution Control Authorities (CAWPCA) President Denis Cuevas, NEWEA Vice President Virgil Lloyd, Mike Headd of Woodard & Curran, Rachel Watson of Stantec, and NEWEA State Director Bill Norton represented our state. The Connecticut contingent met with six out of our seven legislative delegates' staffs, and met directly with congressional representatives John Larson, Joe Courtney, and Rosa DeLauro, impressing on them the critical importance of preserving clean water and the infrastructure. Handouts included the following:

- America's Water Infrastructure—Today's Needs for Our Nation's Future
- Water Reuse—Transforming Water
- Sustaining Our Future
- Water's Worth It
- Value of Water
- PFAS—A Class of Contamination of Emerging Concern

The Connecticut contingent emphasized to the legislators and their staffs the importance of including wastewater utilities in the upcoming infrastructure bill and the critical role that these utilities and associated infrastructure play in the sustainability of our society. Our members have also made inroads with the legislators by having "drive-ins" at their local offices here in the home state. Mr. Cuevas met with Representative Jahana Hayes in her Waterbury office, and the staff at the Fairfield water pollution control facility were visited by Representative Jim Himes at their Memorial Day picnic on May 24. At both of those visits, we communicated our message about the need for federal funding of wastewater projects.

Upcoming 2019 CWPAA/CAWPCA Events		
CAWPCA Fall Workshop	October 25	Aqua Turf Club, Plantsville
Managers' Forum	November 21	MDC Training Center, Hartford

DEEP/Municipal POTW Proposed MISC General Permit Changes and Associated Issues

On January 14, 2019, the Connecticut Department of Energy and Environmental Protection (DEEP) issued a public notice regarding the proposed issuance of the General Permit for Discharges of Miscellaneous Sewer Compatible (MISC) Wastewater from Industrial Users. The MISC permit was originally issued on October 25, 2013, reissued May 3, 2018, and will expire on October 30, 2020.

The most significant proposed change in this permit is that it requires the publicly owned treatment works (POTW) authority to administer the permit, while the current permit is administered by DEEP. Under the current permit, the POTW is responsible for all wastewater, but only after it has been discharged into its system, with the right to inspect any facility to review its wastewater generating operations; since the 1970s, DEEP has administered and enforced the permits with the industrial users.

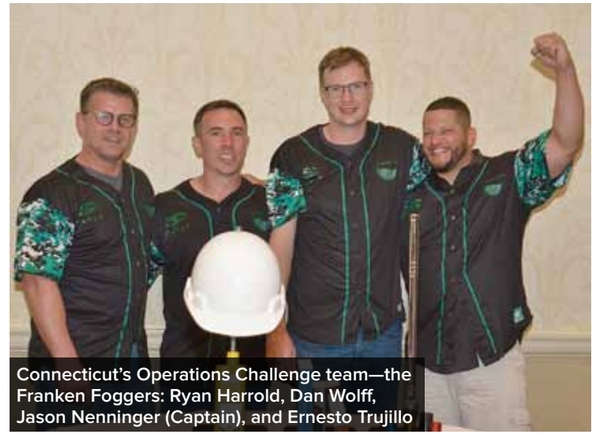
In proposing the change of responsibility, DEEP originally stated that the change was necessary due to decreases in staff. After many POTW representatives noted that they also have decreased staffing issues, DEEP took the position that the POTW has always managed the wastewaters in question and that therefore the change does not result in a practical increase in the workload for the POTWs.

The POTWs have challenged this proposed General Permit (GP) for the following reasons:

- There are doubts about the DEEP's authority to issue a permit while assigning responsibility to the POTWs for administration of said permit.
- Strict nitrogen and phosphorus removal programs have already markedly increased user fees, and the POTWs cannot at this sensitive time add further fee increases to accommodate this permit alteration.
- POTWs do not have staff with the needed information and skills to answer questions about the permits, review permit registrations, process fees, and revise their ordinances to support this GP.
- The proposed GP creates conflicts for many POTWs between their responsibilities under this state-issued permit and their inter-municipal agreements.

With the altered GP, many of the POTWs would be forced to renegotiate their inter-municipal agreements to address this added responsibility.

A petition was filed for a public hearing. In the meantime, a stakeholder group has been formed, and representatives of Connecticut's POTWs have had several meetings with DEEP to find a solution.


Connecticut's Operations Challenge team—the Franken Foggers: Ryan Harrold, Dan Wolff, Jason Nenninger (Captain), and Ernesto Trujillo

CWPAA Product Show

The Connecticut Water Pollution Abatement Association (CWPAA) hosted its 34th Annual Trade Show on April 25 at the New Life Church in Wallingford. Seventy vendors covering the gamut of the wastewater trade were in attendance, and 170 operators and managers visited the show. NEWEA Executive Director Mary Barry staffed the NEWEA booth; it is always a pleasure to receive such support from NEWEA. Other support organizations in attendance were DEEP, Connecticut OSHA, Connecticut River Conservancy, and New England Interstate Water Pollution Control Commission. The always-popular raffle sent each of four happy winners away with a $100 bill. The event has been held at this location for several years; the church treats us very well, and the staff even makes up special water-themed table decorations for us.

CAWPCA Spring Workshop

The Aqua Turf Club in Plantsville was the setting once again for the CAWPCA Spring Workshop. The event was well attended by managers throughout the state and consultants from all over New England. A highlight of this year's event was the guest speaker, DEEP Commissioner Katie Dykes. Commissioner Dykes offered an overview of the department's goals and what they hope to accomplish. She also answered questions from the audience. The event included several workshops: *DEEP Updates, Legislative Update, Tech Talk, Resiliency Approaches & Reducing Risks at Pump Stations, Stratford Living Shoreline Project,* and *PFAS – Experience from Halfway Around the World.* An award ceremony was held, and CAWPCA President Mr. Cuevas presented Andrew Lord with the Presidential Excellence Award.

2019 Sewer Open

As always, in 2019 the CWPAA Sewer Open was held on the third Friday of June (June 20). Extraordinarily, this year the weather did not cooperate with us, but that did not dampen the spirits of the 120 golfers who participated. As the day progressed, the sky turned brighter and the participants greatly enjoyed a day of golf, casual networking, and a picnic. Thanks to our tee sponsors, the festivities raised $4,200 for the CWPAA Scholarship fund, awarded to five recipients attending college with environmental majors. Through the raffle of a fairway driver, $1,100 was raised to help defray costs for our Operations Challenge team, the Franken Foggers, who did very well at the New England regional Operations Challenge competition. With five teams competing, they took three first-place awards and one second-place award. Congratulations to them, and we wish them good luck at the national competition in Chicago. For the great success of this year's Sewer Open, we thank all the individuals who gave their time, our dependable tee and green sponsors, and those who generously donated raffle prizes.

Managers' Leadership Program Wrap-Up

Art Enderle's successful Connecticut Wastewater Managers' Training Program wrapped up its fifth season on June 24, 2019. Eighteen students successfully completed the 10-month program and will graduate at a ceremony planned for the annual Managers' Forum on November 21, 2019. Participants came from water pollution control facilities across Connecticut. Mr. Enderle stated, "Many former graduates of the program have realized promotions both into management and advancement into upper management. There are many new superintendents and chief operators who have come out of this program. Many great relationships have been formed as a result of the networking that occurred at the program. The Managers' Training Program would not be possible without the help and support of the individual instructors who help throughout the program and organizations such as the Connecticut Water Pollution Abatement Association, Connecticut Department of Energy and Environmental Protection, Connecticut Certification Advisory Committee, New England Interstate Water Pollution Control Commission, and all of the superintendents who allow their operators to attend."

Massachusetts State Director Report

by Justin deMello
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Washington, D.C. Fly-In

On April 3 and 4, 16 water professionals from Massachusetts and nearly 40 from New England met in Washington, D.C., as part of the Water Week 2019 National Water Policy Fly-In. The event was organized by the National Association of Clean Water Agencies (NACWA) and WEF. Representatives from all 50 states gathered on Capitol Hill to meet with state legislators to discuss the importance of water and encourage the continued investment in our most precious resource. Representing Massachusetts and the Massachusetts Water Pollution Control Association (MWPCA) were Ray Willis of Onsite Engineering and Justin deMello of Woodard & Curran. The extended Massachusetts contingent included NEWEA and Massachusetts Water Works Association (MWWA) members.

Over the two days, the Massachusetts team conducted meetings with Senators Markey and Warren, and visited Representatives Neal, Lynch, Clark, Keating, Kennedy, Moulton, and Trahan. While most of our discussions focused on continued investment in our municipal infrastructure through grants, Water Infrastructure Finance and Innovation Act (WIFIA), and the State Revolving Fund (SRF) program, we also discussed our aging workforce, the Water Warriors Initiative, and the infamous perfluoroalkyl and polyfluoroalkyl substances/perfluorooctanoic acid (PFAS/PFOA).

It was an incredible opportunity to meet face to face with legislators, get on our soap box, and remind our leaders that while the taps keep flowing and the toilet water keeps disappearing, we are not forgotten and investment in water is necessary and worth it.

Mickey Nowak MWPCA Executive Director, State Representative Norman Orrall (12th Bristol District), Jaimye Bartak Springfield Water and Sewer Commission, and John Downey MWPCA President Elect, talking wastewater at Water's Worth It day

State Legislative Event

On May 22, MWPCA hosted the annual legislative Water's Worth It Day event at the State House in Boston with MWWA and the American Council of Engineering Companies of Massachusetts (ACEC/MA). For the third straight year, MWPCA joined MWWA and ACEC/MA to create a strong industry-wide message around the importance of water and infrastructure investment. The event included scheduled meetings with State Representatives and legislators in the morning followed by a networking lunch. Hot topics included PFAS/PFOA, infiltration/inflow (I/I) regulation changes, Municipal Separate Storm Sewer System (MS4), aging workforce, lead in drinking water, and climate resiliency. With more than 100 in attendance, our presence resonated, and our message was clear. We hope to build upon the successes of this year's event and double the turnout next year.

Spring Meeting

MWPCA hosted its spring quarterly technical meeting on March 20, 2019, at the Devens Common Center in Devens. The meeting was technology focused, starting with a great overview of the Devens wastewater treatment facility (WWTF). Other presentations included sludge dewatering technologies, UV disinfection, and a collection system rehabilitation project in Uxbridge. More than 70 attended the sessions and lunch.

Summer Meeting

MWPCA hosted the western regional meeting on June 12, 2019, at the Log Cabin in Holyoke. The meeting was safety focused with a kickoff presentation from Jeff Gamelli on the Westfield WWTF. Other topics included gas meter testing, lone worker safety devices, upgrades to two secondary clarifiers in Chicopee, and Top 10 OSHA violations at WWTFs. Nearly 90 attendees partook in the technical sessions and the always delicious catered lunch and networking.

Golf Outing

On June 18, MWPCA hosted its Annual Golf Tournament at Shaker Hills in Harvard. The smell of freshly cut grass, the buzz of golf carts, the "pings" off the tee, and the shouts of happy golfers could be heard throughout the day. The venue was spectacular, and the turnout was good. Next year, MWPCA will relocate the golf event to the easily accessed Heritage Country Club in Charlton. The already-booked date is June 17, 2020; please mark your calendars and join us.

Management Training

New England Interstate Water Pollution Control Commission, Massachusetts Department of Environmental Protection, and MWPCA have kicked off another Massachusetts Wastewater Management Training Program this year. Twenty-two registrants are taking advantage of this one-year program aimed at developing essential skills to propel candidates into management positions. Topics to be covered include Introduction to Management, Advanced Process Control, Working with the Media, National Pollutant Discharge Elimination System (NPDES) Permitting and State Regulations, Engineering Design and Blueprint Reading, Preventive Maintenance, Microbiology, Finance and Budgeting, and Job Shadowing.

Operations Challenge

After many dry years, Massachusetts had an Operations Challenge team who attended a spring training event in Rhode Island and then represented MWPCA at the regional competition in New Hampshire in June. While our team, the Resource Revolution, did not bring home a championship, they gained valuable experience for a more seasoned run in 2020. Kudos and thanks to our 2019 Operations Challenge team: Dennis Flores, Scott Urban, Brian Pelitier, and Tyler Schofield. We look forward to cheering you on at next year's events! Local competition sharpens skills. If anyone else is interested in having fun while networking and learning plant and people skills, think about pulling together a team to compete for next year. It has been many long years since there was an intrastate competition in Massachusetts.

The Resource Revolution, our Massachusetts Operations Challenge team: Scott Urban, Dennis Flores, Tyler Schofield, and Brian Pelitier

Operator Exchange

This September, Massachusetts and Rhode Island sent a wastewater operator to each other as part of this year's Operator Exchange. The all-expenses paid trip included chauffeuring a lucky operator from Massachusetts around to several facilities across the state of Rhode Island. The tour was spread over three days and aligned with the Narragansett Water Pollution Control Association (NWPCA) Annual Conference that was held at the Twelve Acres in Smithfield, while the Rhode Island operator toured a variety of Massachusetts facilities, finishing up at our fall meeting at the Wachusett Mountain resort.

This is an incredible opportunity for operators to tour several facilities, learn about different technologies, network with peers, and build lasting friendships within the industry. The lucky operator representing Massachusetts this year was Operations Challenge team member Scott Urban of Westfield. Congratulations, Scott. We look forward to hearing about your visit to the Ocean State!

Vermont State Director Report

by Chris Robinson
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Spring Meeting

The Green Mountain Water Environment Association (GMWEA) Spring Meeting took place in Killington on May 23. Approximately 200 participants attended this event. Nine training sessions were offered, as well as the annual election. The following are the GMWEA board of directors:

- President – Tom DiPietro
- 1st Vice President – Mike Barsotti
- 2nd Vice President – Chris Cox
- Secretary – Amy Macrellis
- Treasurer – Wayne Elliott
- Past President – Rick Kenney
- Directors – Steve Crosby, Bob Fischer, Ryan Peebles, Chris Robinson, and Eileen Toomey

GMWEA's annual awards were presented at the luncheon. Check out the GMWEA website for a list of the winners. A special thank you to NEWEA Executive Director Mary Barry for attending and to NEWEA Treasurer Clayton "Mac" Richardson for re-presenting the NEWEA awards to worthy Vermonters.

NEWEA Spring Meeting

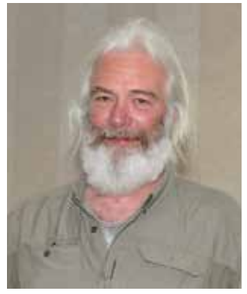
Three GMWEA board members attended the NEWEA Spring Meeting along with a few committee members. Congratulations to James Sherrard, stormwater coordinator, town of Williston (now in Burlington) for an excellent stormwater presentation, "Meeting TMDL Requirements."

Water Quality Day

Since 2014, GMWEA has celebrated Water Quality Day each year on May 30. This year, 18 facilities participated, providing guided tours to the public through utilities ranging from wastewater treatment to water treatment and filtration to stormwater treatment systems. Hundreds of Vermonters participated. For more information check out our website.

George Dow Memorial Golf Tournament

Each year nearly 100 players and sponsors take part in this annual event. This year the event was held on August 23. It was a great success, and fun was had by all. The proceeds from this event help fund the GMWEA scholarship administered by the Vermont Student Assistance Center.



Rod Munroe of Rutland City (recently retired) received the Andrew D. Fish Laboratory Excellence Award

Chelsea Mandigo of Essex Junction Village received the GMWEA Stormwater Award

60th Annual Vermont Science, Technology, Engineering, and Mathematics Fair/Stockholm Junior Water Prize

GMWEA board members volunteered again this year to judge water-related projects at the fair. GMWEA uses this venue to select a candidate for the Stockholm Junior Water Prize. The event was held on March 30 at Norwich University. Congratulations to Virginia Snyder, an 11th grader at Windsor School, for winning our top award for her project "Designing a Solar-powered Ultrasonic Cyanobacteria Growth Inhibitor."

Don't Flush It! Campaign

The first brochure in GMWEA's Vermont Water-wise Communities Initiative, "Don't Flush It! Volume 1: Cloggers!" is now available. It is a guide to saving money and hassle and protecting the environment by knowing what not to flush, pour, or spill into your private septic tank or municipal sewer system. To download a print-ready PDF of "CLOGGERS!" visit the GMWEA website. It is free for reproduction and distribution for any nonprofit, public use.

Stormwater Training

GMWEA provided a training session on the new Vermont Stormwater Manual that was released in 2018. The training was held on September 20 at the Vermont Agency of Natural Resource Annex Building in Montpelier.

Government Affairs

Bob Fischer, GMWEA and NEWEA Government Affairs Committee chair, has been successful in scheduling quarterly regulator meetings. The meetings with Vermont's Agency of Natural Resources/Department of Environmental Conservation (ANR/DEC) staff have been mutually beneficial for all. The two-hour meetings are held in Montpelier, with approximately 25 attendees.

Vermont's bicameral legislature consists of the 150-member House of Representatives and the 30-member Senate. Elections are held in November of every even-numbered year, and everyone serves two-year terms. The biennial terms commence on the first Wednesday following the first Monday in January. The legislative sessions run January through May, with "crossover" taking place before the end of March; this means a legislator has less than three months to bring up a bill, learn the facts, pass the bill, and "cross it over" to the other house. The "learn the facts" part is where we come in. With hundreds of bills to consider, a legislator with potentially limited or no knowledge on a technical subject has little time to learn the material, and confusion can result when there are parties testifying on opposing sides of an issue during informational hearings. This can make it especially difficult for water quality experts, who often have limited time to go to the State House to support their argument, while there are opposing groups who are paid to be there every day and are well known to the legislators. Despite these difficulties, in 2019 a few water quality bills passed both chambers and were signed into law by the governor.

Act 76 shifts 6 percent of the rooms and meals tax to fund clean water projects, a measure expected to generate $12 million annually after 2021. It also commits more than $20 million of state funds toward leveraging other funding sources each year resulting in an estimated annual clean water investment of more than $50 million. EPA offered the following comments in a letter to Vermont ANR on July 11, 2019: "EPA is very pleased with the state's passage of Act 76. In combination with the other dedicated clean water funding sources enacted by the Vermont legislature since 2015, Act 76 is expected to produce long-term funding levels in the ballpark of the needs identified by the 2017 Vermont state treasurer's report and Vermont's Act 73 report." The funding components of Act 76 allow Vermont to meet another of the 28 2016 EPA milestones and a new Lake Champlain total maximum daily load (TMDL) plan, and EPA's endorsement confirms that Act 76 complies with that plan. Another aspect of Act 76 divides the Lake Champlain basin into 17 watersheds and creates a "clean water service providers" model, which Vermont ANR hopes will give local experts more control over their watersheds. Over the next 18 months ANR will develop pollution reduction targets and develop a method for choosing the providers for each watershed. Existing regional planning commissions and conservations districts are likely candidates.

Act 21 requires all public community and non-transient, non-community water systems to conduct monitoring on or before December 1, 2019, for the maximum number of perfluoroalkyl and polyfluoroalkyl substances (PFAS) detectable using standard analytical methods. After initial monitoring, water systems will conduct continued monitoring until ANR adopts a maximum contaminant level (MCL) for five listed PFAS (regulated PFAS contaminants). If initial monitoring detects regulated PFAS contaminants at or above 20 parts per trillion (ppt), a system will conduct quarterly monitoring; if initial monitoring detects regulated PFAS contaminants at or above 2 ppt but below 20 ppt, a system will monitor annually; if initial monitoring detects regulated PFAS contaminants below 2 ppt, a system will conduct monitoring every three years; if monitoring confirms regulated PFAS contaminants in excess of 20 ppt, the water system will implement treatment to reduce PFAS contaminants in the drinking water below 20 ppt.

On or before February 1, 2020, ANR will adopt by rule a maximum contaminant level (MCL) for regulated PFAS. The act requires ANR to issue a plan to regulate PFAS in surface waters (possibly affecting wastewater facilities). On or before January 1, 2020, ANR shall adopt, at a minimum, water quality standards for the regulated PFAS contaminants. GMWEA's executive director testified before the Senate Natural Resources and Energy Committee. The committee was considering setting limits immediately but agreed to the House version, which tasks ANR with the above-listed testing. Letters to wastewater facilities that are targeted for testing by the ANR Solid Waste Management Program were received on July 30, 2019.

Act 66 relates to testing and remediation of lead in the drinking water of schools and child care facilities that requires all school districts, supervisory unions, independent schools, and child care providers to test for lead in the drinking water from outlets in each building or facility it owns or controls. Initial sampling will be conducted by December 31, 2020. Prior to sampling, a school or childcare provider will notify parents, guardians, and staff of requirements for testing, sampling results, and the response to be taken if lead is present in drinking water at or above the action level of 4 parts per billion (ppb).

Upcoming Events

The GMWEA Fall Trade Show and Conference will take place on October 30, 2019, at the DoubleTree Hotel and Conference center (formerly the Sheraton) in South Burlington.

Rhode Island State Director Report

by Scott Goodinson
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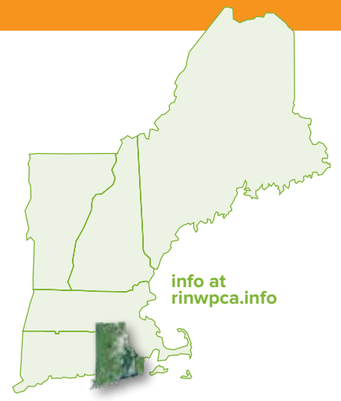

The Narragansett Water Pollution Control Association (NWPCA) continues to thrive and grow. Our membership, committees, and events get better and better every year. We celebrated again this year our very own Ocean State Alliance's first place win at the Operations Challenge regional competition held during NEWEA's Spring Meeting. We wish the team congratulations and best of luck in the Windy City at WEFTEC 2019 in September!

Who's who—our board members

President Peter Eldridge is the wastewater superintendent in Narragansett, and previously served as an asset manager for United Water. Mr. Eldridge may be best known for his 23 years of operating the West Warwick facility. He has been active in both NWPCA and NEWEA for decades.

Vice President Pete Connell has over two decades of experience in the industry, and now manages projects for Inland Waters, Inc., a pipeline services consultant and contractor based in Johnstown. He has long been an active participant in NWPCA.

Treasurer James Lauzon, superintendent of the Woonsocket water pollution control facility (WPCF), has 44 years of experience in operating facilities from Gloucester, Massachusetts, to Newport. He was active in the Massachusetts Water Pollution Control Association before migrating to Rhode Island, where he has long been active in NWPCA.

Secretary Nora Lough has been the biologist at the Narragansett Bay Commission (NBC) since 2005, where she is responsible for the biological work for NBC's two major wastewater treatment facilities. Ms. Lough has also taught many lab and data-focused workshops throughout New England. She is active on the NEWEA Laboratory Practices Committee and is an Operations Challenge judge.

Executive Board Member Bernard Bishop is chief operating officer at the West Warwick Wastewater Department after decades as the superintendent at the South Kingstown regional wastewater treatment facility (WWTF). Mr. Bishop has long served in officer positions in both NWPCA and NEWEA.

Executive Board Member Michael Spring has more than 25 years of experience in the wastewater industry in various maintenance, management, operations, and safety roles. Mr. Spring has also aided the Rhode Island Operations Challenge program as coach, team captain, and committee chair. He is known for his documentation of NWPCA and NEWEA events through his photographs, generously offered gratis for association publication and distribution.

Executive Board Member Michael Bedard serves on the operations staff at the West Warwick Regional Wastewater Facility, where he has shown exemplary service to the town and to NWPCA. He received the NEWEA Alfred E. Peloquin award for Rhode Island in 2014.

Executive Board Member Vincent Russo, Jr. is a licensed electrician and Grade 2 operator for the West Warwick Regional Wastewater Facility. With 16 years of service in the wastewater industry, Mr. Russo has competed for five years on the Rhode Island Operations Challenge team, Ocean State Alliance, helping lead the team to consecutive regional championships.

Director of Vendor/Consultant and Coordination Christopher Campo is a Young Professional (YP) with Seacoast Supply, Inc., long a supporter of NWPCA. Chris brings the YP vendor's perspective to the association's event planning and enhancement of the members' experience.

Director of Vendor/Consultant and Coordination Steven Buckley, executive vice president of Fusion Environmental Services, brings more than 40 years of experience in the engineering and O&M services business to bear on the important vendor/consultant role in NWPCA activities. Mr. Buckley has long been an active vendor and exhibitor within both NWPCA and NEWEA events.

Operator Certification Board Representative Paul Desrosiers of NBC is the superintendent of the 65 mgd (246 ML/d) NBC Fields Point WWTF. Mr. Desrosiers is known for his long service and involvement in NWPCA and NEWEA, where he served as state director.

NEWEA State Director and NWPCA Past President Scott Goodinson, the superintendent at the 7.7 mgd (29 ML/d) Warwick Sewer Authority plant, has worked in the wastewater industry for nearly 30 years. Mr. Goodinson holds numerous industry certifications. A long-time NWPCA board member, he is also known for his participation on Rhode Island's "Fecal Matters" Operations Challenge teams.

NWPCA thanks all the above for their dedicated service to the association and the industry.


Traci Pena and Melissa Mooradian volunteered at the golf outing

Round-up of Activities

On March 27, NWPCA members sponsored and participated in the Rhode Island Clean Water Legislative Luncheon at the House Chambers in the State House in Providence. Valuable contact was made with our state legislators, reminding them of the importance of public fiscal support for our clean water efforts.

Five of our wastewater treatment and reclamation facilities held "open houses" on March 29 and 30, where the public was invited to tour the plants and ask questions in an informal gathering with refreshments served. All participating facilities reported sizeable public interest in our work.

NWPCA board members attended the career fair that was held at the high school in Johnston on April 11. Important career information and industry goodwill was conveyed to attending students who were seeking facts and ideas to help with their future career employment decisions.

The New England Operations Challenge Training Day was held at the West Warwick regional WPCF on April 12. Operators from five states learned about the events and networked in a casual learning environment. The event included a tour of the treatment facility.

Several NWPCA board members volunteered again this year to judge the 2019 Rhode Island Science and Engineering Fair. More than 250 students entered projects this year. Our top three selections were forwarded to the NEWEA Stockholm Junior Water Prize subcommittee for consideration. Congratulations to the Rhode Island winner, Brooke Newbury, a 10th grader from St. Mary Academy – Bay View, in Riverside. Her project was entitled, "Using Aloe Vera to Purify Water," (see page 58) and she did an awesome job!

Award Nominations

NWPCA award nominations were reviewed, and the award winners were selected for well-deserved recognition:

- James Marvelle Leadership Excellence Award – Kim Sandbach
- Collections System Operator of the Year – Joe Colicchio
- Robert Markelewicz Award for Outstanding Maintenance Contributions – Dave Brouillard
- Joseph Mattera Safety Award:
  - More than 5 mgd (19 ML/d) – West Warwick WPCF
  - Less than 5 mgd (19 ML/d) – Narragansett WPCF
- Plant Performance Awards:
  - Platinum – Narragansett, Burrillville, and New Shoreham facilities
  - Gold – Cranston, South Kingston, Smithfield, and Quonset Point facilities
  - Silver – NBC, Fields Point, Warwick, and Woonsocket facilities

Congratulations to all for a job well done.

Annual Golf Outing

NWPCA held its annual golf outing on Monday, June 24, at the Potowomut Golf Club, in Warwick, and it was another successful sell-out, with golfers enjoying a great barbecue lunch, dinner, and prizes. In addition, there is a more informal weekly golf outing at the beautiful Richmond Golf Club for a fun but competitive nine holes and a "10th hole" network gathering—it is a great way to meet old friends or make new ones.

Events and Updates

NWPCA is committed to getting our message out while serving our members and promoting our ever-changing business. Our industry's continued success for Rhode Island, NEWEA, and WEF depends on all of us. Please visit the NWPCA website or Facebook page for all events and updates at rinwpca.org and facebook.com/NWPCA.

2019 SPRING MEETING & EXHIBIT *Proceedings*

The New England Water Environment Association held its Annual Spring Meeting on June 2–5, 2019, at Wentworth by the Sea in New Castle, New Hampshire. Meeting registrants totaled 241. Registrants included 165 members, 30 non-members, 15 Operations Challenge participants, and 16 guests. The meeting also featured 18 exhibit booths.

A full NEWEA Executive Committee meeting with committee chairs was held on Sunday, June 2, 2019, with NEWEA President Ray Vermette presiding. In addition to the Opening Session, there were nine technical sessions

BREAKFAST & GENERAL OPENING SESSION

Moderator:
- Amy Anderson, NEWEA Program Committee Chair, Arcadis

Welcome
- Ray Vermette, NEWEA President, Dover, NH

Featured Speaker:
- Jeanne Shaheen, United States Senate, New Hampshire

SESSION 1
INNOVATIVE SOLUTIONS TO EVERYDAY PROBLEMS

Moderators:
- Matt Formica, AECOM
- Kate Biedron, CDM Smith

A Global Community Within Anaerobic Ammonium Oxidizing Bioreactors
- Jennifer Lawrence, Tighe & Bond
- Ray Keren, University of California/ Berkeley

How to Meet Water Quality Requirements by Shutting your Plant Down . . . Permanently: HRSD's Program to Decommission a 24-MGD WWTP to Satisfy TMDL Water Quality Regulations
- Will Schafer, Kimley-Horn
- Jacob Williams, Kimley-Horn

A Synergistic Approach to Net Zero Resource Recovery Facilities—Success Story and Innovations at Hermitage Municipal Authority
- Sudhakar Viswanathan, Veolia Water Technologies
- Thomas Darby, Hermitage Municipal Authority
- Meg Hollowed, Veolia Water Technologies
- Jason Wert, Rettew

Targeted Phosphorus Recovery
- Justin Wippo, Thermal Process Systems

SESSION 2
COLLECTION SYSTEMS—PROACTIVE TOOLS AND EMERGENCY RESPONSE

Moderators:
- Brad Hayes, Woodard & Curran
- Scott Lander, Retain-It

1. U.S. Senator Jeanne Shaheen from New Hampshire delivers the keynote address **2.** Local schoolchildren were welcomed for two performances by Mr. and Mrs. Fish **3.** The historic Wentworth by the Sea was a stately venue **4.** NEWEA President Ray Vermette takes his duties seriously when it comes to attracting Young Professionals **5.** Vonnie Reis and Brad Hayes network **6.** The latest 5S recipients are subjected to the traditional induction ritual **7.** Guest Mike Zimmer waves from the crowd at the President's Reception

Big Sewer Break—Big Problems
- Jeremy Bouvier, City of Manchester, NH EPD
- Ben Horner, Hazen and Sawyer
- Fred McNeill, City of Manchester, NH EPD

Prescriptive Cleaning May be a Bitter Pill to Swallow but Some Municipalities are Finding a New Tech-Cure
- Jay Boyd, ADS LLC
- Matthew Brown, ADS LLC

GIS Tools for Management and Manipulation of Wastewater Infrastructure Data
- Michael Hanley, Dewberry
- Peter Garvey, Dewberry

Nantucket's Emergency Response to Catastrophic Force Main Break—January 2018
- Paul Millett, Environmental Partners Group, Inc.
- David Gray, Jr., Town of Nantucket, MA
- Ziad Kary, Environmental Partners Group, Inc.

SESSION 3A
PHOSPHORUS REMOVAL—MONITORING STRATEGIES AND INNOVATIVE TECHNOLOGIES

Moderator: Ned Beecher, NEBRA

Orthophosphate Monitoring and Phosphorous Removal Control
- Myra Michaels, Xylem
- Benjamin Barker, Xylem
- Robert Smith, Xylem

Rare Earth Technology in Wastewater Treatment
- Logan Wherry, Neo Water Treatment

SESSION 3B
SYSTEM OPTIMIZATION FOR ENERGY SAVINGS AND ENERGY USE

Moderator: Sharon Nall, NH DES

Optimizing Biosolids Processing, Energy Reuse and Sidestream Treatment
- Meg Hollowed, Veolia Water Technologies
- Sudhakar Viswanathan, Veolia Water Technologies
- Brad Mrjdenovich, Veolia Water Technologies

City of Manchester, NH WWTF Boiler Upgrade Project
- Robert Robinson, City of Manchester, NH EPD
- Robert Morris, City of Manchester, NH EPD
- Ryan Nealley, Yeaton Associates, Inc.

SESSION 4
STORMWATER STRATEGIES—PLANNING FOR SUCCESS

Moderators:
- Natalie Pommersheim, Environmental Partners Group, Inc.
- Renee Bourdeau, Horsley Witten Group

Stormwater Master Planning for Urban and Rural Communities
- Dana Allen, Watershed Consulting Associates, LLC
- Kerrie Garvey, Watershed Consulting Associates, LLC
- Becky Tharp, Watershed Consulting Associates, LLC
- Andres Torizzo, Watershed Consulting Associates, LLC








1. Denise Descheneau, Zach Henderson, Phil Tucker, and Linda Carroll attend the Public Awareness Committee meeting **2.** Back seat, Mike Curry and Henry Albro; front seat, Tim Vadney and John Jackman on the bus heading off to tour the Peirce Island WWTF in Portsmouth **3.** Ginny Roach presents a New England Stormwater Coalition Stormy Award to Katie Chloe and Julie Eaton for their climate resilience work in the city of Boston

Credit for Going Green: Expert Elicitation Methods to Develop Pollutant Load Reductions from Buffers
- James Houle, University of New Hampshire Stormwater Center

Stormwater Management in Multiple Dimensions
- Carol Hufnagel, Tetra Tech

Meeting TMDL Requirements: Municipal Incentives and Support for Private Stormwater Updates
- James Sherrard Jr., Town of Williston, VT

SESSION 5
INNOVATION IN OUR INDUSTRY

Moderators:
- Jim Barsanti, City of Framingham, MA
- Heidi Baird, Tighe & Bond

Installation of Screw Press for Solids Dewatering at Westerly WWTF
- Stephen Clark, Jacobs
- Nick De Gemmis, Jacobs
- Kevin Dahl, Jacobs

Case Study: UV Upgrade Produces Real Energy Savings for Ayer, MA WWTP—How Innovative Non-Contact Technology Cut Power Consumption and Costs
- Kenneth Harwood, Town of Ayer, MA
- Thomas Valorose, Russell Resources, Inc.

RMI and Shincci Sludge Dryer—Game Changer for Biosolids Management
- Shelagh Connelly, RMI Recycles
- Charley Hanson, RMI Recycles

Self-Leveling Manhole Technology—Protecting the Integrity of Your Roadways and Minimizing Maintenance Costs
- Brian Steitz, EJ
- Craig Coggins, EJ

SESSION 6
2018 STORMY AWARDS—BEST IDEAS IN NEW ENGLAND STORMWATER

Moderators:
- Zach Henderson, Woodard & Curran
- Kerry Reed, City of Framingham, MA

Municipal and institutional stormwater management programs in New England are challenged by limited dedicated funding, political support, and staff capacity. Each year, the New England Stormwater Collaborative, a joint committee of NEWWA, NE APWA and NEWEA, awards exceptional ideas that are changing that situation. This session provided an overview of the STORMY Award program, presented the 2018 winning ideas, and ended with a panel discussion

The 2018 New England Stormy Award winners are:

Franklin Tree Wells
- Brutus Cantoreggi, Town of Franklin, MA

Think Blue Massachusetts—A Statewide Education Campaign to Build Awareness of Stormwater
- Robin Leal Craver, Town of Charlton, MA and MA Statewide Municipal Stormwater Coalition

Climate Resilient Design Standards and Guidelines for Protection of Public Rights of Way
- Katie Choe, City of Boston, MA DPW

Panel Discussion on Past and Present STORMY Award Winning Ideas

1. John Adie, Paul Hogan, Susan Guswa, and Tim Loftus listen as Karla Sangrey (center) stresses a point **2.** Roberto Vengoechea speaks on promoting workforce diversity **3.** Jennifer Lawrence discusses anaerobic ammonium oxidizing reactors **4.** Will Schafer and Erica Carter jointly present an innovative approach to regulatory satisfaction **5.** Erika Rodriguez shares her perspective on diverse workforce success

SESSION 7
WATER TECHNOLOGY AND INNOVATION—EMBRACING FORWARD-THINKING APPLICATIONS AND SOLUTIONS TO ADVANCE THE NATION'S CLEAN AND SAFE WATER GOALS

Moderators:
- Helen Gordon, Environmental Partners Group
- Deb Mahoney, Hazen and Sawyer

Water Innovation—Inspire, Connect, and Accelerate the Revolution
- Prof. David Reckhow, University of Massachusetts/Amherst
- Patrick Wittbold, University of Massachusetts/Amherst
- Michael Murphy, MA Clean Energy Council
- Miles Walker, Woodard & Curran

Workforce Diversity—Attracting and Retaining a Diverse Workforce in the Water Industry

Roberto Vengoechea, Watts Water Technologies
- Jacqueline Ashmore, Boston University Institute of Sustainable Energy
- Erika Rodriguez, Chica Project

SESSION 8
RESILIENCY STRATEGIES—BRACING FOR CHANGE

Moderators:
- Patrick Gordon, StormTrap
- Vinta Varghese, Jacobs

The City of Quincy Coastal Flood Mitigation & Infrastructure Resiliency Strategies
- Marina Fernandes, Tighe & Bond
- Paul Costello, City of Quincy, MA
- Gabrielle Belfit, Tighe & Bond

Resilient Design and Regulating for Climate Change
- Annique Fleurat, VHB
- Mark Costa, VHB

Living with the Bay Rebuild by Design Resiliency Strategy: The Plan, The Program, The Projects
- Jake Oldenburger, Tetra Tech
- Michael Bomar, Tetra Tech
- Jason Hellendrung, Tetra Tech

Advancing Statewide Risk Reduction and Resilience in Massachusetts
- Aaron Weieneth, AECOM

SESSION 9
PLANT OPERATIONS

Moderators:
- Tom Hazlett, Woodard & Curran
- John Adie, NH DES

Addressing Brain Drain in Portland, Maine
- Scott Firmin, Portland Water District
- Charlene Poulin, Portland Water District

Updating a CSO Facility with New Technology and No Interruption in Service
- Roger Kaliman, Tetra Tech
- Carol Hufnagel, Tetra Tech

A Multi-Sector Approach to Reduce Energy Consumption and Optimize Process Efficiency at the Upper Blackstone
- Edris Taher, Upper Blackstone Clean Water
- Karla Sangrey, Upper Blackstone Clean Water
- Tim Loftus, Upper Blackstone Clean Water


1


2


1


2


3


4


3


4

1. At the tournament, Deb Mahoney triumphantly plants the flag as teammate Dave Miller addresses the winning ball **2.** The colorful Jim Galasyn and Andy Fish were tough judges in the Ops Challenge laboratory event **3.** Kim Sandbach, Kate Biedron, Janine Burke-Wells, Nora Jean Lough, Nicole LaBoy, and Adam Yanulis strike a pose prior to the Tuesday evening dinner **4.** Phil McHenry of the New Hampshire Seacoast Sewer Snakes mounts a rescue harness on the "victim" during the safety event competition

Opening the Floodgates of Experiential Learning for Students of All Ages
- Nick Tooker, University of Massachusetts
- Todd Brown, University of Hartford
- Annalisa Onnis-Hayden, Northeastern University
- Nels Tooker, Newington, NH Public Schools

OPERATIONS CHALLENGE

Operations Challenge Committee:
Travis Peaslee, Chair
Scott Goodinson, Vice Chair

Operations Challenge was held on June 3–4. Five teams participated in the competition:

Connecticut – Franken Froggers
Jason Nenninger (Captain), Ryan Harrold, Dan Sullivan, Ernesto Trujillo, Dan Wolff

Maine – Force Maine
Riley Cobb (Captain), Shelby Carver, Nate Melanson, Dan Munsey

Rhode Island – Ocean State Alliance
Eddie Davies (Captain), Nicole LaBoy, Vinnie Russo, Kim Sandbach

Massachusetts – Resource Revolution
Dennis Flores, Brian Pelitier, Tyler Schofield, Scott Urban

New Hampshire – Seacoast Sewer Snakes
Patty Chesebrough, David Jones, Philip McHenry, Michael Patrick, Dan Tanzella

The Operations Challenge Awards Reception was on June 4. Committee Chair Travis Peaslee and each event coordinator, assisted by NEWEA President Ray Vermette, presented trophies to the winning teams of each event and to the overall first-, second-, and third-place teams. The results are as follows:

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

Overall Competition
- First Place – Rhode Island
- Second Place – Connecticut
- Third Place – Maine

During the reception, it was announced that NEWEA would support the first-, second-, and third-place teams in the 2019 WEF National Operations Challenge competition to be held September in Chicago.

Event Coordinators
- Process Control – Paul Dombrowski, Michael Harris
- Safety – André Brousseau
- Collection Systems – Michael Armes
- Laboratory – Marylee Santoro
- Pump Maintenance – Dan Laflamme

Scorekeeping
- Overall – Travis Peaslee, Vivian Matkivich, Paula Drouin

Judges
- Process Control – Paul Dombrowski, Mike Harris, Susan Guswa
- Safety – Rick Hartenstein, Jason Swain, André Brousseau
- Collection Systems – Tim Vivian, Mike Armes, Mike Smith, Eliza Morrison, Scott Neesen
- Laboratory – MaryLee Santoro, Margie Bower, Nora Lough, Walter Palm, Jim Galasyn, Phyllis Rand, Jeannette Brown, Andrew Fish, Nancy McAuley-Lesieur, Dennis Palumbo
- Pump Maintenance – Dan Laflamme, Jay Pimpare, Jim Barsanti, Alex Buechner, Jennifer Lichtensteiger

Miscellaneous
- Trophies – Joseph Kruzel, Michael Burke
- Shirts – Hoyle, Tanner, & Associates

SELECT SOCIETY OF SANITARY SLUDGE SHOVELERS

During the Monday evening reception, Influent Integrator Charles Tyler inducted eight new members into the Select Society of Sanitary Sludge Shovelers: Harry Austin (hon.), Todd Brown, Robert Domkowski, Joseph Kruzel, Nora Lough, Jerry Potamis, Kerry Reed, Timothy Vadney

MISCELLANEOUS

Various committee meetings were held throughout the Spring Meeting. The Annual Golf Tournament was held at the Breakfast Hill Country Club. Attending spouses and guests enjoyed a number of recreational and social activities during the meeting.

1. Ryan Harrold and Ernesto Trujillo of the Franken Foggers work on the Ops Challenge lab event **2.** Rhode Island's Ocean State Alliance team receiving the first place Collection Systems Event trophy from Event Coordinator Michael Armes **3.** The Franken Foggers of Connecticut prepare for their Operations Challenge safety event run **4.** Force Maine's Shelby Carver and Riley Cobb tackle the Ops Challenge pump maintenance event

MEETING PLANNERS
- Conference Arrangements – Ron Tiberi
- Program – Amy Anderson
- Registration – Meg Tabacsko & NEWEA Staff
- Operations Challenge – Travis Peaslee
- Guest Program – Lauren Hertel
- Golf Tournament – Dennis Vigliotte

MEETING MANAGEMENT
- Director – Kate Biedron
- Sponsors – Dennis Vigliotte

EXHIBITORS

ADS Environmental
Aquionics, Inc.
Atlantic Fluid Technologies
Bristol Community College
CUES
Duke's Root Control Inc
EMS NEW ENGLAND
EST Associates, Inc.
Green Mountain Pipeline Services
Martindale Associates
Mechanical Solutions, Inc.
National Water Main Cleaning Co.
Neo Water Treatment
Prime Resins
Smith & Wilkinson
Statewide Aquastore, Inc.
Walker Wellington LLC
Williamson Electrical Co., Inc.

SPONSORS

ADS Environmental Services
AECOM
Aqua Solutions
ARCADIS
Black & Veatch
Brown and Caldwell
Carlsen Systems
CDM Smith
David F. Sullivan & Associates
Dewberry
Duke's Root Control
Environmental Partners Group
EST Associates
Flow Assessment Services
Fuss & O'Neill
GHD
Green Mountain Pipeline Services
Hayes Pump
Hazen and Sawyer
Hoyle, Tanner & Associates, Inc.
Jacobs
Kleinfelder
Mott MacDonald
NASSCO
NEFCO
Nitsch Engineering
Stantec
SUEZ
Synagro Northeast
Tata & Howard
Tetra Tech
The MAHER Corporation
Tighe & Bond
Weston & Sampson
Woodard & Curran
Wright-Pierce

Upcoming Meetings & Events

NORTHEAST RESIDUALS & BIOSOLIDS CONFERENCE, EXHIBIT AND TOUR
October 16–18, 2019
Sheraton Springfield Monarch Place
Springfield, MA

YOUNG PROFESSIONAL POO & BREW
OCTOBER 16, 2019
Springfield, MA

JOINT NEWEA & NEWWA IT CONFERENCE—INFORMATION TECHNOLOGY & ASSET MANAGEMENT
November, 5, 2019
New England Water Works Association
Training Center, Holliston, MA

UTILITY MANAGEMENT CONFERENCE WORKFORCE SUSTAINABILITY
November 14, 2019
Courtyard Marriott, Cromwell, CT

NEWEA ANNUAL CONFERENCE & EXHIBIT
January 26–29, 2020
Boston Marriott Copley Place Hotel
Boston, MA

AFFILIATED STATE ASSOCIATIONS AND OTHER EVENTS

21ST ANNUAL NERPC/EPA NEW ENGLAND INDUSTRIAL PRETREATEMENT COORDINATORS WORKSHOP
October 21–23, 2019
Lowell, MA

CAWPCA FALL WORKSHOP
October 25, 2019
Aqua Turf, Plantsville, CT

GMWEA FALL TRADESHOW AND CONFERENCE
October 30, 2019
DoubleTree Hotel and Conference Center, Burlington, VT

CWPAA MANAGER'S FORUM
November 21, 2019
MDC Training Room, Hartford, CT

NHWPCA WINTER MEETING
December 13, 2019
Ashworth by the Sea,
Hampton, NH

This is a partial list. Please visit the state association websites and NEWEA.org for complete and current listings.

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/m	**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)

NEWEA/NEWWA IT FAIR

The New England Water Works Association Information Technology Committee and the New England Water Environment Association Asset Management Committee are co-hosting the Fall 2019 Information Technology & Asset Management Fair. This event is a unique interactive learning forum targeted to share the latest technological tools available for use as identified by drinking water and wastewater operations professionals who use, or plan to use, information technology in their daily work. Water and wastewater information technology professionals, senior operations personnel, as well as general water/wastewater managers will find this program of interest.

The fair will consist of a combination of technical presentations and "learning stations," where actual demonstrations of technology may be made in a small group interactive forum. All attendees will be required to attend each presentation and learning station to earn credits. Our intent for this year's symposium is to assemble a diverse set of presentations and points of view from projects, studies, and practices demonstrating how utilities have leveraged technology to meet the challenges of maintaining aging infrastructure and meeting regulatory requirements.

Information Technology & Asset Management Fair:

Technology in the Water Works Industry

November 5, 2019
New England Water Works Association Training Center, Holliston, Massachusetts

Register online at
newea.org

New England Water Works Association
a Section of the American Water Works Association

NEWEA
WORKING FOR WATER QUALITY

Exhibit Information

The NEWWA/NEWEA Information Technology & Asset Management Fair offers a limited number of opportunities for exhibit tabletops. The exhibits must pertain to topics, services or equipment related to Information Technology and/or Asset Management. The cost to exhibit is $350.00 and includes a full registration to the event. If you are interested in exhibiting, contact Katelyn Todesco at katelyn@newwa.org

New Members April–July 2019

Jeffrey McCutcheon
University of Connecticut
Storrs, CT (ACAD)

David Brown
Huntersville, NC (DUAL)

George Malonson
Marstons Mills, MA (PRO)

Michael Holland
Holland Company
Adams, MA (PRO)

Michael Domach
Pittsburgh, PA (PRO)

Dave Beauchamp
Ted Berry Company, Inc.
Livermore, ME (PRO)

John Beckley
Massachusetts Water Resources Authority
Chelsea, MA (PRO)

Joseph Havelka Jr
Colchester, VT (PRO)

Aaron Alibrio
Johnson Controls
Rocky Hill, CT (PRO)

Linda Rauch
Charlestown, MA (PRO)

Michael Abcunas
Cambridge Public Works
Cambridge, MA (PRO)

Scott Strang
Ober-Read & Associates
Brandford, CT (PRO)

Jake Stick
Boston, MA (PRO)

Deborah Duhamel
City of Salem
Salem, MA (PRO)

Matt Silva
Flow Assessment Services LLC
Auburn, NH (PRO)

Rebecca Saucier
Wright-Pierce
Wright-Pierce, NH (PRO)

Christopher Norton
Wright-Pierce
Portsmouth, NH (PRO)

Rene Vaynes
Flow Assessment Services LLC
Auburn, NH (PRO)

Roberto Vengoechea
North Andover, MA (PRO)

Teresa Walters
Dewberry
Boston, MA (PRO)

Laurie Kellndorfer
CDM Smith
Manchester, NH (PRO)

Gary Smith
Venturi Aeration, Inc.
Pelham, NH (PRO)

David Mondello
Veolia North America
Gloucester, MA (PRO)

Danielle Hasselberg
Glastonbury, CT (PRO)

Walter Scott
Bedford, NH (PRO)

Julianne Marrion
AECOM
Chelmsford, MA (PRO)

Thomas Grant
Portand Water District
Portland, ME (PRO)

Dylan Chase
New Shoreham WWPF
Block Island, RI (PWO)

Gregory Quink
Norwalk, CT (PWO)

Nicholas Volinsky
York Sewer District
York Beach, ME (PWO)

Nicole LaBoy
Warwick, RI (PWO)

Thomas Bjorkland
Town of South Windsor WPC
South Windsor, CT (PWO)

James Kavanaugh
South Windsor WPCF
South Windsor, CT (PWO)

Robert Butler
Town of South Windsor WPC
South Windsor, CT (PWO)

Jared DeNardis
South Windsor WPCF
South Windsor, CT (PWO)

Jeff LeMay
Town of SouthWindsor WPCF
South Windsor, CT (PWO)

John Mclaughlin
City of Torrington WPCA
Torrington, CT (PWO)

Ken Pousland
Upper Blackstone WPAD
Millbury, MA (PWO)

Kelly Taylor
MassDEP
Boston, MA (REG)

Nancy Lesieur
NH DES
Concord, NH (REG)

Melissa Saale
S Royalton, VT (STU)

Elizabeth Devaney
Leominster, MA (STU)

Tianbao Wang
University of Connecticut
Storrs, CT (STU)

Margaret Keefe
Storrs, CT (STU)

Marcus Brunelle
Storrs, CT (STU)

Arianna Ortiz
Boston, MA (STU)

Gina Cortese
Somerville, MA (YP)

Benjamin Shriber
Weston & Sampson
Portsmouth, NH (YP)

Heidi Baird
Tighe & Bond
Portsmouth, NH (YP)

Matthew Vareika
Evoqua Water Technologies
Lakeville, MA (YP)

Adrian D'Orlando
Brown and Caldwell
Andover, MA (YP)

Kara Cash
Brown and Caldwell
Andover, MA (YP)

Daniel Tanzella
Weston & Sampson
Woburn, MA (YP)

Brandon Holland
AECOM
Rocky Hill, CT (YP)

Michael Patrick
Wright-Pierce
Portsmouth, NH (YP)

Wiktor Tomkiewicz
Tata & Howard Inc
Marlborough, MA (YP)

Academic (ACAD)
Affiliate (AFF)
Complimentary (COMP)
Corporate (COR)
Dual (DUAL)
Executive (EXEC)
Honorary (HON)
Life (LIFE)
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Professional WW/OPS (PWO)
Student (STU)
Young Professional (YP)

Thank you

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Build relationships with water industry leaders *and* make a positive impact on the water environment

Join NEWEA's 2020 Annual Sponsor Program

NEWEA offers companies the opportunity to promote their products and services throughout the year by participating in multiple sponsorship activities. Annual Sponsorships include:

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

NEWEA
WORKING FOR WATER QUALITY

Advertiser Index

Upcoming *Journal* Theme

Winter 2019—**Safety**

NEWEA/WEF* Membership Application 2019

Water Environment Federation® the water quality people®

NEWEA WORKING FOR WATER QUALITY

Personal Information (please print clearly)

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

Business Name (if applicable)

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

City, State, Zip, Country

Home Phone Number | Mobile Phone Number | Business Phone number

Email Address

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

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

Employment Information (see back page for codes)

1. ORG Code | Other (please specify) | 2. JOB Code: | Other (please specify)

3. Focus Area Codes | Other (please specify

Signature (required for all new memberships) | *Date*

Sponsorship Information

WEF Sponsor name (optional) | Sponsor I.D. Number | ACQ. Code for WEF use only | WEF 19

Membership Categories (select one only)

		Member Benefit Subscription	Dues
☐ **Professional Package**	Individuals involved in or interested in water quality	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online*	$185
☐ **Young Professional Package**	New members or formerly student members with 5 or less years of experience in the industry and less than 35 years of age. This package is available for 3 years. Date of birth (mm/yy) _____	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online*	$70
☐ **Professional Wastewater Operations (PWO) Package**	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 # _____	■ WE&T (including *Operations Forum*) ■ *WEF Highlights Online*	$110
☐ **Academic Package**	Instructors/Professors interested in subjects related to water quality.	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online* ■ *Water Environment Research* (Online)	$185
☐ **Student Package**	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.	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online* ■ *Water Environment Research* (Online)	$15
☐ **Executive Package**	Upper level managers interested in an expanded suite of WEF products/services.	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online* ■ *World Water* ■ *Water Environment Research* (Online) ■ *Water Environment Regulation Watch*	$355
☐ **Dual**	If you are already a member of WEF and wish to join NEWEA		$45
☐ **Corporate Membership** (member benefits for one person)	Companies engaged in the design, construction, operation or management of water quality systems. Designate one membership contact.	■ *WE&T* (including *Operations Forum*) ■ *Water Environment Research* (Print) ■ *Water Environment Regulation Watch* ■ *WEF Highlights Online*	$420
☐ **New England Regulatory Membership**	This membership category is a NEWEA only membership reserved for New England Environmental Regulatory Agencies, including: USEPA Region 1, CT Department of Energy and Environmental Protection, ME Department of Environmental Protection, MA Department of Environmental Protection, NH Department of Environmental Services, VT Department of Environmental Conservation, and RI Department of Environmental Management		$50

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

Payment

☐ **Check or money order enclosed**
Made payable to NEWEA
10 Tower Office Park, Suite 601
Woburn, MA 01801
For more information: 781.939.0908
Fax 781.939.0907 NEWEA.org

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Signature | Exp. Date

Name on Card (please print)

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Depending upon your membership level, $10 of your dues is allocated towards a subscription to the NEWEA Journal.

NEWEA/WEF* Membership Application 2019

Water Environment Federation® the water quality people®

NEWEA WORKING FOR WATER QUALITY

To help us serve you better, please complete the following:
(choose the one that most closely describes your organization and job function)

What is the nature of your ORGANIZATION?

(circle one only–required) (ORG)

1
Public/Private Wastewater Plants and/or Drinking Water and/or Stormwater

2
Public/Private Wastewater Only

3
Public/Private Drinking Water Only (e.g. municipality, utility, authority)

4
Industrial Systems/Plants

5
Consulting or Contracting Firm

6
State, Federal, Regional Government Agency

7
Research or Analytical Laboratories

8
Educational Institution

9
Manufacturer of Water/Wastewater/ Stormwater Equipment or Products

10
Water/Wastewater/Stormwater Product Distributor or Manufacturer's Rep.

11
Public/Private Stormwater (MS4) Program Only

12
Public Financing, Investment and Banking

13
Non-profits

99
Other _____
(please specify)

What is your Primary JOB FUNCTION?

(circle one only) (JOB)

1
Management: Upper or Senior

2
Management: Engineering, Laboratory, Operations, inspection, Maintenance

3
Engineering and Design Staff

4
Scientific and Research Staff

5
Operations/Inspection Maintenance

6
Purchasing/Marketing/Sales

7
Educator

8
Student

9
Elected or Appointed Public Official

10
Other _____
(please specify)

What are your KEY FOCUS AREAS?

(circle all that apply) (FOC)

1
Collection Systems

2
Drinking Water

3
Industrial Water/Wastewater/ Process Water

4
Groundwater

5
Odor/Air Emissions

6
Land and Soil Systems

7
Legislation (Policy, Legislation, Regulation)

8
Public Education/Information

9
Residuals/Sludge/Biosolids/Solid Waste

10
Stormwater Management/ Floodplain Management/Wet Weather

11
Toxic and Hazardous Material

12
Utility Management and Environmental

13
Wastewater

14
Water Reuse and/or Recycle

15
Watershed/Surface Water Systems

16
Water/Wastewater Analysis and Health/ Safety Water Systems

17
Other _____
(please specify)

Optional Items (OPT)

Years of industry employment? _____
1 (1 to 5) **2** (6 to 10) **3** (11 to 20)
4 (21 to 30) **5** (>30 years)

Gender? _____
1 Female **2** Male

Education level? (ED) _____
1 High School **2** Technical School
3 Some College **4** Associates Degree
5 Bachelors Degree
6 Masters Degree **7** JD **8** PhD

Education/Concentration Area(s) (CON) _____
1 Physical Sciences (Chemistry, Physics, etc.)
2 Biological Sciences **3** Engineering Sciences
4 Liberal Arts **5** Law **6** Business

Water quality professionals, with fewer than 5 years working experience and under the age of 35, are eligible to join WEF as an Active Member, while participating in the NEWEA/WEF Young Professionals Program. This program allows up to 50% off of the Active Member dues, valid for the first three years of membership. This program is available for new member applicants and Student Members.

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

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