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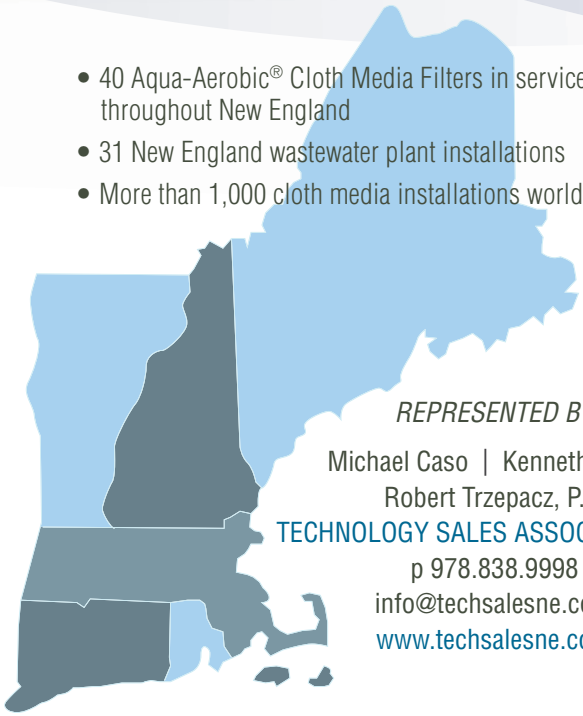

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photo by Thomas S. Benjamin

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NEWEA
WORKING FOR WATER QUALITY

OUR ASSOCIATION WAS ORGANIZED EIGHTY-FIVE 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:

A 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.

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

A Corporate Member shall be a sewerage board, department or commission; sanitary district; or other body, corporation or organization engaged in the design, consultation, operation or management of water quality systems.

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

A Young Professional Member shall be any individual with five or fewer years of experience in the water quality industry and who is less than 35 years of age.

A Professional Wastewater Operations Member (PWO) shall be any individual who is actively involved on a day-to-day basis with the operation of a wastewater collection, treatment or laboratory facility, or for facilities with a daily flow of <1 million gallons per day. Membership is limited to those actually employed in treatment and collection facilities.

A Student Member shall be a student enrolled for a minimum of six credit hours in an accredited college or university.

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Preserving & Enhancing the Global Water Environment

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President's message
Water's Worth It

Dear NEWEA Member,
With spring finally fully well underway, many activities planned for 2014 come to mind, and I urge all to look forward to these activities in the year ahead. We have the regularly scheduled spring and annual conferences, and this year five specialty seminars are planned. These programs require enormous coordination and effort by the committees involved. The level of commitment and the value that these events provide to members are impressive, so I want to thank all who are involved, from NEWEA office staff to the committee members who make it happen.

One area I want to focus on during my presidency is to increase our value to those operators who are members. This effort started in March 2013 at the NEWEA planning session. Two major outcomes from that session were to provide an operator page on NEWEA's Web site and an intrastate operator exchange program. The operator page will be geared for and provide information of interest to operators. Operators should expect to see links to training calendars, member profiles, highlighted operator awards, and Operations Challenge information, among other things. The intrastate operator exchange program will provide great opportunities for exchange of information. As you may know, NEWEA has supported an interstate operator exchange program for years. That program exchanges operators among the six New England states, and many operators have taken advantage of the opportunity. However, the interstate exchange is limited to one operator from each state per year. The intrastate program will enable the exchange of operators within each state, providing opportunities for exposure to different treatment processes and equipment. There is no limit to the number of operators who can take advantage of this program. Also included is the goal to secure operator training credit hours for these exchanges. I will provide updates on this program as the year progresses.

Of great value to our membership are the specialty seminars, and we have a full slate scheduled this year, including seminars on microconstituents, energy and sustainability, asset management, collection systems and watershed management, and stormwater. These seminars will all provide the latest in technical expertise and practice. Please check the NEWEA calendar for the dates and more detail on these important subjects.

One area I want to focus on during my presidency is to increase our value to those operators who are members

NEWEA advocates strongly for New England utilities, supporting our efforts to communicate effectively with our elected officials. NEWEA hosted its annual Congressional Breakfast in Washington, D.C., on April 9 at the Rayburn House Office Building, and the government affairs committee put together another strong program for the breakfast. Closer to home, NEWEA continues to support an annual legislative meeting at least annually in each New England state. This year I have attended meetings in Vermont and Maine, and both of these programs are maturing with good results. I encourage all in the industry to get involved by participating at least at the state meetings. This can seem frustrating because, as we all know, state and federal governments do not move at lightning speed. But as an industry, we need to have a consistent message and presence to impress upon the minds (and votes) of our elected officials the importance of supporting water infrastructure. Our industry needs to be viewed as a resource of information and expertise for elected officials, and I witnessed that at the two meetings I attended in the questions asked by the elected officials. Perseverance and endurance are necessary to provide opportunities for us to influence the legislative process.

This year will also be a year of transition. As you may know, Elizabeth Cutone is retiring after 23 years of dedicated service to NEWEA. As directed by the association by-laws, the management review committee has sought another person for the executive director position with the help of a search and selection subcommittee. Although we can never replace Elizabeth, we must look forward to this as an exciting change for the association, and I encourage all of you to join me in welcoming our new executive director, Mary Barry. Elizabeth, we thank you for your years of service to the association and your leadership, which has helped to bring NEWEA to what it is today—a great value to its members and a premier member association of the Water Environment Federation (WEF).

Of great value to our membership are the specialty seminars, and we have a full slate scheduled this year, including seminars on microconstituents, energy and sustainability, asset management, collection systems and watershed management, and stormwater.

Finally, I thank you for the opportunity to represent NEWEA and to continue to maintain our fine reputation in New England and as a member association of WEF. Our reputation as a leader among member associations comes through the leadership of our executive director and from the tireless efforts of the active members of NEWEA, and for that I say, thank you.

Bradley Moore
2014 President

NEWEA
WORKING FOR WATER QUALITY

From the Editor

Spring brings rain, and rain brings infrastructure management challenges: stormwater runoff affecting water quantity and quality and leading to combined sewer and sewer system overflows. The rains overload pipe capacity and wear away crumbling infrastructure. We have seen the results in collapsing underground pipes impacting access to water, waste disposal, and damaging roads, making daily life frustrating to say the least. My last two editorials highlighted the need of our profession to take a more holistic approach to managing water resources and infrastructure. This month we are focusing on integrated planning. The concept of integrated planning is taking root in our Northeast communities as they look at water resource protection and infrastructure projects in different ways. Rather than solving one problem at a time they are looking to address multiple issues while considering economics, water quality, and regulations.

Our feature articles focus on integrated planning projects developed with the goal of saving money and addressing more than one challenge. These projects attempt to balance the water nexus: water supply, stormwater management and wastewater management.

Green infrastructure is being used increasingly to address water quality and quantity problems in communities. For municipal practitioners, the question that always arises is, how effective are these systems and how should we best construct and maintain them?

In our first article, you will read about how two medical facilities improved stormwater management through the installation of less centralized and more natural looking and functioning green infrastructure that yielded many environmental and human benefits.

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Our second article presents an overview of the New York City green infrastructure plan. The city will spend more than $1 billion in the next 20 years to reduce stormwater runoff and improve water quality. It uses bioswales extensively and the New York City Department of Design and Construction, in association with the New York City Department of Environmental Protection, has installed 22 since 2011 in the boroughs of Brooklyn and Queens.

Meanwhile, the city of Chicopee, Mass., has taken a holistic approach to resolving mandated decreases in combined sewer overflows without breaking the bank. Chicopee Mayor Richard Kos presented this project at the annual legislative event on March 6, sponsored by the Massachusetts Water Pollution Control Association government affairs committee, in association with NEWEA and the New England Interstate Water Pollution Control Commission. Mayor Kos explained the challenges his community faces with one of the lowest per capita incomes in Massachusetts and the highest user rates in the state. The city has spent $135 million to address 80 percent of the city's combined sewer overflow volume, and the remaining 20 percent will cost the city another $100 million. Read how Chicopee is using a triple bottom line approach and "green technologies" to reduce the cost of eliminating the remaining combined sewer overflows in the system.

Our final feature covers how the town of Cheshire, Conn. water pollution control facility cost-effectively addressed a restrictive effluent limit of 0.12 mg/L on total phosphorus as part of the National Pollutant Discharge Elimination System permit renewal process. The town incorporated a testing program and pre-qualification of process equipment to ensure success and avoid costly project overruns.

I would like to thank my associate editor, Meredith Zona. Meredith is a past *Journal* editor and has continued to be an important contributor on the journal committee and a consistent contributor of the *Journal's* Industry News section.

Helen Gordon
Journal Committee Chair and Editor

Industry news

CLASS-ACTION LAWSUIT TARGETS MAKERS OF "FLUSHABLE" WIPES

by Jennifer West
Treatment Plant Operator magazine on-line blog section

The discussion over wipes products and "flushables" became more heated in March when Dr. Joseph Kurtz of Brooklyn, N.Y., filed a class-action lawsuit against Kimberly-Clark and Costco Wholesale in the Brooklyn Federal Court. The lawsuit seeks damages of $5 million and represents 100 people, claiming that consumers around the country have experienced flooding, clogged pipes, jammed sewers and problems with septic tanks due to disposable products labeled "flushable." Kurtz says he paid plumbers $600 to unclog pipes in his New York and New Jersey homes.

"The defendants should have known that their representations regarding flushable wipes were false and misleading," the complaint states. "(The wipes) do not break down as manufacturers advertise."

Eric Bruner, a spokesperson for Kimberly-Clark, stands behind the company's labeling standards. "Kimberly-Clark has an extensive testing process to ensure that our flushable wipes products meet or exceed all industry guidelines," he says. "We stand behind our claims of flushability. Beyond that, as a matter of policy, we don't comment on pending litigation."

The lawsuit is just another component in a lengthy discussion between wipes manufacturers and those who deal with them once they are flushed, including plumbers, septic tank pumpers, collection system workers and treatment plant operators.

"The word 'flushable' means it won't clog your toilet or your house," says Deputy Commissioner Vincent Sapienza of the New York City Department of Environmental Protection (DEP) in an interview with ABC News. "But when it gets to a sewage treatment plant, the wipes wrap around the equipment, shut it down, and then the treatment plant workers go and manually pull these wipes out."

New York DEP and other utilities around the country recommend that people do not flush wipes, and instead dispose of them in the garbage. Until now, the wastewater industry has relied on public education to modify consumer behavior. Industry educational efforts, including a joint pilot program between the Maine Wastewater Control Association and the Association of Nonwoven Fabrics Industry, continue to focus on proper disposal.

Later this year, the Water Environmental Federation and the American Public Works Association are expected to meet with product manufacturers to determine what the term "flushable" should mean. Until then, the wait is on to see what the courts say about the issue and whether consumers are standing up and taking note.

Could this lawsuit be the tipping point for the discussion on wipes? It is the first time a consumer has proactively addressed the issue of "flushable" wipes, so it, in some respects, marks a new level of intensity in the discussion.

INJECTING WASTEWATER UNDERGROUND COULD INCREASE MERCURY LEVELS IN GROUNDWATER

Water/Waste Processing e-newsletter

New research by a scientist at the non-profit marine research organization Woods Hole Oceanographic Institution (WHOI) suggests there are increased levels of mercury in Cape Cod's groundwater.

Biogeochemist Carl Lamborg claims that the naturally low concentration level of mercury in wastewater can increase during treatment processes that break down waste, due to microbial action that transforms it into a more toxic form of the chemical. His research, published in Environmental Science and Technology, looked at the level of mercury and its forms in water and ground samples taken between 2010 and 2012 from the area around a wastewater treatment plant run by the Massachusetts Military Reservation. He noticed that the mercury concentration in the groundwater was much higher than could be expected, and when he investigated he discovered that the key was in the plume of pollutants formed where wastewater had been discharged underground for nearly 60 years.

Examining two different points of the plume, he found that upstream there were microbes breaking down iron in a process known as iron reduction, which also made mercury less likely to stick to sediment, allowing it to seep into groundwater. The sample taken downstream revealed a higher concentration of monomethyl mercury, which could badly damage fish and human health if accumulated.

Although Lamborg claimed there is no immediate risk to people from the levels of mercury present in the groundwater, he stressed that it would not have risen to such levels if water had not been disposed of underground.

EPA AND ARMY CORPS OF ENGINEERS CLARIFY PROTECTION FOR NATION'S STREAMS AND WETLANDS

Julia Q. Ortiz
EPA News Release

The U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Army Corps) jointly released a proposed rule on March 25, 2014, to clarify protection under the Clean Water Act for streams and wetlands that form the foundation of the nation's water resources. The proposed rule will also benefit businesses by increasing efficiency in determining coverage of the Clean Water Act. The agencies are launching a robust outreach effort that will last through late in June, holding discussions around the country and gathering input needed to shape a final rule.

Determining Clean Water Act protection for streams and wetlands became confusing and complex following Supreme Court decisions in 2001 and 2006. For nearly a decade, members of Congress, state and local officials, industry, agriculture, environmental groups, and the public asked for a rulemaking to provide clarity. The proposed rule clarifies protection for streams and wetlands. The proposed definitions of waters will apply to all Clean Water Act programs. It does not protect any new types of waters that have not historically been covered under the Clean Water Act and is consistent with the Supreme Court's more narrow reading of Clean Water Act jurisdiction.

"We are clarifying protection for the upstream waters that are absolutely vital to downstream communities," said EPA Administrator Gina McCarthy. "Clean water is essential to every single American, from families who rely on safe places to swim and healthy fish to eat, to farmers who need abundant and reliable sources of water to grow their crops, to hunters and fishermen who depend on healthy waters for recreation and their work, and to businesses that need a steady supply of water for operations."

"America's waters and wetlands are valuable resources that must be protected today and for future generations," said Assistant Secretary of the Army (Civil Works) Jo-Ellen Darcy. "Today's rulemaking will better protect our aquatic resources, by strengthening the consistency, predictability, and transparency of our jurisdictional determinations. The rule's clarifications will result in a better public service nationwide."

The health of rivers, lakes, bays, and coastal waters depends on the streams and wetlands where they begin. Streams and wetlands provide many benefits to communities—they trap floodwaters, recharge groundwater supplies, remove pollution, and provide habitat for fish and wildlife. They are also economic drivers because of their role in fishing, hunting, agriculture, recreation, energy, and manufacturing.

About 60 percent of stream miles in the U.S flow only seasonally or after a rain event, but have a big impact on downstream waters. And approximately 117 million people – one in three Americans – get drinking water from public systems that rely in part on these streams. These are important waterways for which EPA and the Army Corps are clarifying protection.

Specifically, the proposed rule clarifies that under the Clean Water Act and based on the science:

- Most seasonal and rain-dependent streams are protected.
- Wetlands near rivers and streams are protected.
- Other types of waters may have more uncertain connections with downstream water, and protection will be evaluated through a case-specific analysis of whether the connection is protecting similarly situated waters in certain geographic areas, or adding to the categories of waters protected without case-specific analysis.

The proposed rule preserves the Clean Water Act exemptions and exclusions for agriculture. Additionally, EPA and the Army Corps have coordinated with the U.S. Department of Agriculture (USDA) to develop an interpretive rule to ensure that 53 specific conservation practices that protect or improve water quality will not be subject to Section 404 dredged or fill permitting requirements. The agencies will work together to implement these new exemptions, and periodically review and update USDA's conservation practice standards and activities that would qualify under the exemption. Any agriculture activity that does not result in the discharge of a pollutant to waters of the U.S. still does not require a permit.

The proposed rule also helps states and tribes. According to a study by the Environmental Law Institute, 36 states have legal limitations on their ability to fully protect waters that are not covered by the Clean Water Act.

The proposed rule is supported by the latest peer-reviewed science, including a draft scientific assessment by EPA that presents a review and synthesis of more than 1,000 pieces of scientific literature. The rule will not be finalized until the final version of this scientific assessment is complete.

Forty years ago, two-thirds of America's lakes, rivers and coastal waters were unsafe for fishing and swimming. Because of the Clean Water Act, that number has been cut in half. However, one-third of the nation's waters still do not meet standards.

The proposed rule will be open for public comment for 90 days from publication in the Federal Register. The interpretive rule for agricultural activities is effective immediately.

CALIFORNIA BREWERY BENEFITS FROM WASTEWATER-TO-ENERGY SYSTEM

Water/Waste Processing e-newsletter

Bear Republic Brewery in Cloverdale, Calif., has deployed an innovative wastewater-to-energy system called EcoVolt that uses bioelectric technology to simultaneously treat water and generate renewable biogas to fuel the facility.

The technology was developed by Cambrian Innovation with the support of EPA and funding from the Small Business Innovation Research (SBIR) national program. The Boston, Mass.-based business received funds from the program to research and manufacture systems that treat wastewater and produce electricity at the same time.

The EcoVolt technology can produce about half of the electricity needed to fuel the brewery and can provide up to 20 percent of the energy needed for heating. The brewery operates at an average annual capacity of 72,000 barrels of beer, EPA's regional office said.

The formal launch of the technology at the Bear Republic Brewery was attended by Jared Blumenfeld, EPA regional administrator for the Pacific Southwest, who stated that the unique technology will allow the brewery to operate much more sustainably. Not only does the system allow the business to cut energy costs and preserve water, which is vital during California's drought, it also allows local businesses to succeed and supports jobs in the area, he added.

Bear Republic Brewery in Cloverdale, Calif., has deployed an innovative wastewater-to-energy system to simultaneously treat water and generate renewable biogas

PRESIDENT'S FY15 BUDGET CUTS EPA, SRF FUNDING

AMWA *Monday Morning Briefing*

The $3.9 trillion fiscal year 2015 budget request sent by President Obama to Congress in March proposes new cuts to EPA and the drinking water and clean water state revolving funds (DWSRF and CWSRF). The President's plan would provide EPA with $7.9 billion next year, about $300 million below both its final FY14 appropriation and the amount of funding Obama proposed for the agency last year.

The SRFs would bear the brunt of the cuts, with the DWSRF and CWSRF together reduced by $581 million compared to their FY14 funding levels. The DWSRF would be cut to $757 million (down from $906.9 million this year), while the CWSRF would have its funding cut to around $1 billion (compared to nearly $1.5 billion this year).

If enacted, the White House's proposal would provide the DWSRF with its lowest annual appropriation since 1998, while representing the fifth straight year of declining budgets for the program. To justify the cuts, Obama's documents explained the budget would "focus [the SRFs] on communities most in need of assistance" and would "target assistance to small and underserved communities that have a limited ability to repay loans." According to the White House, even with the reduced levels of funding, the SRFs would finance "approximately $6 billion annually in wastewater and drinking water infrastructure projects."

These arguments may not be good enough for members of Congress who traditionally support strong water infrastructure investments. One such senator, Water and Wildlife Subcommittee Chairman Ben Cardin (D-Md.), expressed his concerns about proposed reductions in water infrastructure funding. This was among the issues Senator Cardin discussed with the Association of Metropolitan Water Agencies (AMWA) members in April at the 2014 Water Policy Conference.

The White House's proposal would provide the DWSRF with its lowest annual appropriation since 1998, while representing the fifth straight year of declining budgets for the program.

Obama's EPA budget would continue a requirement that states reserve between 20 and 30 percent of their DWSRF funding to support loan forgiveness in disadvantaged communities, though the percentage of CWSRF funds reserved for such purposes would be reduced to between 10 and 20 percent. States would not be required to set aside a specific portion of DWSRF funding for "green infrastructure" projects, but at least 20 percent of CWSRF dollars would have to be spent for such projects.

AMWA and other water utility and municipal organizations wrote to the White House in January to oppose SRF funding cuts. The groups will now turn their attention to Congress to counter the President's proposed reductions to the SRFs.

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Good medicine—green infrastructure achieves multiple benefits at two medical facilities

THOMAS S. BENJAMIN, RLA, LEED AP BD+C, Northampton, MA

ABSTRACT | Over recent decades stormwater management has moved from strictly hard-armored infrastructure to less centralized and more naturally appearing and functioning, and often vegetated, green infrastructure approaches. These low-maintenance green infrastructure strategies have yielded multiple environmental and human benefits that hard infrastructure cannot provide, and often at a fraction of the cost.

Two medical facilities, Kent Hospital in Warwick, R.I., and the Veterans Affairs Medical Center (VAMC) in Northampton, Mass., demonstrate site-specific green infrastructure techniques woven together through campus-wide master planning. Kent Hospital is an early adopter of green infrastructure approaches, such as rain gardens. The success of green infrastructure at Kent Hospital inspired the U.S. Environmental Protection Agency (EPA) to conduct rain garden training for federal facility managers at the Northampton VAMC, which used the training to develop the VAMC's own network of passive natural depressions to capture, pretreat and infiltrate stormwater at the source. Both campuses have realized significant habitat and aesthetic benefits in the process, while avoiding costly and environmentally compromising practices such as fertilizing and mowing.

KEYWORDS | Green infrastructure, LID, rain garden, healing garden, bioretention swale, infiltration trench, level spreader, naturalized plantings, master plan and maintenance plan

INTRODUCTION

Not long ago, the only accepted way of managing stormwater runoff produced by wet weather events was to collect, concentrate and convey flow in highly centralized, generally hard-armored and often expensive infrastructure systems. These systems were intended to transmit flow quickly and efficiently "away" from the site or project and downstream into the nearest receiving water body, possibly providing some filtration of pollutants en route. Often the bulk of these systems consisted of piped flow below the ground that served to keep stormwater "out of sight and out of mind." The above-ground manifestations typically consisted of highly engineered linear, rip-rap lined trapezoidal channels and geometric detention/retention basins, hard-armored at the bottom and ringed with turf grass or other low-value vegetation at the top. This was as "green" as stormwater management got.

Things changed as the shortcomings and damage produced by these systems, both at site-specific and watershed levels, became ever more apparent. Some of these site-specific shortcomings included major maintenance challenges and public safety liabilities. Shortcomings at the watershed level included increased peak flows following storm events, creating major downstream flooding (and bank erosion) threats, and dramatically altered natural flow regimes that resulted in "flashier," high-impact events harming aquatic wildlife, particularly in urban/suburban streams.

At the same time, increased interest and regulatory imperatives to regain lost natural resource values and environmental benefits from more natural stormwater management approaches led to major rethinking of how to deal with water that falls (or melts) on to the landscape. "Starting at the source" to capture and infiltrate raindrops as close to where they fall as possible, and slowing down the runoff process often by using densely vegetated features, became heralded as "best management practices" (BMPs). The rise of BMPs began providing useful alternatives to the strictly hard infrastructure systems built for directing and moving water "away" (or downstream) as quickly as possible.

We environmental, engineering and design professionals now find ourselves well into the era of "low-impact development" or LID. The term came into common use during the past decade with a strong push from the regulatory community to promote decentralized, passive methods in integrated systems for managing stormwater using a variety of features, many of them closely mimicking subtle, naturally occurring vegetated catchments in the landscape. More recently the term "green infrastructure" has come to define site-specific and watershed level systems of naturally based and visible stormwater features, with a strong emphasis on densely vegetated techniques serving as the filtration workhorses. With thoughtful design, these techniques, such as rain gardens, have achieved not only effective stormwater management but also have provided considerable habitat and aesthetic values, served as catalysts for larger facility sustainability efforts, and reduced maintenance costs through reduced or eliminated irrigation, fertilization and mowing needs.

Figure 1. Kent Hospital bioswale located at the Trowbridge Center

EPA LEADERSHIP—SOAK UP THE RAIN CAMPAIGN

EPA and the state environmental agencies regulate stormwater through state and federal permits. EPA will release a draft small municipal separate storm sewer system (MS4) general permit for Massachusetts soon. One requirement of the permit is the management of stormwater runoff from new development and redevelopment. The draft permit encourages the use of both LID and green infrastructure practices as a mechanism for stormwater management. Information about EPA's MS4 program can be found at: epa.gov/region1/npdes/stormwater/MS4_MA.html.

EPA states that providing solutions to stormwater problems through green infrastructure implementation is a regional and national priority. For more information about the national green infrastructure program, visit: water.epa.gov/infrastructure/greeninfrastructure/index.cfm#tabs-1.

In 2012, EPA's New England regional office launched the "Soak up the Rain" campaign to raise awareness and encourage citizen action to reduce polluted runoff. Soak up the Rain promotes planting of trees and rain gardens, and installation of rain barrels, permeable pavements and green roofs, as well as other practices that help infiltrate rain water where it lands. The Soak up the Rain Web site has news and information on what's happening around New England and links to everything from how-to guides and videos to a rain garden mobile app. It is also a resource for municipalities and others looking for outreach and implementation tools and ideas. Visit the Web site at: epa.gov/region1/soakuptherain.

To lead by example, EPA has worked vigorously with many "property-rich" federal agencies to green their own facilities, including the Departments of Housing and Urban Development, Defense, and Veterans Affairs. Many successful and replicable green infrastructure examples have emerged from EPA's Soak up the Rain effort, as described below.

A TALE OF TWO HOSPITALS

Kent Hospital, in Warwick, R.I., and the Veterans Affairs Medical Center (VAMC) in Northampton, Mass., are two institutions that have integrated naturally based wet weather management

Figure 2. Kent Hospital rain garden at Breast Health Center

systems into their campuses and benefited greatly from these systems. At Kent Hospital, a large aesthetically disconnected campus has become visually stitched together through a unified green infrastructure system that includes rain and healing gardens, bioretention swales and most recently a community/staff vegetable garden on site, the edges of which passively pretreat stormwater (Figure 1). At the Northampton VAMC, diverse, high-visibility rain gardens have created attractive focal points while solving acute flooding and erosion problems.

At both facilities the addition of a diverse, largely native plant palette to formerly paved areas, lawns or annual beds has created significant wildlife habitat value and aesthetic interest through much of the year. The low-maintenance nature of the green infrastructure features installed at both hospitals has also helped to reduce regular site maintenance and associated costs.

The achievements at Kent Hospital inspired EPA to conduct rain garden training for federal facility managers at the Northampton VAMC in 2011 to install the facility's first rain garden. That event initiated the VAMC campus's journey to a more water-friendly and sustainable model. The training and installed projects at the Northampton VAMC have, in turn, inspired other VA medical centers in New England to construct green infrastructure improvements.

KENT HOSPITAL—A DECADE OF CAMPUS-WIDE LANDSCAPE PLANNING AND GREEN INFRASTRUCTURE IMPROVEMENTS LEADS TO RECOGNITION

Kent Hospital's mission is to provide top health care to patients and promote wellness in the community. Kent started as a small rural county hospital in the 1940s. Since that time, the communities that Kent serves have grown tenfold in population. To keep pace with community needs, Kent has also grown substantially and is now part of the Care New England Health System.

In the early 2000s, Kent Hospital looked like many other healthcare institutions, characterized by a mix of building types and substantial paved areas surrounded by high-maintenance, lawn-oriented landscapes. This conventional landscape approach required constant resource inputs to support mowing, fertilizing, irrigation and occasional pesticide application. Garden beds of exotic, non-native flowers and shrubs required frequent weeding and pruning to look presentable.

In addition, runoff from impervious surfaces like rooftops and pavement traveled across the campus and into catch basins without pretreatment or management. Particulate matter and pollutants carried in runoff, such as nutrients from lawn fertilizers, ended up just downstream in sensitive wetlands that drained into nearby Narragansett Bay, a highly regulated coastal zone. Opportunities to passively remove pollutants and recharge groundwater by infiltrating rainwater into the campus's naturally sandy soils were missed.

Around 2003, Kent entered a significant period of building expansion. Kent's timing coincided with the state of Rhode Island's increasingly stringent safeguarding of coastal zone water quality from non-point source pollution. New policies promoted landscape-based LID techniques for recapturing and infiltrating runoff. The hospital saw a win-win opportunity to pursue building development projects while creatively integrating new landscape-based solutions to provide the necessary stormwater management.

The regulatory compliance imperative coupled well with a broad reassessment of the campus's "institutional" appearance and the cost and healthfulness of its landscape. As a result, Kent moved decisively to develop a more sustainable, low-maintenance and cost-effective approach with gardens and open spaces that encourage "wellness" for patients and staff while enhancing environmental health.

PLANNING PROCESS AND PROJECT IMPLEMENTATION

The evolution of Kent's sustainable campus landscape initiative was both capital project and master plan driven. In the early 2000s, Kent planned major upgrades to the emergency department and emergency room, including a 1,393-square-meter +/- (15,000-square-foot) women's imaging center addition, substantial new parking, driveways and street frontage retaining walls. The campus's new 4,645-square-meter +/- (50,000-square-foot), five-story Trowbridge data center was also being planned. In seeking stormwater permits from the state, Kent learned it was approaching its runoff discharge limits, and additional impervious surfaces would produce runoff volumes far in excess of those limits.

The solution lay in aggressively infiltrating stormwater through naturally landscaped LID features favored by the state. Kent first developed plans for a rain garden to serve the new women's imaging center (now breast center) and naturalized landscape improvements to the emergency department. Replacing a high-maintenance lawn, the 465-square-meter +/- (5,000-square-foot) rain garden consisted of two gently graded depressions or lobes that accept both the center's roof runoff via downspouts and surface runoff from surrounding walkways. In total, the garden pretreated runoff from a roughly 930-square-meter +/- (10,000-square-foot) catchment area.

A glass cabana-like canopy structure covering the breast center's approach walkway provided a key visual element around which to develop the rain garden. The garden was heavily planted with a diverse mix of low-maintenance, deep-rooting native wildflowers and grass species, edged with dense, low native shrubs and punctuated by a flowering understory with canopy trees planted to provide shade. Plantings offered a light, softening, beach-like effect harkening to the campus's coastal location. Hospital patrons and staff enjoyed a sequence of bloom from early spring through fall, and colorful berries and interesting textures to view through the colder months. Butterflies, other beneficial pollinating insects, and songbirds became frequent visitors as well (Figure 2).

Across the street from the rain garden, Kent also created a 280-square-meter +/- (3,000-square-foot) linear bioretention swale along the Trowbridge center's street frontage to occupy the space between the street and sidewalk. By extension, a similar native planting palette replaced lawn and higher-maintenance plantings along the campus's 457-meter +/- (1,500-linear-foot) main frontage on Toll Gate Road, and highlighted the emergency room entrance with conspicuously bright red-berried shrub plantings. Parking islands in the new emergency department patient lot were planted with salt-tolerant native grasses, helping to visually stitch together the surrounding naturally landscaped areas into a coherent whole. Given the emphasis on native grasses, perennials and groundcovers, these natural landscapes established rapidly, often providing nearly full vegetative cover within one to two growing seasons following installation.

Completed in 2004, Kent soon realized the benefits of these first sustainable landscape projects for stormwater management. The rain garden and bioretention swale easily accepted and passively pretreated runoff without any erosion or overflow, including a number of "100-year storm" or larger events during the first several years. Special attention to soil preparation and use of a protective "compost-mulch" covering greatly reduced the need for irrigation of the newly planted areas and prevented erosion. The compost-mulch helped increase biological activity in the soil or "soil life," thereby optimizing conditions for plant growth. Infrequent weeding and cutting back flowers and grasses replaced regular mowing and blowing, freeing up maintenance staff to focus elsewhere and sparing the campus constant engine noise, dust and exhaust from maintenance equipment. The Kent community liked what it saw and wanted more.

As early as 2004, Kent began a comprehensive campus landscape master plan for expanding the sustainable landscape approach across the entire campus. The first-draft master plan focused on additional capital building projects. From 2007 to 2009, the next major piece of Kent's sustainable landscape expansion, a healing serenity garden, was developed in association with a new cancer infusion center/PETScan facility (Figure 3). The new infusion center featured the sustainably minded reuse of an equipment warehouse. Around the building Kent removed six precious parking spaces to create the healing garden space on a prominent knoll adjacent to the center. Large windows faced out into the garden space, and a quiet stone fountain provided a focal point and soothing ambiance. Again, a dense groundcover, in this case including many fragrant herbs and medicinal plant species, helped pretreat surface runoff from internal walks and surrounding areas. Flowering groundcovers extended down and protected a steep escarpment from the serenity garden to the campus's main drive located just below the garden site. The project's groundcover plantings impressively established within one growing season. Within two seasons protective tall grasses and shrubs on the garden's edges provided substantial visual buffering of surrounding driveways and parking areas, thereby enhancing a sense of privacy and quiet for the garden's visitors.

Figure 3. Kent Hospital Serenity (Healing) Garden at Infusion (Cancer) Center

Figure 4. Kent Hospital Memorial Plaza of Honor bioretention swale

Figure 5. Kent Hospital sustainable landscape walking tour

By 2008, when the first gardens were four years old, Kent began to realize additional cost-saving benefits from its sustainable landscape areas. As perennial wildflowers and grasses filled in, they also benefitted from periodic divisions to best maintain their vigor and aesthetic qualities. Division of one plant might produce four new plants that could then be transplanted to other areas on campus. Kent realized that its established gardens could serve as nurseries to expand the sustainable landscape program campus-wide per the initial master plan's vision. Further, the repetition of successful species throughout the campus would unify and strengthen the total visual image and even help patrons with way-finding through many large parking lots. Reuse of existing plants, by the hundreds, would also create large savings for new installations.

In 2010, Kent added the plaza of honor, another important sustainable landscape feature to the list (Figure 4). The plaza featured three large flag poles and a wall of memorial bricks to honor community members and hospital donors. The entire 1,115-square-meter +/- (12,000-square-foot) plaza slopes toward a bioretention garden that receives much of the site's surface runoff. Again, densely planted with native flowers and grasses, the 93-square-meter (1,000-square-foot) bioretention garden pretreats and infiltrates all runoff from the surrounding plaza and walkways. Located in a peripheral area of the campus, irrigation was not an option for establishing gardens here. Except for a water truck providing irrigation during the first season in 2010 (a dry year), no additional irrigation has been provided, and plantings were fully established during the 2011 growing season. Little maintenance has been performed since planting this area, and the site, framed by large ledge rock outcrops, retains a controlled wildness.

In 2011, Kent refined and finalized the landscape master plan to provide a roadmap for transitioning the campus's remaining two hectares (five unpaved acres) to sustainable landscapes within five years. The master plan also provided a detailed maintenance plan to guide management of the sustainable areas far into the future, covering such topics as control of invasive plant species. The maintenance plan features an easy-to-read, color-coded maintenance schedule focused on annual tasks such as deadheading spent flowers or dividing plants for transplant. One project that immediately emerged from the master plan included a new staff garden for raising vegetables and flowers. The staff garden was so successful during its first season in 2012 that Kent doubled its size for the 2013 season.

A further master plan-recommended initiative, on-site composting of cafeteria waste for reuse in the landscape, is in the planning stages with Kent's "keeping it green" committee. Inspired by the sustainable landscape improvements, Kent established the "keeping it green" committee to promote sustainable practices facility-wide, such as energy conservation and waste reduction.

The switch to sustainable landscapes has saved the hospital $20,000 to $40,000 in landscape maintenance costs since 2007. The cost to install the green infrastructure pieces has been around $250,000, yielding a payback in as little as five years. These savings have been realized from a combination of reduced maintenance regimens as a result of the switch from lawn and annual beds to native perennial groundcover. According to Kent's staff, water-use reduction alone by removing irrigation has saved the hospital as much as $4,000 annually. The town of Warwick, R.I., recently raised water rates by about 11 percent so more annual water savings are likely from avoided irrigation. The areas transformed cover more than 1.2 hectares (three acres). Further savings have been realized by creating sustainable landscapes in place of conventional models. Virtually none of the nearly two hectares (five acres) that are sustainably landscaped at Kent require irrigation, fertilization, pesticide application, mowing or blowing. In 2004, Kent required at least two staff members to perform landscape maintenance. In 2013, Kent had one staff member dedicating only a quarter to half of his time to landscape maintenance (in season), which is periodically augmented through a contracted ecological landscaper.

Finally, costs to expand the program campus-wide have been substantially offset through reuse of transplanted materials sourced on-site from already established gardens. For instance, creation of the new, productive staff garden salvaged 200 native switchgrass plants for reuse in immediate projects, such as softening the appearance of a large, free-standing electrical transformer box that had to be at the campus's main entrance.

Today, natural grasses, wildflowers, and native trees and shrubs cover the most prominent portions of Kent's campus in gardens and landscape strips that passively pretreat stormwater. Most features are small, ranging from nine square meters +/- (100 square feet) up to 1,000 square meters +/- (one-quarter acre). These small, localized catchments typically treat catchment areas similar in size, depending on the site's layout relative to the surrounding buildings and terrain. These rain and healing gardens, and bioretention swales, quietly clean impurities from rainwater runoff while providing low-maintenance beauty throughout the seasons. Kent's green infrastructure also serves as an on-site nursery that allows the hospital to economically expand its naturalized low-maintenance landscape.

PUBLIC EDUCATION AND RECOGNITION

In 2011, with nearly half of the 17.8-hectare (44-acre) campus's four unpaved hectares (10 acres), or over 1.2 hectares (three acres) in sustainable cover, Kent hosted a walking tour for EPA, the Rhode Island Department of Environmental Management (RIDEM), Rhode Island Coastal Resources Management Council (RI CRMC), and University of Rhode Island cooperative extension/sustainable storm water program, to raise awareness of the campus's efforts and to provide much-needed examples to the public (Figure 5). As a follow-up, a self-guided walking tour brochure of Kent's sustainable landscape was then developed in partnership with the state environmental agencies. Three additional landscape walking tours involving nearly 100 participants have been conducted since 2011, raising awareness and promoting sustainable landscapes in general, and green infrastructure in particular.

Kent's sustainable landscape program offers a tangible example of its commitment to the immediate community and the public at large. In 2012, the hospital received an environmental merit award from EPA for its leadership in connecting community wellness with environmental health through its sustainable landscape program.

In 2013, Kent's sustainability and green infrastructure efforts were twice recognized. Kent first received the sustainable operations award from Hospitals for a Healthy Environment in Rhode Island (H2ERI) that recognized both Kent's green infrastructure work and the larger sustainability efforts it inspired for the entire facility, including energy conservation, waste reduction and promotion of healthy, locally grown food.

Late in 2013, the infusion center at Kent's serenity (healing) garden achieved recognition with Healthcare Design magazine's first landscape architecture award for healthcare environments. The removal of precious parking spaces to create a largely vegetated space that readily infiltrates stormwater while providing welcome solace to the cancer center's patients, all on a tight budget, no doubt contributed to the serenity garden's recognition.

Kent is proud of these honors and will continue to set an example as it completes the landscape master plan's recommendations toward a fully sustainable campus and facility.

NORTHAMPTON VAMC: EDUCATING FACILITY MANAGERS AND SOLVING PROBLEMS WITH GREEN INFRASTRUCTURE

EPA's 2011 rain garden training/installation at the Northampton VAMC drew participation from some 40 managers from federal facilities across the Northeast (Figure 6). Following the 2011 rain garden training, the VAMC kept all participants engaged in the garden's growth and development through online updates, including photo documentation. The VAMC has constructed two rain gardens and one rain/healing garden on the facility's 20-hectare (50-acre) main campus.

BUILDING 26 RAIN GARDEN

Site selection for VAMC's first rain garden focused on site characteristics that would make for an ideal location. These included high visibility, located just off

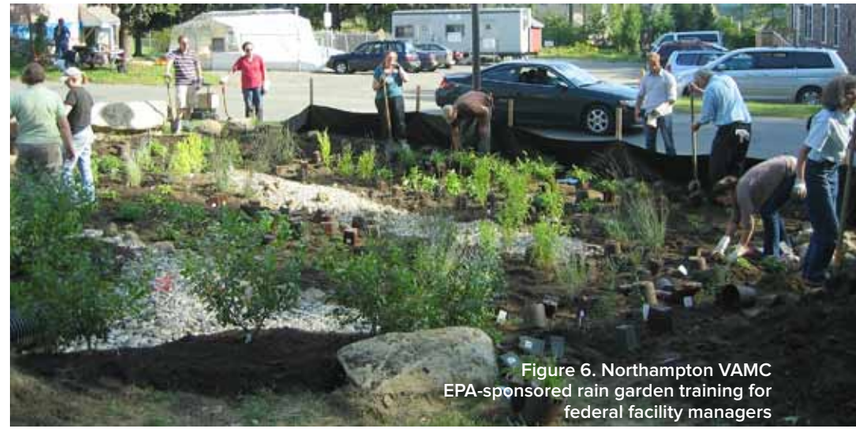

Figure 6. Northampton VAMC EPA-sponsored rain garden training for federal facility managers

Figure 7. Northampton VAMC infiltration trench and level spreader at Building 26 rain garden

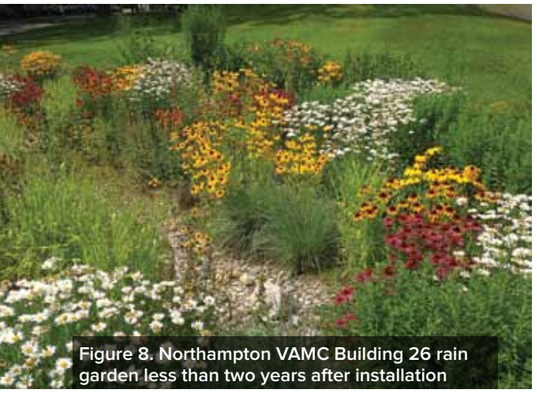

Figure 8. Northampton VAMC Building 26 rain garden less than two years after installation

the campus's main ring road, easy access to adjacent building downspouts and favorably situated to capture additional surface flow off the lawn, and located just across the campus's ring road from the VAMC's conservatory, which houses an impressive horticultural therapy program and productive vegetable garden. The new garden would reinforce this side of the campus as a "garden district" of sorts.

Other site characteristics included a gently sloping lawn facing south with full sun exposure, easy access to adjacent building downspouts, and no subsurface infrastructure constraints or impediments. Soils supporting the lawn were compacted from years of mowing and essentially devoid of organic matter from chemical fertilizing, but were favorable to percolating water from about 0.3 meters (1 foot) below surface level, supported by a silty loam texture. The hilltop site was well above groundwater with significant depth to bedrock, offering good potential for subsurface infiltration capacity. The compacted soils supported a sparse, unhealthy lawn with bare, eroding patches that contributed sediment and nutrients from fertilizing to a catch basin just below along the ring road. This catch basin could serve as overflow for the proposed rain garden in large storm events.

This first rain garden was next to a residential building (Building 26) and designed to accept runoff via downspout for a 93-square-meter +/- (1,000-square-foot) roof as well as surface flow from an additional 93-square-meter +/- (1,000-square-foot) lawn area. The resulting circular-shaped rain garden basin covered just less than 93 square meters +/- (1,000 square feet) with a surface depth of 0.30 meters (one foot) below existing grade at the low point, roughly situated in the middle of the basin. A subsurface pipe connected the downspout to the rain garden basin discharging into the basin's upper end.

A 6-meter (20-foot) long, 1.3-meter (4-foot) wide, by 0.6-meter (2-foot) deep gravel trench was excavated to create capacity for infiltration in the basin's center. Soil separator fabric wrapped the 1.9- to 7.6-centimeter (¾- to 3-inch) diameter gravel to prevent intrusion of fines. Natural cobbles were placed along the pipe discharge into the basin, and along the infiltration trench's surface to dissipate energy. From there flow was directed over a wide, naturally appearing, cobble-retained level spreader, further dissipating energy and helping to ensure fairly uniform moisture access throughout the basin. Natural stones also lined the gravel infiltration trench (Figure 7).

In preparation for planting, the basin's pre-existing soil was loosened to a depth of 0.15 meters (6 inches) using a bucket loader and fine graded using hand rakes. No additional topsoil was brought in, saving considerable expense, and the garden was planted by EPA-trained participants. The only soil amendments included a slow-release organic fertilizer and a compost-based organic planting mix to backfill planting holes for some 300 native/naturalized perennial flowers and grasses, and 15 low-growing shrubs. Compost was spread over the entire surface to a 7.6-centimeter (3-inch) depth and later seeded with winter ryegrass to provide immediate, temporary cover during the first winter. Flowering bulbs were added later in the fall, and finally a thin layer of fine textured saltmarsh hay was laid over the surface after the hard frost set in.

Within the first two months after installation the region experienced a freak October snowstorm that dropped as much as 0.30 meters (1 foot) of heavy, wet snow in Northampton. The garden emerged unscathed. The 2012 and 2013 growing seasons saw full establishment of the intended cover, which became an impressive matrix of color and texture starting in early April and extending until late fall. The garden's basin has yet to overflow into the adjacent catch basin, and little or no erosion has been observed, including after Hurricane Sandy in October 2012 and significant snowfall and melt-off in late winter 2013.

Maintenance for the Building 26 rain garden has included two thorough weedings during the first growing season in June and August 2012, totaling about six person-hours. In 2013, the garden received virtually no maintenance except for a targeted weeding (by hand) in the summer and a final cutting (with weed-eaters and hand tools) in late fall. Since installation, the rain garden has required neither irrigation nor fertilization. Typically, once fully established this type of green infrastructure will require little but targeted maintenance (Figure 8).

BUILDING 1 BIOSWALE—PREVENTING A WET BASEMENT ON A TOUGH SITE

Based on the success of the VAMC's first rain garden project at Building 26, the facility expanded to what it is now thought of as a comprehensive campus-wide rain garden "program" to include the main building (Building 1) entrance area.

However, the site couldn't have been more different from the first garden, consisting of a narrow linear concrete planter bed completely surrounded by paved/hard surfaces, located in full shade against the building's north-facing wall, and fully exposed to cold northerly winds blowing in grit and debris from the adjacent driveway. The planter was 10.67 meters +/- (35 feet) long by about 1.22 meters (4 feet) wide (plantable area). It was fed stormwater from three steel downspouts pouring fast-moving water from a steeply sloping roof area above that exceeded 93 square meters (1,000 square feet) in size. One of the downspouts directed roof water straight into an adjacent basement window well, contributing to frequent flooding and mold problems in that building.

To add to the site's challenges, soils were a compacted clayey, silty loam with stubborn deep-rooting weeds. Even worse, as excavation began it became apparent that only the rear half of the planter soil was "communicating," or in contact, with the subsoil; the front half consisted of about 15 centimeters (6 inches) of soil placed directly over asphalt! The subsoil itself was a heavily compacted road-base aggregate material largely lacking organic matter to support plant life.

Despite these challenges, with significant hand shovel excavation work the subsoil base material at each of the three downspouts was loosened enough to allow flow rushing out from downspouts to readily percolate into the ground. River cobbles wrapped in soil separator fabric absorbed and dissipated the strong flow out of each downspout. Shortly after excavation but before stabilization with plantings and mulch, the excavation work was put to the test when Hurricane Sandy dropped nearly 7.6 centimeters (3 inches) of rain. The tightly contained planter successfully drained without overflowing on to the adjacent main driveway. However, the installation work stalled when a roofing project overhead discovered asbestos in the shingles being replaced.

Work resumed in the spring of 2013 with 100 shade-tolerant native/naturalized perennials, grasses, and low shrubs installed and mulched. Despite the challenging site, this second garden grew rapidly through the 2013 season and has consistently drained without clogging or overflowing onto the adjacent driveway (Figure 9).

Figure 9. Northampton VAMC Building 1 rain garden

BUILDING 60 (CHAPEL) HEALING RAIN GARDEN

The VAMC's most recent green infrastructure project is a showy and fragrant healing garden that also actively infiltrates roof water from the campus's centrally located Chapel. This rain garden actually functions more like a bioswale in that a strong linear path of roof water flows from one end to a yard drain at the other (downstream) end. This gravel-lined "stream" feature is reinforced with a dense planting of grass-like chives, with the yard drain serving as an overflow. Similar in size to the Building 26 rain garden, the chapel's garden captures rain water from roughly 93 square meters (1,000 square feet) of roof area and filters flow through a garden covering about the same area on the ground. A small amount of surface runoff also reaches this garden during heavy rainfall events. In the spring the VAMC enjoys the blooming of hundreds of bulbs such as daffodils and fragrant hyacinths placed along the garden's edge at the chapel's entrance walkway. This is certainly the campus's "showiest" rain garden to date. (Figure 10)

GREEN INFRASTRUCTURE MASTER PLAN

While the chapel's healing garden was under design, the VAMC also prepared a far-reaching campus-wide green infrastructure master plan to promote integrated stormwater management throughout the facility. The master plan has identified and prioritized distinct projects that, taken together, will greatly reduce stormwater runoff from this hilltop campus down to the busy Route 9 corridor, a major state roadway passing below the campus and subject to flooding near the campus's driveway entrance. Projects have been prioritized based on their ability to solve acute flooding problems, proximity to building

Figure 10. Northampton VAMC Chapel/Building 60 healing garden (Spring 2013)

downspouts, and overall visibility to the medical center's population. Efforts have also been made to distribute the projects as equitably around the campus as possible, given their popularity as beautifying features. The highest-priority green infrastructure projects are under design with a focus on solving parking lot flooding issues by placing bioswales along their edges.

The next project will likely develop a bioretention swale surrounding the campus's new central parking lot that will also capture runoff from an adjacent covered walkway's roof.

CONCLUSION

With thoughtful design, green infrastructure techniques such as rain gardens provide not only effective stormwater management but also habitat and aesthetic values, and lower maintenance costs through reduced or eliminated irrigation, fertilization and mowing needs. These approaches can also serve as catalysts for larger facility sustainability efforts. The passive green infrastructure features developed at Kent Hospital over the past decade and more recently at the Northampton VAMC have performed well, filtering out solids and preventing flooding at the surface while replenishing groundwater below. The plantings have deeply rooted and largely established themselves as planned, greatly improving aesthetics and adding important habitat values for many forms of wildlife.

The costs to develop these green infrastructure features have been offset by reduced maintenance, generally recouping the original investment within as little as three years, often within five years, and certainly within 10 years depending on the original condition. Facilitated through well-considered master planning, entire campuses have been or can be transformed from sterile landscapes with little or no stormwater management values to highly valuable and visibly integrated systems that seize every opportunity to "start at the source."

For Kent Hospital, the transition from hard infrastructure and high maintenance landscapes to a green infrastructure system of attractive gardens is a point of great pride, one for which the institution has been widely recognized. Not surprisingly, based on a decade-long record of successful projects, Kent is transforming its entire campus to this more sustainable model. Inspired by Kent, the Northampton VAMC is also well on its way to developing a similar network of aesthetically pleasing, highly visible green infrastructure features that quietly solve persistent drainage and erosion problems. These two long-established medical facilities realize that environmental and human benefits provided by green infrastructure cannot be matched strictly by hard infrastructure approaches. As such, they have committed themselves to a sustainable model that will provide such benefits, coupled with lower installation and maintenance costs, well into the future.

ABOUT THE AUTHOR

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Construction assessment of right-of-way bioswales in New York City

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ABSTRACT | Through its green infrastructure plan, New York City is proposing to spend more than $1 billion over the next 20 years to reduce stormwater runoff and improve water quality. A major plan component includes installation of curbside bioswales throughout the city. Starting in 2011, 22 initial bioswales were installed in the boroughs of Brooklyn and Queens by the New York City Department of Design and Construction (DDC), in conjunction with the New York City Department of Environmental Protection (DEP). To inform and improve future bioswale construction, the construction process and system components were evaluated. The results included process enhancement recommendations and suggested design alternatives to improve construction, maintenance, and performance. A graphic construction guide and checklist were developed as aids for future projects. The results provide the opportunity to understand in detail how these streetscape structures have been installed and to identify the need for any improvements.

KEYWORDS | Bioswale, stormwater, green infrastructure, construction process, design recommendations, New York City, engineered soil, planting

INTRODUCTION

New York City is proposing to spend $1.5 billion on green infrastructure installations over the next two decades to reduce stormwater runoff and improve the water quality of the New York Harbor. Right-of-way bioswales (ROWBs)—curbside vegetated basins that detain and infiltrate street runoff—are seen as important to the city's green infrastructure plan. To comply with the federal Clean Water Act, the city ROWBs and other green infrastructure projects will be able to manage one inch of rain on 10 percent of impervious areas within DEP priority combined sewer overflow (CSO) tributary areas that currently drain to CSO structures by 2030. Several projects are underway, and over the next few years New York City will undertake numerous additional projects for installation of ROWBs in these CSO tributary areas. DDC will implement most of the design and construction management for these projects, mostly as stand-alone projects that are not linked to street infrastructure construction.

The city initiated construction of 22 pilot ROWBs as a valuable "trial run" to understand and anticipate possible issues with future bioswale construction and construction management while the New York City Standards for Green Infrastructure were being finalized. These pilot bioswales were installed as part of four DDC infrastructure projects in the Gowanus, Fort Green, and Bedford-Stuyvesant neighborhoods of Brooklyn and in the College Point section of Queens (Figure 1).

Based on DDC staff experience with the installation of the initial bioswales, DDC determined that an evaluation of the construction process and initial ROWB system components as installed would be beneficial. DDC also wanted to assess the apparent function and post-construction status of various pilot ROWBs that differed slightly from the current New York City standards for green infrastructure. The assessment led to construction process enhancement recommendations and suggested design alternatives to improve construction, maintenance, and performance. The data collected as part of this assessment will provide critical information to assist field inspectors, resident engineers, and other DDC staff members as they oversee the construction of future bioswales.

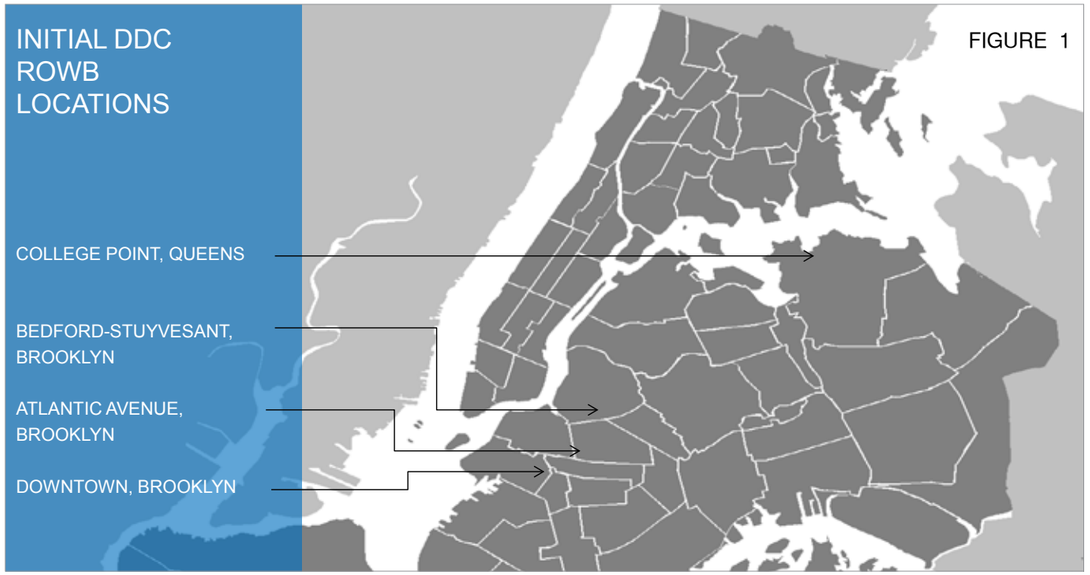

FIGURE 1

DESCRIPTION OF WORK AND METHODOLOGY

Following review of the DEP standard green infrastructure contract drawings and DDC's draft specifications, a questionnaire was developed to interview key DDC and consultant staff members, such as engineers-in-charge, resident engineers, and field inspectors, regarding their experiences and "lessons learned" during the construction process. Ongoing maintenance issues were also discussed with the New York City Department of Parks and Recreation (DPR) maintenance staff responsible for the upkeep of the completed Brooklyn bioswales. Over several months, many site visits were made to each ROWB project, including inspections during planting and rain events. Visual observations and photos of both the construction process and completed ROWB installations were recorded. In addition, other state and municipal bioswale design and construction processes were researched, including those in Portland, Ore., Seattle, Wash., and Minnesota and North Carolina, providing examples for comparison of both completed projects and alternative means and methods for green infrastructure construction and overall construction project management.

A final assessment report included observations of construction and design issues, as well as construction process and design alternative recommendations. Educational and training materials, including a construction checklist and graphic ROWB construction guide, were also developed for use by DDC and other city staff, contractors, and maintenance staff for future bioswale projects.

During ROWB construction, DDC experimented with several installation techniques and materials that differed from the current ROWB details and specifications. Also, construction of these bioswales was completed under existing standard highway and sanitary infrastructure projects with contractors and field staff who were largely unfamiliar with green infrastructure design and construction. In addition, the pilot bioswales were constructed under change orders to standard infrastructure projects on a time and materials payment basis. As these various conditions were atypical, observed construction issues were objectively compared to the current standards, and recommendations were provided accordingly.

To cover the various objectives of the assessment, it was separated into four segments. Segment I included the observed issues during field visits and interviews with DDC staff, and DEP and DPR maintenance staff, as well as recommendations for improvement of specific construction techniques. Segment II included additional recommendations of

Stone and improper grading preventing runoff from entering the ROWB

design alternatives that could help improve future ROWB installations. Segment III provided suggestions for staff and contractor education and training, as well as the supplemental construction support information that will be provided. Segment IV outlined potential maintenance needs for the bioswales and recommended practices and priorities. Construction and maintenance were the main focus of this assessment, and the ROWBs hydrologic function was not quantitatively addressed.

RESULTS AND DISCUSSION

Segment I. Observed issues and recommendations

In concept, ROWBs are relatively simple structures: Street runoff enters the swale through the curb inlet and infiltrates into the soil of the vegetated basin (including trees, shrubs, and herbaceous plants). Any water that is unable to infiltrate flows out of the structure through the curb outlet However, since each component of a bioswale has tight dimensional tolerances that must be met during construction, attention to detail is critical when constructing each element. Furthermore, those performing and overseeing construction must understand both the design intent and the functional integration of the single components within the larger ROWB. There is also the inherent design and construction challenge of retrofitting green infrastructure into an existing street fabric that is often crowded with utilities, subsurface structures, heavy traffic, and many other urban constraints.

During the assessment, a number of items and processes were identified as construction issues that needed correction or improvement. Many of these issues, if not corrected, would likely affect the function, aesthetics, and long-term maintenance of the structures. Following is an inventory of construction issues and items observed at multiple locations. Each item is followed by recommendations on how these issues could be corrected in the field during construction. Segment II discusses other related issues, such as design and training.

GRADING

Proper grading is essential for bioswales to function successfully. Within the ROWB footprint, the specified grading often has slight differences in elevation that, if not met closely, will lead to poor performance, allowing runoff water to bypass the structure, enter through the outlet or not be properly infiltrated as designed. Poor grading could also lead to the erosion or undercutting of the soil medium (DEP Web site). At many of the inspected sites, unsatisfactory grading was observed. Perhaps the most visible issue was no discernible graded depression within the planting bed as specified in the ROWB details.

During the site visits for this assessment, these particular improper grading approaches were observed:

- The ROWBs were graded level with no central 8-centimeter (3-inch) depression and without slopes at the inlet or outlet to allow for water to efficiently enter or exit the ROWB.
- The grade of the adjacent sidewalk was followed for the width of the swale. In these cases, the ROWB soil is sloped toward the street without any internal dishing. This was particularly evident in sidewalks with noticeable grade changes (three percent or more) from the building lot line to the street.
- The grades at the inlets and outlets were not flush with the curbs.
- In some ROWBs, the top of the tree ball was set above the depression and not flush with the bottom of the swale, restricting the efficient flow of rainfall runoff through the swale.

The concrete inlet and outlet pads generally appeared to have been placed true to line and grade, and the grading issues appear limited to the soil medium within the ROWBs. However, according to DDC staff, meeting the specified inlet and outlet grades was sometimes difficult given contractual limitations on street and sidewalk removal and restoration. In addition, DDC staff noted issues with matching street grades to the concrete pad inlets and outlets when restoring asphalt in the surrounding streets.

Recommendations for improved grading include:

- Careful attention and oversight should be applied to grading within the planting bed.
- The flare of the tree's root ball should be set level with the finished grade of the bioswale, not above the finished grade.
- Soil installation prior to planting should anticipate future plantings that will likely raise the final grade; for instance, set grades slightly lower to account for soil added with future plantings.
- The contractor must not follow the sidewalk slope when setting the soil grades. After planting, final slopes should be adjusted towards the edge of the ROWB to compensate for any larger freeboard that may develop when the sidewalk slope is counter to the proposed grades.
- Line items should be added to future contracts for additional removal and replacement of adjacent pavement as needed.

ENGINEERED SOIL

Compaction adversely affects soil structure, reduces stormwater infiltration, and inhibits plant root growth. Once soil is compacted, the soil structure is also difficult to repair. Examples of observed soil compaction that could affect the ability of the ROWBs to fully perform include:

- Heavy compaction by foot traffic as well as vehicles mounting the curb, often by heavy commercial trucks jostling for parking space in largely industrial locations, was particularly noted at all the sites left unprotected and unplanted for long periods between soil installation and final planting. At least one of the inspected bioswales had standing water present after a moderately rainy day, indicating the engineered soil had become so compacted from traffic that it was no longer fully infiltrating.
- On two occasions, landscape subcontractors planted on very wet or saturated soil. Compaction rates increase when soils are saturated. It is very likely that trampling saturated soils could detrimentally affect the soil structure, and any prior care that was maintained during the initial soil installation would be compromised.

The following other soil issues were noted:

- Some unfinished ROWB sites showed significant erosion, likely due to being left without mulch or plants for an extended period of time. Erosion rills were present on unplanted bioswales, indicating that soil sediment was running into the street during rain events. Significant differences in soil color and texture were noted at two adjacent bioswales, and upon examination, one of these soils appeared to have a pronounced amount of clay present. This suggests that there was not always proper inspection of the soil to determine if it met specifications.
- Soil seemed to have settled from around the shrubs at several sites. It was not clear from the inspection if that had to do with settling of the soil, erosion or improper planting.

Recommendations for engineered soil include:

- Soil should be carefully inspected for consistency and lab results approved prior to installation. As stated in the specifications, "the material delivered to the site shall be visually and continuously inspected…to ensure that it is consistently the same material previously approved and delivered to the site (DDC, 2012)."
- Inspections should be both visual and by hand to ensure that the engineered soil meets the specifications. Visual inspections can ensure that the soil is free from debris and any large particles, while a hand texture test would allow field staff to determine if the soil contains levels of clays or organics that could slow infiltration. If the soil does not meet specifications, it should be rejected.
- An approved sample of engineered soil should be shared with field staff to provide a visual example of acceptable material.
- To reduce compaction and work-related erosion, the contractor should not be allowed to work in the rain, after a significant rain event or when the bioswale is saturated. After soil has been placed, the contractor should use boards set over the bioswale to minimize foot traffic on the engineered soil.
- When possible, planting should be scheduled to allow for vegetation installation immediately or shortly after soil placement to help avoid erosion, compaction, and undermining.
- If planting will be delayed after soil placement, mulch should be placed on the exposed soil immediately after grading and until plant installation can occur.
- If planting and installation of steel tree pit guards will not occur immediately after engineered soil installation, steel pedestrian barricades should be installed along the sidewalk edge of the ROWB to prevent foot traffic within the bioswale. Orange safety fencing should be installed along the curb edge, restricting access to the bioswale from the street, while still allowing for access to parked vehicles.
- In addition, if planting will be delayed after soil placement, sandbags, "erosion eels" or other erosion control devices should be placed in the inlet and outlet after soil installation to prevent rainfall runoff from entering the inlet or outlet and eroding the soil before the swale is fully planted. This is critical when heavy rain is forecasted.

Ponding water shows poor infiltration, likely due to compacted engineered soil

Excess sediment buildup preventing runoff from entering (an unplanted) ROWB

STONE STRIP BED

During the site visits for the assessment, a number of issues were observed regarding installation of the ROWBs' curbside stone strip bed. Many of these issues, however, may be a result of the stone strip bed design and cannot be fully corrected during construction. Developed to function as both a structural drainage element and as a limited space for public on-grade access to parked vehicles, it is likely that the design of the stone strip bed will need to be revised to ensure functionality of future bioswale installations.

Following are observed issues with the construction of the stone strip bed:

- Migration of the top layer of stone into the adjacent soil bed was noted as a common problem in many of the bioswales. Continued maintenance must be performed to keep it in place (DDC, 2012).
- In some ROWBs, the stone was wrapped in light gauge mesh to reduce stone migration. This appeared to work for keeping the stone in place. However, the light gauge mesh, exposed over time to water and wintertime freeze-thaw action, could disintegrate fairly quickly. In addition, the inexpensive appearance of the "chicken wire" may create an aesthetic that reflects a temporary character rather than a permanent structure. DPR maintenance crews had been cleaning and sifting the stone by hand, and if the mesh were used, the staff would need to develop alternative methods of cleaning the stone. Cleaning and sifting the stone by hand would likely not be a sustainable practice as the number of installed ROWBs increases.
- Siltation of the stone strip appeared to be an issue in several bioswales. The stone appeared to rapidly silt up after rain events, compromising the infiltration of the bioswale. Moreover, it was observed that fully silted stone strips act as a barrier during rain events, preventing runoff from entering the inlet The DPR maintenance crew stated that bioswales they are currently maintaining have already had to be cleaned by hand several times within the first year of installation.
- In various locations it was observed that the stone bed L-shaped plastic edging was not in place, or installed with the bottom angle pointing in the wrong direction, or an inferior unspecified non-angled edging product was used. Even when installed correctly, the plastic edging did not seem to hold the stone in very well and, in at least one case, acted as a barrier that impeded runoff flow into the engineered soil medium.
- When removing soil for tree installation and replacement planting, landscape subcontractors at two sites were observed dropping and storing large amounts of soil directly on the stone strip. The laborers then proceeded to walk over the stone, further pushing soil into the stone matrix. The stone strips at these locations could be compromised from silt, so soil storage above the stone strip needs to be avoided.

Recommendations for stone strip bed include:

- Contractor needs to use specified L-shaped edging and should install it as detailed in the contract drawings.
- Thin gauge "chicken wire" should not be used to secure stone strip in place. The wire will likely break down quickly from exposure to water and winter freeze and thaw. As mentioned, there are also aesthetic implications when using this material. The thicker-gauged, fully coated wire mesh originally recommended by DDC would be more suitable. If wire is used, alternative methods of cleaning the stone, such as washing it out with pumped water, would need to be developed.
- The contractor should protect the stone strip during plant and soil installation.
- The inlet and outlet should be blocked until the ROWB is completely planted and mulched. Prior to completion, sandbags or barriers such as erosion eels should be placed in the inlet and outlet to prevent flows from entering the bioswale.
- The stone strip bed should be properly graded, flush with the curb and L-shaped edging.
- The 5- to 8-centimeter (2- to 3-inch) grade of stone is preferable to smaller-sized stone as it seemed to silt up and migrate much less.

PLANTING

Planting needs to be acknowledged and made apparent as a critical component of the engineering and construction of the ROWB. Proper placement of the plants would facilitate infiltration and water flow, and create root structure that would keep the soil from eroding. Bioswale planting was an admitted challenge for many of the engineering field staff who had little or no prior experience working with plants.

The following planting issues were observed:

- Grading and plants were set higher than the finished grade at several sites. Not only could this lead to plant mortality from exposed roots, it could also interrupt the flow of water through the bioswale. This appeared to be particularly problematic where the trees were planted directly in the proposed swale depression.
- Landscape crews caused compaction of the soil by working in wet soil or by poor sequencing of work.
- Soil fell into and was compacted into the stone strip during planting.
- At one project location, trees were placed by the contractor in the wrong locations. Instead of planting a small ornamental tree at a location under overhead wires, the contractor installed a canopy tree that would conflict with the utility wires when mature. Both the canopy tree and the ornamental tree needed to be subsequently transplanted.
- A certified arborist was not present as specified in the specifications during the planting at two separately observed sites.
- Geotextile fabric was mistakenly installed by the contractor over the entire planting bed at the ROWBs in one project location. At several of these ROWBs, the fabric had been lifted up, folded over and ripped, impeding the flow of runoff and likely leading to increased erosion of the soil.

Recommendations for planting include:

- Plants should be set so that the root flare is flush to 2½ centimeters (1 inch) above finished grade of the bioswale so that the root flare is exposed.
- Planting should be performed to ensure that compaction and disturbance to the engineered soil are minimized. This could be accomplished by completing work sequentially, such as planting from one edge to another or by placing planks across already planted sections.
- As stated in the specifications, a certified arborist should be present during planting of trees to ensure trees are planted as required, the species is healthy, and there is full coordination with DPR.
- Planting should not be done in the rain, immediately after a significant rain event or if the soil is excessively wet, since it could lead to soil compaction and compromise bioswale performance.
- The stone strip should be protected during the planting to ensure that the stone remains clear of sediment.
- Contractors should be pre-evaluated for experience in green infrastructure work. The specifications state that the landscape contractors must be pre-evaluated before commencing work on bioswale projects. Among the criteria is prior experience in "the installation of green infrastructure systems…landscape experience with other agencies, such as DEP and DPR (DDC, 2012)."

STEEL TREE PIT GUARDS

Most bioswale guards appeared to be installed well and are in good condition. However, a few issues were observed:

- One of the guards had significant amounts of paint peeling throughout the metal structure that would require a complete refinishing.
- Another guard had heavy amounts of concrete wash and splatter covering portions of the metalwork with enough concrete adhered to the guard that would require scraping and refinishing.
- Two of the guards were also damaged by being struck by vehicles.

Planting and associated foot traffic in saturated soils could lead to compaction

- Some guards were installed too close to the curb and not within the specified setback. This is a potential tripping hazard for pedestrians.
- Some guards were installed level and not in accordance with the grade of the sidewalk.

Steel tree pit guard recommendations include:

- The resident engineer needs to receive and approve shop drawings for the guards.
- The guards should be installed as per the dimensions on the plans.
- Steel guards should be installed after concrete work is finished to prevent damage to the guard by concrete wash or splatter.

HIGH-DENSITY POLYETHYLENE (HDPE) BARRIER

At most locations it was observed that the HDPE barrier did not rest flush with the surface of the curb, creating a puckered and variable edge between the stone strip bed and the curb. This not only allowed for runoff to potentially infiltrate between the barrier and the curb, it also was unsightly. In addition, it could be a possible tripping hazard for people entering or exiting a car parked in front of an ROWB. Based on DDC staff observations during construction, issues with the HDPE barrier are likely best addressed by a design modification discussed in Segment II.

Pedestrian barriers used as ROWB protection during construction

Segment II. Additional design recommendations

Besides the apparent issues identified during the construction process, observations of the ROWBs were useful in highlighting potential opportunities and constraints with the bioswales' design. Site inspections, interviews, and observations revealed a variety of potential design issues. The following additional recommendations address various design elements that could be modified to help ensure the success of future ROWB installations.

GRADING/ENGINEERED SOIL PHASING AND PROTECTION

The increased amount of future ROWB projects may require construction that occurs throughout the year, including outside the designated planting seasons. While pre-planning and phasing would help to properly schedule construction projects, it is likely some bioswales would not be able to be planted immediately after engineered soil installation and would need to remain unplanted for several months until the next planting season. To ensure that compaction and erosion of the soil does not happen in the interval between backfilling and planting, the following amendments to the contract documents were recommended:

- If planting will not occur immediately after soil installation, pedestrian barriers should be erected along sidewalk edges after installation of the soil.
- Mulch should be spread on the exposed soil to a depth of 5 to 8 centimeters (2 to 3 inches).
- Sandbags, erosion eels or other suitable erosion devices, supported by rigid backing boards, should be specified to block the inlet and outlet to prevent flows from entering the bioswale.

Fine grading should be done just prior to planting to make certain that grading and planting are fully coordinated. A freeboard of 5 to 10 centimeters (2 to 4 inches) should be left by the contractor at the initial backfilling to allow for importation of soil during the fine grade and planting sequences. It was recommended to revise the contract documents to include a specification for fine grading, including the following:

- Bioswale grades are completed true to line and grade.
- Damages due to settlement, vandalism, compaction or erosion are corrected.
- Soil can be added in specific anticipation of plant installation so final grades meet specified elevations. The bottom of the swale depression should be 8 centimeters (3 inches) below the inlet as specified.

Additional recommended revisions to the engineered soil specification included:

- The engineered soil should be installed in shallow 15- to 20-centimeter (6- to 8-inch) lifts to eliminate the potential for air pockets as well as reduce potential subsidence or settling.
- Some form of post-construction testing, such as in-situ probing with a handheld penetrometer, is recommended to identify high rates of compaction.

STONE SILT STRIP DESIGN

From the standpoint of hydrologic function, there appears to be little additional benefit to having a stone strip bed along the curb and it appears that it could be eliminated from the design. However, as the stone strip bed also functions as a space for the public to step when entering and exiting their vehicles parked adjacent to the bioswales, the stone strip bed, or another access feature, needs to remain as part of the ROWB design. Following are the recommended design modifications for the stone strip function and aesthetic:

- Fully wrap the stone in coated, larger gauge wire. Alternative maintenance methods for cleaning the stone other than those used by the DPR maintenance crew would need to be developed if the mesh continues to be included as part of the stone strip bed design.
- Larger-sized stone used experimentally on several bioswales appears to better mitigate siltation and reduce migration. A New York City Department of Transportation type 2 gravel or similarly sized material should be specified for the stone strip.
- The homeowner-quality plastic L-angle edging used in the pilot bioswales is inadequate for supporting the stone strip; another, more durable type should be specified.
- Design alterations, such as creating sediment forebays that can be vacuumed, or self-contained below-ground structures that can be removed for cleaning, would allow for fine sediments, as well as debris and road salts, to settle out before entering the stone strip and the rest of the bioswale. This would reduce siltation of the aggregate and soil, as well as collect small pieces of refuse before they entered the bioswale, providing for decreased maintenance. DPR has designed deposit pads for green infrastructure installations they have built along curb sides. If added to the bioswales, these pads could also attenuate the velocity of the water entering the swale, reducing soil erosion.

HDPE LINER

The HDPE liner showed a tendency to pull away from the curb, creating spaces for water to infiltrate against the curb. It was also unsightly and presented a potential tripping hazard for individuals exiting or entering their cars. The following solutions were suggested:

- Specify and detail the installation of the HPDE liner to be set below grade a minimum of 5 centimeters (2 inches). By setting it firmly against the curb beneath grade, it is anticipated that less runoff will infiltrate along the curb.
- Specify and/or add a pre-drilled steel flat-stock bar that fastens the top of the HDPE liner and is firmly anchored to the curb to prevent the liner from pulling away from the curb. This was a useful tool in green infrastructure installations in Portland, Ore.
- Care should be taken to ensure that the contractor secures the barrier firmly and without noticeable gapping at the edges at the top of the curb.

PLANTING

The planting process for the ROWBs could be improved with field oversight by someone with experience in green infrastructure, eco-restoration or a related field. Many of the observed problems of the ROWBs could have been avoided with oversight and direction by a professional with an understanding of vegetated drainage systems. Expertise and informed field assistance would particularly benefit field staff regarding soil installation and planting. This individual could work in a similar capacity and contractual method as that of restoration specialist, a consultant position used by DEP for large-scale best management practice (BMP) installations as part of the Bluebelt natural stormwater management program in Staten Island, which focuses on ecologically sound and cost-effective stormwater management solutions (DEP Web site).

The impact, if any, of road salt upon the plants within the bioswales has yet to be seen. However, a large amount of salt may wash into the ROWBs in the winter, especially if there is a lot of snowfall. Salt deposits could adversely affect the health of plant species, lead to mortality of salt-intolerant species and/or burn perennial or seedling roots. Monitoring the bioswale plants for evidence of any impact from salts was recommended, especially as more roadside bioswales are installed. The inclusion of sediment forebays to allow some of the salts to settle before they reach the bioswale soil could also help mitigate this issue. The list of approved plants may also need to be revised to use salt-tolerant species and remove plants that are potentially salt-intolerant such as Cornus sericea.

Segment III. Education and training

As ROWBs are new structures in our urban environment, it is no surprise there seems to be some unfamiliarity among DDC staff, consultants, and contractors regarding their purpose, function, and unique construction methodology. There could even be resistance within the traditionally conservative culture of construction and engineering to the concepts of these new non-standard and "green" approaches to infrastructure. Furthermore, construction of these bioswales was initiated under existing standard highway and sanitary infrastructure projects with contractors and field staff who were largely unfamiliar with green infrastructure design and construction. Many of the issues encountered at the bioswale sites likely can be avoided if staff assigned to ROWB projects are trained on the design intent and proper installation of ROWBs. Training would best be done on site to give staff members a hands-on tutorial in the proper function and installation of the structures. The hands-on experience, coupled with easily read graphics and handouts, could provide an efficient yet thorough understanding of ROWB function and construction for this staff.

Completed and functioning ROWB

The city of Portland, Ore., has been at the forefront of urban green infrastructure in handling water quality and runoff. For almost a decade, this rain-soaked, progressive city has been installing similar street-side bioswales for runoff infiltration, and has a well-organized outreach and educational component to its green streets program. While the landscape conditions and large sidewalk spaces in Portland vary from New York City's, one particularly useful component that could be applied to the city's ROWB program is a downloadable educational pamphlet for contractors (see city of Portland Web site). The pamphlet lays out clearly proper construction techniques and issues to avoid when installing bioswales.

Based on the assessment results and aforementioned research, a double-sided graphic construction guide (Figure 2) and associated one-page construction checklist were developed for field staff for future ROWB projects. The easily

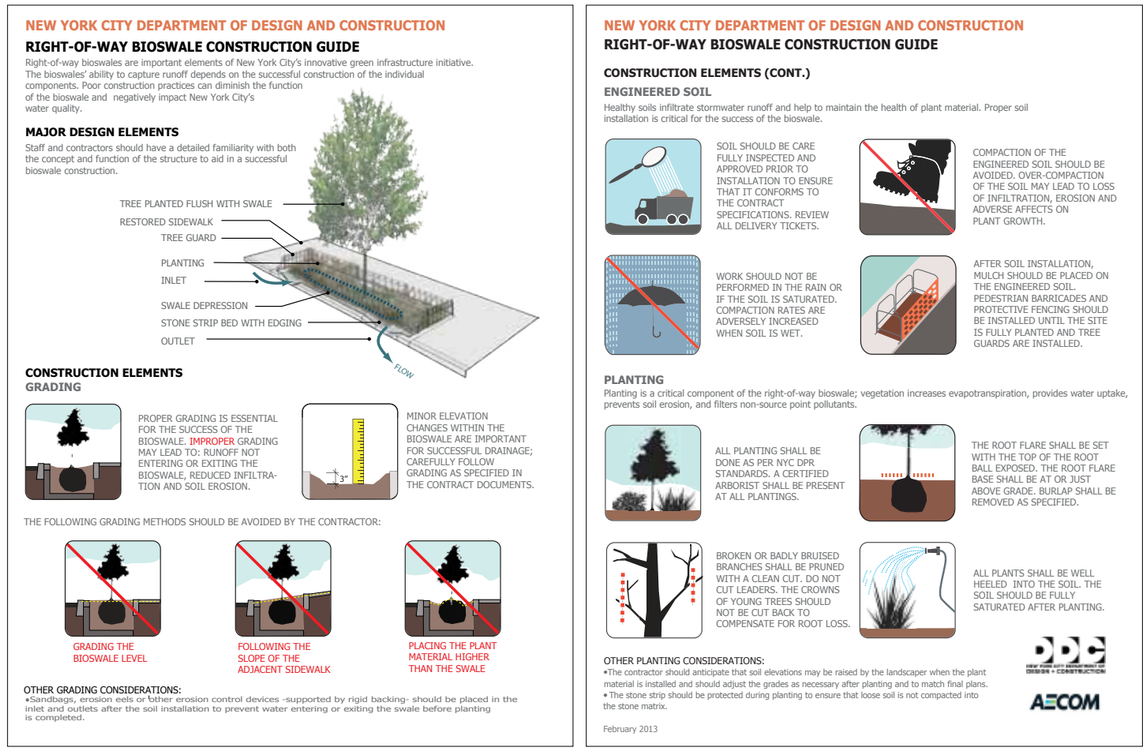

Figure 2. Double-sided graphic construction guide

readable, one-page, laminated field guide and printable one-page checklist are expected to help inspectors and resident engineers make informed decisions in the field and avoid common mistakes during ROWB installation. It was also recommended that this guide be provided to field staff, as well as contractors and subcontractors, before work begins.

Segment IV. Maintenance

Without proper maintenance over time, even a well designed and constructed ROWB will not function to optimal capacity or may eventually fail. The primary focus for maintenance of ROWBs was sediment, debris and litter removal, and general plant care. That the structures are relatively small and self-contained will likely make recognizing and correcting most maintenance issues manageable and straightforward; however, a detailed maintenance inspection plan was recommended for planning the maintenance work. Inspections should be performed monthly but may also be needed following storm events with 2-½ centimeters (1 inch) or more of rainfall, as storms of this magnitude will likely adversely affect the bioswales and maintenance will be required (city of High Point, N.C. Web site). In addition, levels of debris and sediment collection could vary from site to site, so in many cases field inspections would determine how often particular sites are maintained.

Formalized inspection and maintenance record-keeping forms have been shown to be beneficial for field staff to track the maintenance work that is required (Minnesota Department of Transportation Web site). An organized maintenance inspection and tracking system would also help with post-construction assessment, allowing staff to see if there are specific problems with the ROWBs that may need to be addressed during future design and construction. Other municipalities have developed wide varieties of inspection and work forms that could be used as templates but that would need to be tailored to the design and urban conditions inherent in the city's ROWBs. Logging each bioswale into a GIS database and linking the data to an updated database of maintenance and information, such as species planted, could be valuable for planning and tracking general upkeep.

Beyond short-term upkeep, maintenance of these structures for many years or even decades should be planned for, budgeted, and addressed. Protocols should be developed for identifying and handling emergency problems or issues that that may require more extensive or long-term work. Issues such as standing water caused by siltation, settling of the planting beds, compaction from road vibrations, soil contamination from nonpoint source pollution runoff, damage to tree guards or high plant mortality may require extensive repairs or replacement well beyond the scope of quotidian maintenance. Currently, there is no consensus on when bioswale soil medium needs to be replaced, but estimates have ranged from 15 to 25 years (North Carolina Division of Water Quality Web site). The quantity and depth of soil removal should be assessed in the field, and then work would need to be directed and budgeted for either maintenance or capital projects.

An ongoing program of field testing for infiltration rates and compaction should be developed to monitor the swales and know when they need repair. Minimum levels of acceptable infiltration and permeability should be established to determine when remedial work is necessary. Large-scale and comprehensive assessments of ROWB performance, both individually and as a larger system, should be also done at set intervals.

CONCLUSIONS

As the city's Green Infrastructure Plan moves forward, ROWBs will become visible features of New York City's streetscape and will play a vital role in managing rainfall and protecting waterways. In the early phase of this project, it was critical to identify and address design and construction issues. Future inadequate installation and maintenance would not only diminish the critical function of the ROWBs, it would also adversely affect the city and the public's perception and acceptance of these unfamiliar structures. The construction, design, and management recommendations herein can be used to improve the viability and function of future ROWBs as they continue to be built, supporting a model of successful green infrastructure for New York City's rich urban landscape.

ACKNOWLEDGMENTS

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FEATURE

A city at the crossroads—
Chicopee integrated planning

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ABSTRACT | The city of Chicopee, Mass., has completed several combined sewer overflow (CSO) mitigation projects in the last decade, including a 151 ML/d (40 mgd) CSO treatment facility and separation of 56 kilometers (35 miles) of combined sewers, which have collectively abated approximately 70 percent of the city's annual CSO discharge volume. In the process, the city has learned much about its sewer system and construction for CSO abatement. Planning changes to adopt a more integrated approach have also led to tremendous success with the implementation of green infrastructure in recent projects. The city is now developing a more comprehensive integrated plan that will include projects that address all regulatory demands it faces, incorporate green infrastructure elements, and optimize the environmental benefit for each dollar spent on clean water.

KEYWORDS | Combined sewer overflow (CSO), long-term control plan (LTCP), integrated plan, consent decree, financial capability, affordability, regulations, sewer separation, green infrastructure

INTRODUCTION

The city of Chicopee, Mass., is developing an integrated management plan to measure the success of completed CSO and water pollution control treatment projects, consider several means of reducing project costs, and determine the relative importance of CSO abatement with other regulatory requirements so that available funds can be spent on projects that create the greatest benefit to public health, the environment, and the city's long-term infrastructure needs.

With the U. S. Environmental Protection Agency's (EPA's) release of the "Integrated Municipal Stormwater and Wastewater Planning Approach Framework" in 2012, the city became interested in pursuing integrated planning to replace its recommended plan with a more comprehensive implementation plan that addresses all regulatory demands facing the city. The city envisions an implementation plan that includes green infrastructure elements and optimizes the environmental benefit for each dollar spent on clean water.

A BRIEF HISTORY

Chicopee occupies about 62 square kilometers (24 square miles) of land area at the confluence of the Connecticut and Chicopee rivers in Hampden County. The Connecticut River bounds the city of Chicopee along the west, and the Chicopee River runs through the southern portion of the city from the east to its confluence with the Connecticut River to the west.

The city's combined sewer legacy started in the mid- to late 1800s when sewers were first constructed to serve residences and industries adjacent to the Connecticut and Chicopee rivers. Since wastewater was not treated at that time, sewers were typically constructed to convey both stormwater runoff and sanitary sewage for "disposal" at the rivers. As development in the city progressed, the combined sewerage system was extended upland, away from the rivers.

In the mid-1960s and early 1970s, the city constructed its water pollution control facility (WPCF), two major sewer interceptors along each river, and several CSO structures to release flows in excess of interceptor capacity during wet weather. Following the passage of the Clean Water Act (CWA) in 1972, EPA and the Massachusetts Department of Environmental Protection (MassDEP) identified CSO discharges as one of the last remaining significant sources of pollution to the Connecticut River. As a result, EPA and MassDEP required that communities along the river abate CSOs to comply with CWA requirements.


Chicopee Falls

In the 1980s and 1990s, Chicopee improved the sewer collection and treatment systems through:

- Elimination of 11 CSOs
- Adjustment of diversion structures to reduce flows from active CSOs
- Creation of two new divisions within the Department of Public Works—the CSO division and the collections system division, each with separate staff and equipment
- Creation of a stormwater fee to fund CSO abatement
- Creation of a public education program, including informational video and brochures
- Expansion of WPCF components
- Pump station upgrades
- Installation of rock traps (sump structures) to improve interceptor, siphon, and pump station performance and maintenance
- Separation of some combined sewers throughout the city, which eliminated an estimated 68 ML (18 MG) per year of CSO volume

The city has completed several CSO mitigation projects in the last decade, including a 151 ML/d (40 mgd) CSO treatment facility and separation of 56 kilometers (35 miles) of combined sewers, which have collectively abated approximately 70 percent of the city's annual CSO discharge volume. The city has learned a lot about its sewer system and construction for CSO abatement, and has successfully implemented green infrastructure in recent projects.

EPA issued a consent order to Chicopee in 1999 that required the city to prepare a scope of work and schedule for completing a long-term CSO control plan (LTCP). The joint document for Chicopee's draft long-term control plan and draft environmental impact report (DLTCP/DEIR) was submitted to EPA, MassDEP, and the Massachusetts Environmental Policy Act office (MEPA) in late 2001. The certificate on the DEIR was issued in February 2002, and requested, consistent with comments by EPA and MassDEP, revision of the timetable for the recommended plan that was part of the 2001 DLTCP/DEIR.

During discussions with EPA and MassDEP following submission of the DLTCP/DEIR, the city identified projects suitable for construction as phase 1 of the LTCP. Construction of the phase 1 projects occurred from 2003 to 2008. The phase 1 projects included the WPCF bypass disinfection facility, the Sandy Hill area sewer separation, modifications to CSO 34.3 at Montgomery and Sheridan streets, the Whittlesey area sewer separation, Paderewski pump station improvements, modifications to CSO 4.2 on Lower Montgomery Street, the North Fairview sewer separation, and the Jones Ferry CSO treatment facility. Collectively, these projects reduced the city's annual average CSO discharge by approximately 1,158 ML (306 MG).

Meanwhile, in 2006, EPA issued a consent decree to Chicopee that outlined the schedule for revising and finalizing the city's LTCP. The consent decree set March 1, 2006, as the deadline for completion of a draft work plan for development of the final LTCP, which was submitted in May 2009.

In 2008, before the final LTCP was completed, the city initiated discussions with EPA and MassDEP regarding selection of phase 2 projects to continue with the timely implementation of the LTCP. The phase 2 projects included the Upper Granby Road sewer separation, the McKinstry Avenue/Lorraine Street sewer separation, and the Chicopee

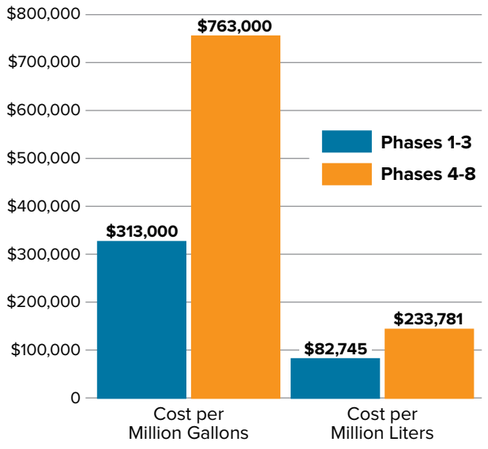

Figure 1. Relative cost burden of LTCP recommended plan phases

Falls area sewer separation. Collectively, these projects reduced the city's annual average CSO discharge by approximately 159 ML (42 MG).

In addition, in 2011, the city constructed improvements to Roberts Pond Dam including replacement of the sewer across the dam and separation of storm drain piping on Irene Street and Roberts Pond Lane. The city also extended the dedicated storm drain from Atkins Street and Prospect Street down to the existing storm drain culvert near the river. These projects are believed to have significantly reduced the city's annual average CSO discharge four years earlier than required by the LTCP, and also eliminated historically frequent and severe street and basement flooding within the project areas. The city hopes to better understand the positive impact of these projects on activations from CSOs 4.1 and 4.3 as part of an integrated management plan, which is described later in this article.

The city is in the midst of sewer separation design and construction for phase 3 of the recommended plan that began in 2013 and includes separation of sewers in the Montgomery Street/Sheridan Street and Willimansett/North Aldenville areas. This work will be completed in 2015, and will abate an additional 242 ML (64 MG) of CSO discharge per year. At the completion of the phase 3 work, the city will have abated nearly 80 percent of its original total annual CSO discharge to the Connecticut and Chicopee rivers.

Traditional sewer separation projects have proven most effective in areas of the city needing infrastructure renewal. For example, areas with failing combined sewers that cause regular in-system backups, old water mains, and roads in disrepair see the greatest benefit from sewer separation. While what has been termed the "geographic approach" to infrastructure renewal comes at a significant cost, it is still the most appropriate solution to clean water and infrastructure renewal needs in some areas of the city. The areas that are the best candidates for this type of approach are typically dense residential and commercial areas with aging infrastructure and little or no remaining open space. The benefit of these projects is that, along with renewing infrastructure, they typically provide definitive elimination or reduction of a CSO discharge. An example of this type of area is the Chicopee Falls area, in which new pipes were constructed to completely separate the sewers in the drainage area.

Areas of the city that may lend themselves to partial sewer separation, green infrastructure, or other types of CSO abatement projects are those with available open space, a relatively low groundwater table, and without the need for comprehensive infrastructure renewal. Areas that do not have a nearby storm drain outfall are also good candidates for green infrastructure, as on-site handling of stormwater typically is far more cost-effective and less disruptive than constructing a dedicated storm drain pipe a relatively long distance to a receiving water. An example is the Granby Road area. The Upper Granby Road sewer separation project separated a portion of the drainage area and included two major green infrastructure elements – enlargement of a detention basin and construction of a below-grade infiltration system.

With about 30 percent of its annual CSO discharge volume left to abate, the city may shift from its traditional "gray infrastructure" approach for CSO abatement to an integrated approach that includes greener infrastructure and other adaptive management techniques. The city also wants to make sure it selects and prioritizes projects such that it complies with all applicable environmental regulations and spends its money wisely.

TIME TO RE-EXAMINE

One factor in the development of the recommended plan phasing in the LTCP was cost-effectiveness, in dollars per million liters (gallons) of CSO abated. Now that Chicopee is in the later phases of the recommended plan, it is commencing, or at least contemplating, work that has a much higher cost per million liters (gallons) of CSO abated. Figure 1 shows the relative cost burden of all projects through phase 3 versus phases 4 through 8. This significant increase in relative cost burden for phases 4 through 8 is largely due to the associated CSOs discharging far fewer gallons per year on average than those associated with the work of earlier phases. In fact, the relative cost burden of future projects is more than double the relative cost burden of projects the city has undertaken and will undertake through phase 3. Given other factors discussed below, the city is re-evaluating whether these less cost-effective sewer separation projects are the most appropriate method for abatement of the

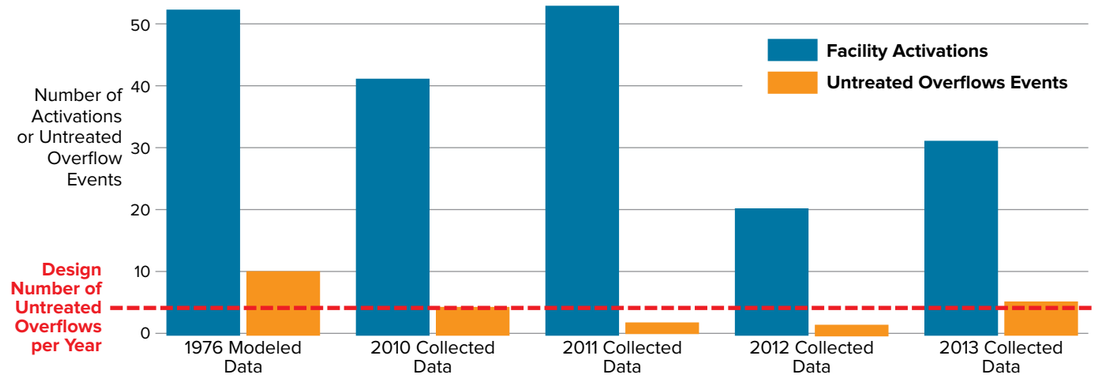

Figure 2. Activations and untreated overflows at the Jones Ferry CSO Treatment Facility (CSO 7.1)

remaining CSOs, or whether there are more cost-effective and environmentally beneficial ways to achieve the objectives.

In recent years, regulations have focused more on discharges from stormwater outfalls. New and more sustainable and comprehensive solutions to CSOs and stormwater have been identified, such as green infrastructure. Chicopee successfully implemented green infrastructure elements on one project that increased aquifer recharge and significantly reduced peak flows in the combined sewer downstream of the area while saving $4.5 million over a traditional sewer separation approach.

As part of the Upper Granby Road sewer separation project, the city constructed a below-ground infiltration system and expanded a stormwater detention basin. The infiltration system stores and infiltrates the peak stormwater flows from a portion of the drainage area that allowed the city to connect the storm drain from this area to a storm drain outfall without increasing the peak flows to the receiving stream. The detention basin was then expanded to store peak stormwater flows from the rest of the drainage area, again allowing the city to connect the storm drain from this area to a local storm drain outfall without increasing the peak flows to the receiving stream.

The Upper Granby Road construction features have not only kept a significant amount of stormwater from entering the Connecticut River interceptor, thus freeing up capacity, but they have also recharged groundwater in the drainage area in which the runoff is generated. These green infrastructure elements also made it possible to separate the sewers in only the upstream portion of the drainage area, which is not near either of the city's major rivers. Therefore, the city reduced construction cost and disturbance by limiting the sewer separation work to the area in which the sewers had the greatest need of replacement. The green infrastructure features appear to be functioning well with minimal maintenance, and the reduction in downstream CSO volume and frequency has been dramatic. Figure 2 shows the total number of activations of the Jones Ferry CSO treatment facility each year since it commenced operation compared to the predicted number of activations based on the 1976 (average year) continuous simulation of the city's SWMM model of its interceptors and CSOs. The success of this project has compelled the city to seek other, similar green infrastructure opportunities. The city may

1. Expansion of the upper Granby Road detention and infiltration basin (during construction)
2. Expansion of the upper Granby Road detention and infiltration basin (post-construction)
3. Construction of the Champion Drive infiltration system

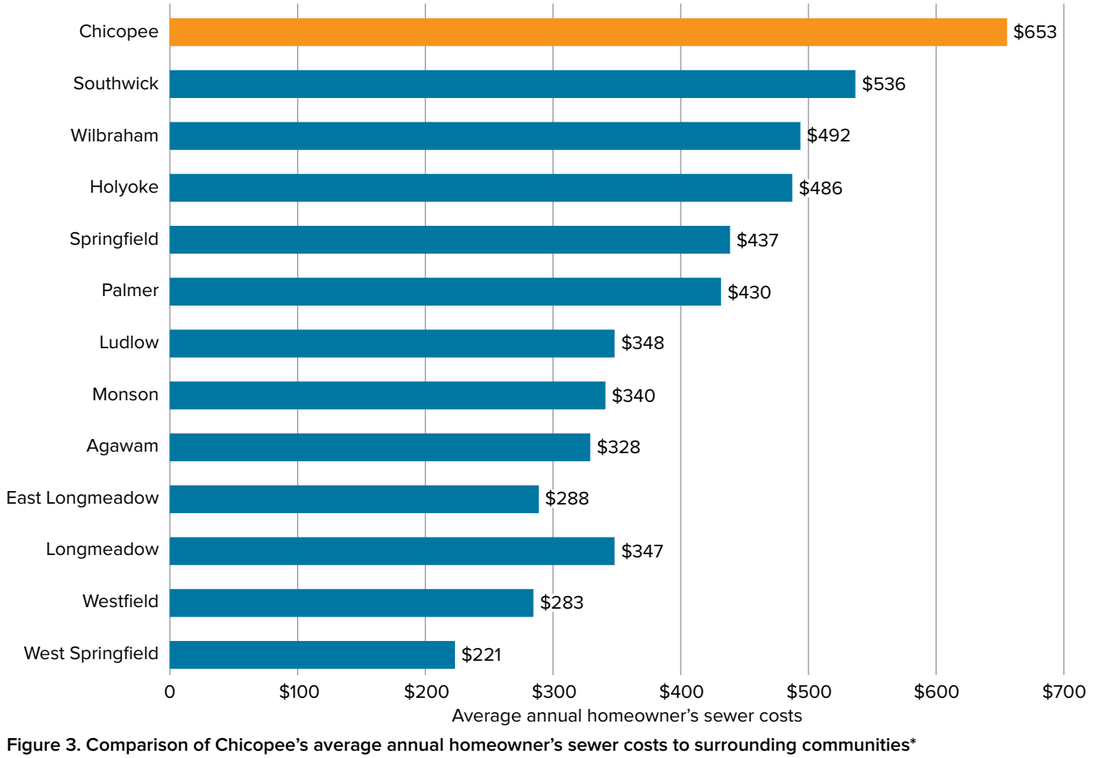

Figure 3. Comparison of Chicopee's average annual homeowner's sewer costs to surrounding communities*

* Current costs for other communities are based on data in Tighe & Bond's 2012 Massachusetts's Sewer Rate Survey and/or found through internet research. The costs for surrounding communities do not include future rate increases.

implement more of these solutions and possibly decrease some of the "gray infrastructure" work, such as sewer separation.

Based on CSO activation volumes and frequency over the past few years, Chicopee believes other CSOs may be abated to an acceptable level of control by partial sewer separation, storage, detention, or some other method. For example, the Jones Ferry CSO treatment facility has been in operation since 2009 and was designed to screen and disinfect the overflows from drainage area 7.1 such that there are four or fewer untreated discharges per year. Approximately 85 hectares (209 acres) of drainage area 8 (total 128 hectares [317 acres]), which is upstream of drainage area 7.1, are still combined and scheduled for sewer separation in phase 8 of the recommended plan. Despite the fact that drainage area 8 is still partially combined, operating data from the Jones Ferry facility from 2009 to 2013 indicate that the facility has only once had more than four untreated discharges in a calendar year (in 2013). This leads the city to believe that safety factors involved in the design of the facility, coupled with greater realized pumping capacity than designed, allow the facility to also handle at least a portion of the wet weather combined flows from drainage area 8, as well as those from drainage area 7.1. Coupled with the partial sewer separation that was completed in drainage area 8, which is the Upper Granby Road area mentioned above, the enhanced performance of the Jones Ferry facility may be controlling discharges from CSO 7.1 to a level that precludes further sewer separation in drainage area 8.

The city is interested in evaluating whether the separation projects completed have freed interceptor capacity for other drainage areas, thus decreasing the overflow volumes and frequencies at other CSO locations. Also, the city has identified ways to re-route flows between drainage areas that have reduced the need for full sewer separation in some areas. For example, during design of the Chicopee Falls area sewer separation projects, the city discovered that some minor changes to the pipe routing would allow the area's sewer to be discharged into the Chicopee River interceptor at a point upstream of a double-barrel siphon considered to be much more reliable than the single-barrel siphon to which it had been discharging. These changes in routing of flows to the city's two main sewer interceptors are expected to help maintain the capacity of the interceptors. In this particular case, the re-routing of flows allowed for the de-activation of an additional CSO (CSO 32.1).

One factor driving the city's desire to re-evaluate the recommended plan is affordability. Chicopee already has the highest sewer rates in the region, making it difficult to attract businesses and job providers to the city. Figure 3 compares Chicopee's average annual homeowner cost to that of nearby communities.

Over the last several years of constructing largely "gray infrastructure" projects, the city has found that these projects cost more than anticipated due to failing infrastructure encountered during either design or construction. The city is also finding that the sewer projects, in many cases, require replacement of water mains, storm drains or old combined sewers designated to be used as storm drains. While the city has tried to minimize these costs and find other funding sources, it has undoubtedly increased the city's debt service to an amount higher than was predicted for this point in the recommended plan.

Therefore, the city would like to re-evaluate the costs associated with sewer separation in light of recent experiences to determine whether there may be more creative options, including green infrastructure that may provide the same level of control at a lower cost and greater environmental benefit.

RATE PRESSURES

Historically, Chicopee has used low-interest financing available through the commonwealth of Massachusetts' state revolving fund (SRF) program to fund its CSO abatement projects. While these loans provide financing for these projects, the funds to pay back the loans must still ultimately come from the city, generally from continual rate increases. The city faces an increasing number of pressures on the sewer user rate, yet another reason why it wants future projects to provide the best environmental "bang for the buck."

The city's current recommended plan largely comprises sewer separation projects that will reduce or eliminate the amount of combined sewage from outfalls. However, untreated stormwater runoff will continue to be discharged from these same outfalls at the completion of the separation projects, and some regulators and water quality advocates are concerned about the negative effects these discharges of runoff have on river water quality. The integrated plan will investigate potential, affordable, and practical stormwater treatment methods that may be incorporated into a modified LTCP.

An increasing number of NPDES permits are being issued that require a capacity management, operation & maintenance (CMOM) program. Chicopee expects that with continued sewer separation in the city, its next NPDES permit will require a CMOM program.

The NPDES permit for the discharge from Chicopee's WPCF includes requirements to evaluate and optimize nitrogen removal. The city has conducted a nitrogen optimization study, which indicated that costly capital improvements and process changes would be necessary to achieve sufficient nitrogen removal at the WPCF. The city has also seen increasingly strict limits in its NPDES permit for certain metals such as aluminum. Reducing the amount of aluminum in the WPCF discharge will also require careful study to optimize plant operation and consider necessary capital improvements.

As in any city, Chicopee's collection system, pump stations, and treatment plant require repairs and maintenance to run reliably. The city has continuously performed maintenance and made upgrades to facilities as needed. In 2012, it completed a capital improvements plan focused on its pump stations and WPCF that prioritized capital improvements at these critical facilities. Chicopee continues to upgrade pump stations and equipment at the WPCF to the extent that funding is available. These upgrades are necessary to maintain the reliability of the pump stations and WPCF. Equipment failures at any of these facilities can result in sewage backups into homes, businesses, and streets, and also overflows into the river.

The city's residents are also burdened with rising water rates. Much of the city's drinking water infrastructure is aging and in need of replacement. In fact, much of the aging water infrastructure was identified as vulnerable during design and construction of sewer separation projects, and, to the extent funding was available, was replaced as part of those CSO abatement projects. While this "geographic approach" to infrastructure renewal is practical in minimizing disturbance to city residents and businesses, and saves money long-term on road restoration, adding water main work to sewer projects increases the cost significantly. Chicopee's water department also foresees a need for more redundancy in some critical transmission lines, including the main supply into the city from the Massachusetts Water Resources Authority (MWRA). These and other improvements to the drinking water infrastructure in the city represent significant costs that require continuous increases to the city's water user fee. Therefore, the city must struggle to balance increases to the sewer and water fees that are manageable for city residents and businesses.

ENTER INTEGRATED PLANNING

When EPA released its memo "Achieving Water Quality for Municipal Stormwater and Wastewater Management Plans" in October 2011, integrated planning began to emerge as the logical next step for the city of Chicopee. The concept sounded perfect; a comprehensive and integrated approach both to evaluating all CWA obligations that offers the best way to identify the most cost-effective and protective solutions and to implement the most important projects first. EPA identified the objective of this planning as putting municipalities on a critical path to achieving the water quality objectives of the CWA. This would be done by identifying efficiencies in implementing sometimes overlapping and competing requirements that arise from separate wastewater and stormwater programs. EPA noted that integrated planning can also lead to comprehensive and sustainable solutions, such as green infrastructure, that improve water quality as well as support other quality-of-life attributes that enhance the vitality of communities. Integrated planning could help achieve CWA compliance by maximizing the city's ever-dwindling infrastructure improvement dollars through the appropriate prioritization of work.

In June 2012, EPA released its "Integrated Municipal Stormwater and Wastewater Planning Approach Framework" to provide further guidance on developing and implementing effective integrated plans. In August 2012, the city submitted a project evaluation form (PEF) to MassDEP for its proposed integrated stormwater and wastewater management plan for SRF funding. MassDEP's release of the intended use plan (IUP) in May 2013 revealed that Chicopee qualified for funding of this planning study under the SRF program. Chicopee subsequently submitted a complete application to the SRF program, including a detailed scope of its proposed plan.

The city is continuing to develop an integrated plan but has learned many valuable lessons in obtaining MassDEP approval to proceed with the plan. First, the objectives of integrated planning are clear in EPA's guidance memos, but the exact scope of an integrated plan is not. While EPA identifies six major "elements" to an integrated plan in its June 2012 memo, much work is required to develop a detailed scope of work specific to the municipality. The guidance is purposely flexible so that the exact scope of the integrated plan can be tailored to fit the community.

EPA will not approve the scope of the plan or the plan itself; however, Chicopee is hopeful that the plan may be considered when negotiating compliance schedules. In particular, the city believes its integrated plan may lead to a request for a modification to its recommended plan and/or the timeline outlined in its consent decree for CSO abatement. A cornerstone of the integrated planning framework is stakeholder involvement, and in particular, regulatory involvement. Regular meetings with MassDEP, EPA, and the public will be essential to development of a successful integrated plan.

CHICOPEE'S INTEGRATED PLAN

The city's integrated plan will measure the success of the completed projects, consider green infrastructure, and consider the relative importance of CSO abatement with other regulatory requirements so that available funds can be spent on projects that create the greatest benefit to public health, the environment, and the city's long-term infrastructure needs. Over the years, the city has come to realize that this type of plan cannot focus solely on CSO abatement and traditional "gray infrastructure" projects.

In keeping with the EPA framework, the city of Chicopee developed a scope of work for its integrated plan comprising eight major elements or tasks:

1. Regulatory review
2. Stakeholder communication plan
3. Sewer system/LTCP update
4. Capital improvements plans
   - WPCF and pump stations
   - Stormwater
   - Drinking water
5. Financial analysis
6. Development of metrics for evaluating project priority
7. Prioritization of projects and implementation schedule
8. Monitoring and assessment plan (for future project evaluation)

Key tasks of this integrated plan from the city's perspective include installation of 37 flow meters at various locations within the wastewater collection system. The city is also re-modeling its interceptors and key collection system components, such as the Jones Ferry CSO treatment facility and the Paderewski flood pump station CSO storage. The plan will include identification and screening of suitable sites for green infrastructure technologies. The structural and operating condition of the interceptors will be determined in various locations based on sonar pipe survey and/or closed-circuit televising. Relevant stormwater requirements will be identified and balanced against the city's CSO abatement needs.

Chicopee's integrated plan will also:

- Anticipate new or revised nutrient limits in the city's NPDES permit
- Factor in capital improvement projects for drinking water and wastewater
- Consider potential future requirements to treat stormwater
- Consider public health and environmental benefit
- Calculate affordability
- Build a priority list
- Develop comprehensive alternatives and costs

OUTCOMES/CONCLUSION

After more than two decades of CSO abatement following a standard sewer separation approach, the city of Chicopee has begun to incorporate green infrastructure features into its program and is examining the impacts of these changes. The city is underway with the data-gathering portions of the integrated plan. Chicopee is eager to find out whether some theories the city has developed over the last few years may be true, such as:

- The combination of available interceptor capacity, treatment facility capacity, and strategic implementation of green infrastructure may obviate the need for full sewer separation in some drainage areas.
- The success of prior CSO abatement projects may lead to re-prioritization of the remaining projects.
- Green infrastructure projects, or elements in projects, may be the most cost-effective in achieving clean water objectives in some areas of the city.

ACKNOWLEDGEMENTS

The authors would like to acknowledge all of the staff of the city of Chicopee's Department of Public Works, in particular the water pollution control division, for their contributions to this paper and to clean water. We also thank the many regulators at MassDEP and EPA who have helped the city, and are continuing to help the city, champion its clean water efforts. Last, we thank the politicians, both past and present, who have approved funding for these critical clean water projects and have advocated tirelessly on behalf of the city.

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Pushing the limit without breaking the bank—selection, procurement, and testing of a phosphorus removal process

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ABSTRACT | The town of Cheshire, Conn., water pollution control plant (WPCP) recently received a restrictive limit of 0.12 mg/L on effluent total phosphorus as part of the National Pollutant Discharge Elimination System (NPDES) permit renewal process. To meet this stringent limit, several proprietary treatment processes were considered and evaluated to select the process that would be part of an upcoming plant upgrade. Disc filtration was the selected technology, and because of the many differences between the available disc filter designs, a pre-selection process during design was used to select a vendor. With the stringent effluent total phosphorus limit, there were concerns about the demonstrated ability of the selected phosphorus removal process to meet the limit reliably. As a result, on-site performance verification testing was incorporated into the process selection program.

KEYWORDS | Disc filter, disc filtration, phosphorus removal


Cheshire WPCP

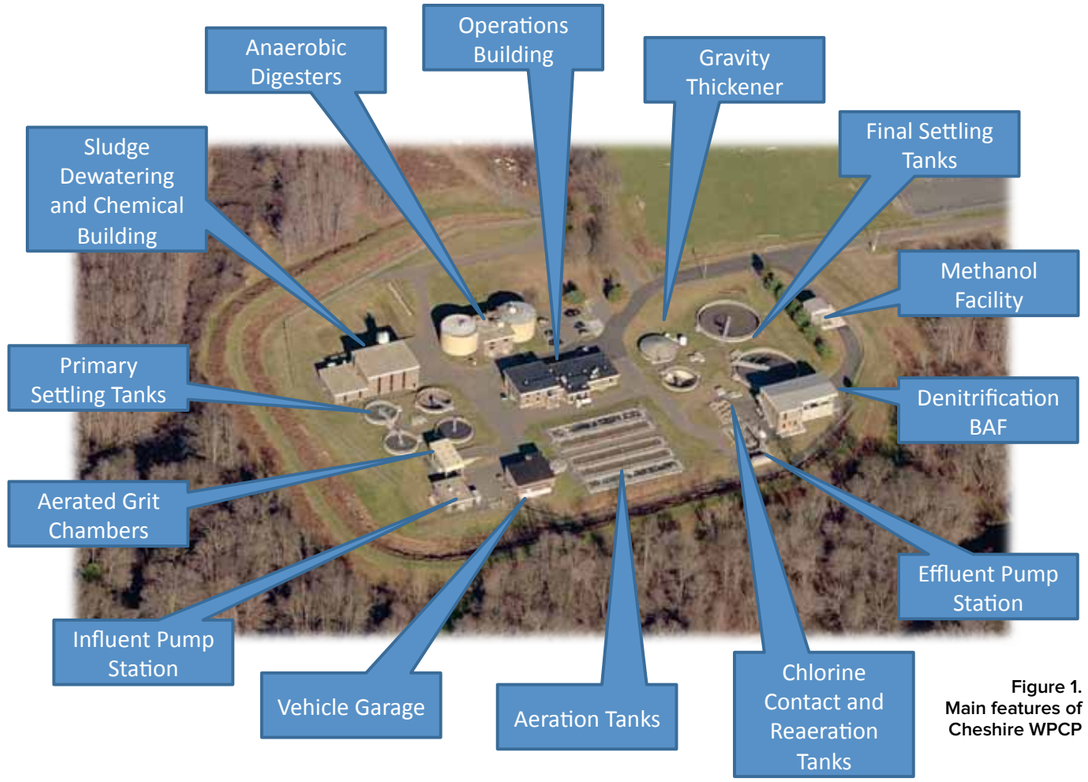

Figure 1. Main features of Cheshire WPCP

INTRODUCTION

Cheshire is a community of approximately 30,000 people, located in New Haven County, south of Hartford. In the denser, more heavily developed areas of town, wastewater is collected and conveyed to an advanced WPCP for treatment prior to discharge of treated effluent to the Quinnipiac River. The WPCP (Figure 1) has an average daily flow capacity of 0.18 m^3/s (4 mgd), and provides carbon oxidation and nitrification using the activated sludge process in a single-stage nitrification configuration, with denitrification accomplished in a downstream biological anoxic filter (BAF). Effluent is seasonally disinfected using sodium hypochlorite and dechlorinated with sodium bisulfite prior to discharge. Waste-activated and BAF sludges are co-settled in the primary settling tanks, anaerobically digested, and dewatered prior to offsite disposal at the incinerator in Waterbury, Conn. Figure 2 presents a process flow schematic of the treatment process.

The WPCP was constructed in phases beginning in 1971 with a major upgrade and expansion in 1992, and the addition of the denitrification BAF in 2006. In 2009, the town began planning for a WPCP upgrade to address worn and aging equipment.

THREE-PRONGED, AGGRESSIVE PHOSPHORUS LIMITS

According to the U. S. Environmental Protection Agency (EPA), nutrient enrichment is one of the most pressing water quality issues facing the nation as a whole. As a result, EPA has increased pressure on all states to aggressively limit the quantity of phosphorus discharged to surface waters. In Region 1, EPA has mandated that all New England states limit phosphorus in all wastewater discharge permits where the potential exists for the discharge to contribute to eutrophication and impairment of designated uses in downstream waters.

The Connecticut Department of Energy and Environmental Protection (DEEP) released its proposed "Phosphorus Reduction Strategy for Inland Non-Tidal Waters" in June 2009. This strategy included effluent phosphorus limits for the 44 wastewater treatment plants in Connecticut discharging treated effluent to inland, non-tidal rivers and streams. The strategy assigned each of the 44 wastewater treatment facilities discharging to inland fresh water resources an average performance limit and seasonal (April through October) permit load. This seasonal load was based on a watershed analysis

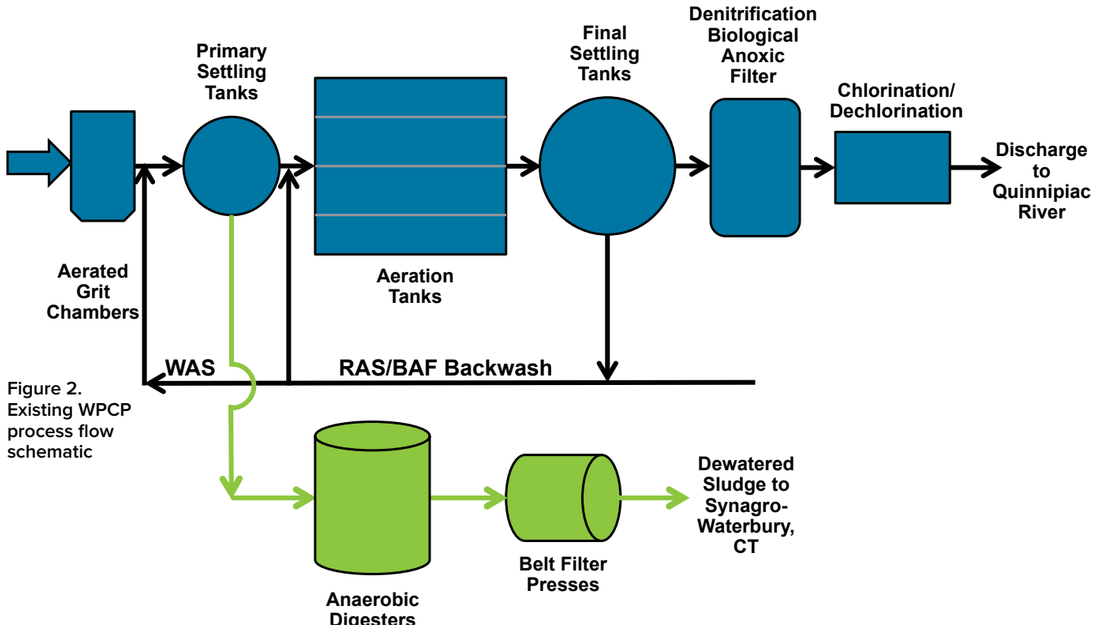

Figure 2. Existing WPCP process flow schematic

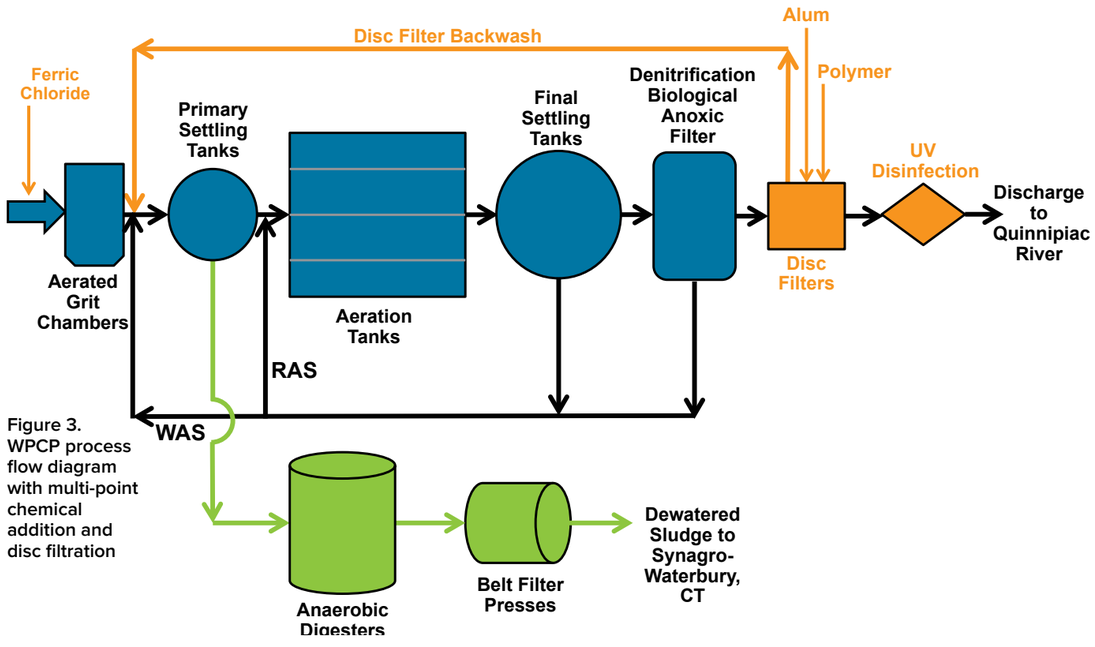

Figure 3. WPCP process flow diagram with multi-point chemical addition and disc filtration

that identified the in-stream load needed to protect aquatic life uses throughout the watershed. The watershed analysis methodology was intended to account for all upstream sources contributing excess phosphorus at the point of discharge. Upon reissuance of the NPDES permit, each wastewater treatment facility affected will be required to achieve the proposed seasonal load assigned to it. The permit limits vary widely, with 12 of the 44 plants required to achieve an effluent total phosphorus concentration of 0.2 mg/L or lower. The Cheshire WPCP is one of 12 plants in the state receiving the stringent limits on total phosphorus.

The Cheshire WPCP's NPDES permit was renewed in 2012 and contained new effluent total phosphorus limits as well as a required compliance schedule to meet the new limits. The limits for the Cheshire WPCP apply from April 1 through October 31 of each year and require:

- Seasonal Average Total Phosphorus: 1.85 Kg/day (4.06 lbs./day) (equivalent to 0.12 mg/L at a design flow of 0.18 m3/s (4.0 mgd))
- Monthly Average Total Phosphorus Concentration: 0.31 mg/L
- Daily Maximum Total Phosphorus Concentration: 0.62 mg/L

INITIAL TECHNOLOGY SELECTION

At the time DEEP proposed the phosphorus limits in 2009, the town was already preparing a wastewater facilities plan to identify improvements to aging equipment and operating and energy efficiency. Review of alternative approaches and initial selection of the technology to meet the limits were part of the facilities planning.

To achieve the stringent total phosphorus limits proposed for Cheshire, it was concluded that chemical precipitation with either an effluent filtration or ballasted flocculation process would be needed. Technologies considered were Co-Mag, ActiFlo, disc filtration, and continuous backwash sand filtration. Each process was sited, sized, and evaluated based on estimated capital and 20-year life-cycle costs, as well as on non-monetary factors. Since the plant disinfection system was to be upgraded to use ultraviolet (UV) disinfection and there was potential to reuse common tankage, all the alternatives included the estimated cost for the conversion to UV disinfection. Table 1 presents the estimated capital, operation and maintenance, and 20-year life-cycle costs for the four technologies evaluated.

Table 1. Wastewater facilities plan phosphorus removal technology comparison

ALTERNATIVE	Capital Costs ($)[1]	20-Year Present Worth O&M Costs ($)	20-Year Life Cycle Costs ($)
Disc Filtration & UV Disinfection	7,900,000	2,600,000	10,500,000
Co-Mag & UV Disinfection	12,800,000	4,500,000	17,300,000
Actiflo & UV Disinfection	10,500,000	3,300,000	13,800,000
Dynasand & UV Disinfection	9,000,000	3,000,000	12,000,000

(1) ENR Construction Cost Index: 8590

Based on the evaluation, chemical precipitation (including coagulation and flocculation) with disc filtration was selected as the recommended process. This technology had an estimated capital cost that was more than $1 million lower and an estimated life-cycle cost of more than $1.5 million lower than the next lowest-cost process.

SELECTING THE VENDOR

Once the disc filtration technology was selected, the project entered the design phase. Figure 3 illustrates the revised process flow diagram with the disc filtration system included. Multi-point chemical addition will be used to precipitate and remove the phosphorus present in the wastewater. Ferric chloride will be added to the aerated grit chamber where the air agitation will mix the ferric chloride with the incoming raw wastewater for subsequent removal in the primary settling tanks. Total phosphorus concentrations in the WPCP influent averages 2.0 to 4.0 mg/L. The ferric chloride addition will be controlled through flow pacing the chemical dose and trimming the dose via the measurements of an online phosphate analyzer. With two biological systems downstream of the primary settling tanks in the process train, sufficient phosphorus must remain in the wastewater after primary treatment to provide enough for biological growth in both treatment systems. The target for total phosphorus levels entering the coagulation and flocculation zones ahead of the disc filters will be 0.5 to 1.0 mg/L. Aluminum sulfate (alum) will be flash-mixed with the denitrified effluent upstream of a coagulation zone followed by polymer addition upstream of a flocculation zone. These zones will have mechanical mixers and be located in the former chlorine contact tanks. Flow will then pass through the disc filters, with filter backwash directed to either a gravity thickener or to the plant drain for subsequent co-settling in the primary settling tanks.

As there are a number of vendors of disc filtration systems, each has its own configuration. These systems differ in:

- Media type
- Flow path
- Head loss

Table 2. Disc filtration systems cost comparison

PROPOSER	Vendor A	Vendor B
Lump Sum Proposal Cost	$1,139,000	$1,117,006
Comparative Construction Costs[1]	$609,000	$738,000
Comparative Present Worth O&M Costs	$1,991,000	$1,984,000
Total Comparative Life-Cycle Proposal Cost	$3,739,000	$3,839,000

(1) These construction costs are comparative only and do not represent the total estimated construction cost of the complete disc filter system installation.
(2) ENR Construction Cost Index: 8590

Table 3. Disc filtration systems non-cost considerations

FACTOR	Vendor A	Vendor B
Submittal Completeness	Minor RFP omissions.	Many RFP requirements not provided or limited information provided.
Exceptions to the RFP	Minor – Did not modify the intent of the RFP. Some contractual exceptions.	Significant process design/ performance guarantee exceptions. Some contractual exceptions.
Average Daily Backwash Volume	0.06 ML/day (17,100 gallons/day) 0.4% of average daily flow. Less flow to be recycled to WPCP influent pump station and reprocessed.	0.28 ML/day (73,000 gallons/day) 1.8% of average daily flow. More flow to be recycled to WPCP influent pump station and reprocessed.
Media Warranty	5-year warranty	1-year warranty
Media Chemical Cleaning Requirement	Not required but recommended by Vendor A. Automatic cleaning system included in supply.	Can be accommodated with provided piping arrangement and manual operation. Vendor B did not anticipate need for cleaning.

that was developed included a requirement for conducting an on-site demonstration of the disc filter performance as part of the vendor pre-selection process. As part of the pre-selection process, once a disc filter vendor had been identified based on the evaluation of submitted proposals, this vendor was designated the "tentatively selected vendor." That vendor was required to set up an on-site pilot-scale demonstration unit to prove that its disc filtration system could achieve the required limits. Additional

- Backwash arrangement
- Depth of disc submergence
- Coagulation/flocculation and chemical dosing requirements

These differences make preparation of a single design that can accommodate the different disc filter systems difficult. As a result, a pre-selection process identified the disc filtration system that offered the most benefits to the town. One concern was that the effluent phosphorus limit of 0.12 mg/L was stringent and there were few full-scale installations of disc filter systems achieving these limits. To address this concern, the request for proposal (RFP) submittal requirements included:

- Prior phosphorus removal installations and data:
  - Minimum of three facilities achieving similar phosphorus levels
- Detailed proposals including equipment layouts
- Fixed lump sum price for furnishing equipment including:
  - Disc filters, tanks, and covers
  - Coagulant and flocculant dosing control systems
  - Coagulation and flocculation mixers
  - Disc filter/chemical cleaning system
  - On-line phosphate analyzer
  - Engineering during design
  - Submittals
- Operation and maintenance data
- Bid bond
- Performance verification testing
- Performance guarantee and bond

Three responses to the RFP were received. One did not meet the specified minimum experience criteria for similar installations and was not considered further. Using the information, costs, and layouts contained in the remaining two proposals (Vendor "A" and Vendor "B"), a comparative construction and life-cycle cost for each proposal was developed (Table 2). The comparative costs accounted for the items that would be required to accommodate the two different filter systems at the WPCP due to differences in the configuration and scope of equipment/ systems supplied by each vendor. These comparative construction cost differences included the following:

- The estimated costs to construct the disc filter portion of the planned UV/ disc filter building. These estimates included the cost for the building excavation, anticipated required sheeting and dewatering during construction, construction of the concrete foundation, and the above-grade brick and block building. These costs were estimated based on filter building layouts (size and depth) and hydraulic information provided in the proposals.
- Vendor A's disc filter backwash flows out of the filters by gravity (versus the backwash being pumped out of the filters by Vendor B). As a result, Vendor A's system requires a separate backwash pump station to allow for the discharge of the filter backwash to the gravity thickener

Figure 4. Ferric chloride totes at grit chamber

Figure 5. Demonstration disc filter

Figure 6. Phosphate analyzer

(per the RFP requirements). Based on the backwash volumes and pumps included in Vendor A's proposal, the costs for the backwash pump station (excavation, sheeting, concrete, mechanical, electrical, and miscellaneous systems) were included in the estimated comparative construction cost. The pump costs were already a part of this proposal.

- The available hydraulic head at the WPCP is limited where the disc filters are going to be used in the WPCP process flow. Vendor B's filters have a higher head loss than Vendor A's filters. As a result of this increased head loss, Vendor B's system would require raising the walls nine inches in chlorine contact tank No.1, which will be converted into a tank with coagulation/flocculation zones for phosphorus removal. The cost to raise the walls of this tank was included in Vendor B's estimated comparative construction cost.
- Vendor B's backwash system would be delivered to the site with the backwash pumps and a number of the backwash valves loose, whereas Vendor A's backwash system equipment and piping would be delivered factory-assembled. As a result, Vendor B's estimated comparative construction cost included the cost to provide the necessary backwash pump installation and to supply and install the backwash piping to connect the supplied pumps and valves.
- Vendor B's backwash system requires 21 solenoid valves for operation (seven per unit) that are not required for Vendor A's filters. The cost comparison therefore included a cost for wiring these valves for Vendor B's system.
- Vendor A's system recommended that an automatic chemical cleaning system be provided for maintenance cleaning of the filter media, so this vendor's proposal included the cost of a portable chemical cleaning unit.

Table 2 presents the life-cycle costs (present worth) developed for each system. These present worth costs are intended to compare the long-term operation and maintenance costs of the disc filters and associated equipment in both vendors' proposals. These present worth costs are not intended as a complete present worth cost of the project, which would include other factors (electrical and maintenance cost of common equipment, electrical equipment, HVAC equipment, chemical feed and storage equipment, etc.) not associated with the scope of the RFP.

Finally, non-cost considerations of each vendor's proposed equipment and proposal were evaluated and summarized (Table 3). Compared on only a capital cost basis (normally the sole basis for selection of a particular vendor's equipment, especially if the general contractor is selecting the equipment), Vendor B's disc filter was the lower cost system. It was concluded, however, that both products could achieve the project goals, and the costs were quite close. But compared on a life-cycle cost basis, which provides a clearer indication of the actual cost to the town, Vendor A's disc filter was the lower-cost system. Based on a life-cycle cost evaluation, as well as consideration of the non-cost considerations of both proposals, Vendor A's disc filter provided the best value and was selected for the plant upgrade, contingent upon completion of a successful on-site verification test.

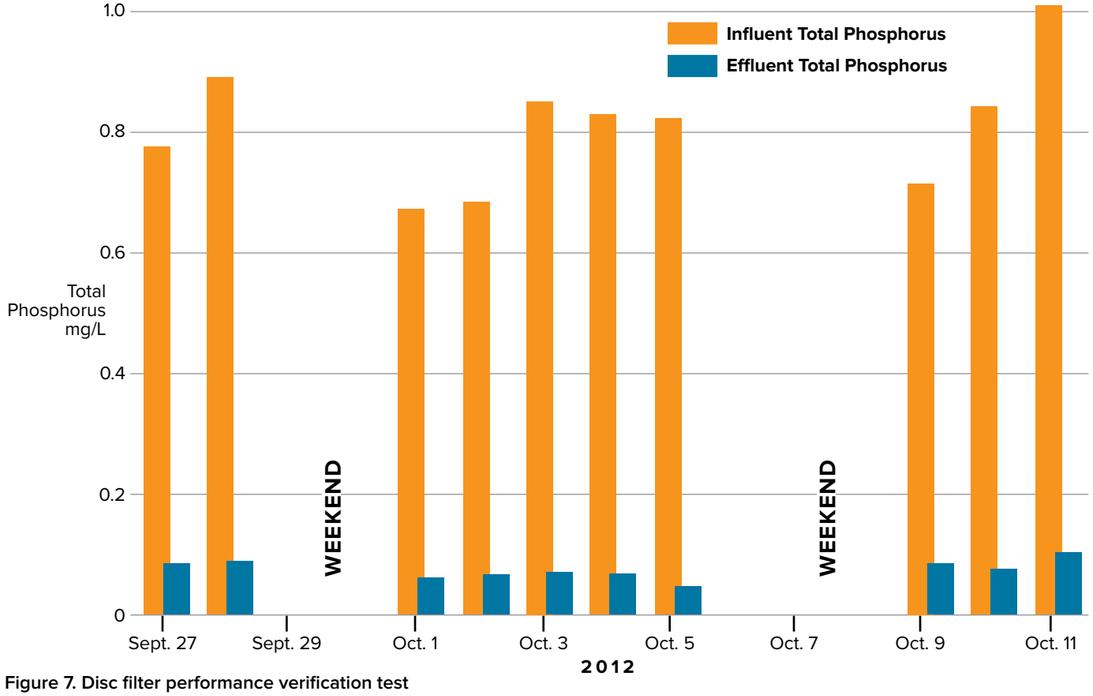

Figure 7. Disc filter performance verification test influent and effluent total phosphorus

PERFORMANCE VERIFICATION TESTING PROTOCOL

The RFP specified a 10-day pilot-scale performance verification test at the WPCP. The testing was required to verify the performance of the disc filter using Cheshire's wastewater, as the 0.12 mg/L effluent total phosphorus requirement was pushing the limits of this technology. As part of the test protocol, the vendor was required to provide a temporary ferric chloride feed system for dosing just upstream of the grit chambers at the WPCP to simulate the full-scale operation of the multi-point chemical addition approach. During the 10-day test, alum and polymer were also fed to the coagulation and flocculation portion of the disc filtration system, and the filters were loaded at the equivalent hydraulic loading rate of average daily flow of 15.1 ML/d (4.0 mgd) for seven days, and at an equivalent hydraulic loading rate of peak daily flow of 41.6 ML/d (11 mgd) for three days. An independent third-party EPA-certified laboratory and Vendor A collected and analyzed daily composite samples of disc filter system influent and effluent for the various forms of phosphorus as well as total suspended solids and turbidity.

PERFORMANCE TESTING RESULTS

A trailer-mounted test disc filter unit was set up at the Cheshire WPCP in early September 2012. A disc filter system influent pump was installed in the denitrification filter effluent channel to feed denitrified effluent to the disc filter system. Following equipment setup and chemical feed system optimization, the performance testing began and the filter system was subsequently operated for 10 eight-hour days. Figures 4 through 6 present photographs of the test equipment.

Table 4 shows that the average total phosphorus concentration was 0.074 mg/L during the seven-day average daily flow testing, and was 0.093 mg/L over the three-day peak flow testing period. Over the 10-day testing period, the average disc filter effluent total phosphorus was 0.080 mg/L, demonstrating that the disc filter system consistently achieved more than 90-percent removal of influent total phosphorus. All the effluent values were well below the target seasonal average total phosphorus concentration of 0.12 mg/L required by the disc filter RFP. Figure 7 charts the total phosphorus data for each day of the test. As indicated, the disc filter system performance was consistent from day to day.

As a result of the successful on-site performance verification test, Vendor A was confirmed as the selected vendor for the disc filter system.

Table 4. Disc filtration system demonstration performance test results

TEST CONDITION	Loading rate, L/M^2-S (GPM/Sq. Ft.)	Effluent Total Phosphorus Test Data	Effluent Total Phosphorus Test Requirement
Average Daily Flow Equivalent Hydraulic Loading Rate (7-day average)	1.22 (1.8)	0.074 mg/L	0.10 mg/L
Peak Flow Equivalent Hydraulic Loading Rate (3-day average)	2.71 (4.0)	0.093 mg/L	0.12 mg/L

PROJECT STATUS

Design of the Cheshire WPCP upgrade, which included the disc filter system, was completed in the spring of 2013. Bids for construction of the project were received in the fall of 2013. Construction commenced in October 2013, and completion is scheduled for November 2015. Work is underway on the construction of the disc filter/UV building.

CONCLUSION

To meet a stringent limit for effluent phosphorus at the Cheshire WPCP, multi-point chemical addition with disc filtration was selected as the lowest-cost technology. Since the disc filter systems differ significantly, a pre-selection process was used to select the equipment vendor. To address concerns with verification of vendor claimed performance, the pre-selection process included a requirement for an on-site performance verification test. This approach allowed the town to select the vendor that provided the best value based on both capital and operations and maintenance costs, and confirm that the full-scale system could achieve the required effluent total phosphorus levels. Based on the results of the on-site testing, and the lower capital costs, WPCPs facing total phosphorus limits in the 0.1 mg/L range should consider disc filters as a viable, cost-effective phosphorus removal technology.

ACKNOWLEDGEMENTS

The authors would like to gratefully acknowledge the assistance and support provided by Cheshire's water pollution control department, the Cheshire Water Pollution Control Authority, and the disc filtration system vendor.

REFERENCES

- U.S. EPA, *Nutrient Criteria Technical Guidance Manual, Rivers and Streams,* July 2000, EPA-822-B-00-002, Washington, D.C.
- Connecticut Department of Energy and Environmental Protection, 2011 *Phosphorus Interim Strategy Fact Sheet,* Hartford, CT.

ABOUT THE AUTHORS

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NEBRA Highlights

Many game-land areas in Pennsylvania have had soils restored with biosolids. This elk herd is enjoying the rich forage that grows sustainably on these sites.

EPA biosolids research & risk assessment — an update

Rick Stevens of the U. S. Environmental Protection Agency (EPA) Office of Water, Office of Science and Technology, recently responded to a request for clarification on the agency's position on biosolids use on land:

"Our standard response to such inquiries is that we believe that the Part 503 standards are protective of public health."

He went on to describe his office's continued biosolids work:

"We continue to evaluate pollutants and conduct research. In 2009 EPA published the Targeted National Sewage Sludge Survey (TNSSS; http://water.epa.gov/scitech/wastetech/biosolids/). TNSSS pollutants are being evaluated by EPA in two phases:

1. "Phase I consists of evaluating ten pollutants (i.e., barium, beryllium, manganese, molybdenum, silver, 4-Chloroaniline, fluoranthene, pyrene, nitrate, and nitrite); the risk evaluations for these ten pollutants are undergoing peer review through June 2014. Following peer review, the Agency will address comments, revise the risk evaluation technical background document, and consider any needed risk management options."
2. "Phase II pollutants include 135 compounds that the agency may evaluate in 2014 and 2015."

EPA believes it has enough data to conduct a probabilistic risk assessment for about 72 of the constituents, but additional data would be necessary for the other 63. Work continues through the Water Environment Research Foundation and other research institutions to fill those data gaps.

Dr. Stevens also noted the following examples of "ongoing or planned research within EPA's Office of Research and Development:

1. "Evaluating the fate and transport of emerging contaminants (including trace organics, nanoparticles and pathogens) in wastewater, surface water, and biosolids, and development of cost effective test methods and management/treatment options to inform risk assessment and potential future wastewater treatment regulations. ORD is finalizing the development of qPCR techniques for quantification of E. Coli and the development of thresholds for use in quantifying Enterococci and E. Coli using qPCR to help the agency better monitor and report the status of pathogens"
2. "Developing and refining the scientific tools available for screening risks for chemical and microbial pollutants found in biosolids"
3. "For pathogens, determining the capability of existing treatment technologies in wastewater and drinking water treatment facilities to control and treat the types and populations of pathogens associated with the warmer water temperatures expected to result from a changing climate."

EPA sewage sludge incineration (SSI) rules —an update

In March, the CA Association of Sanitation Agency Biosolids Program met with U. S. EPA and received the following information from Amy Hambrick of the Office of Air Quality Planning & Standards:

Litigation. On August 20, 2013, the U.S. Court of Appeals for the District of Columbia Circuit remanded portions of the 2011 SSI rules (New Source Performance Standards And Emissions Guidelines) for further explanation. The court did not vacate the rule, and the requirements of the rule therefore remain in place. EPA is evaluating the court's decision and must address the court's remand; however, the court has not provided EPA with a schedule for remand response. States are moving forward to implement the rule.

Gasification. In the SSI rule record (March 21, 2011), EPA responds in the "Response to Public Comments" document that SSI applicability to gasification units would be case by case. The MaxWest Applicability Determination was given for their specific situation. The applicability determination was not intended to be industry-wide.

When other sewage sludge gasifiers pop up, they would likely also have to go through the formal applicability determination process for their specific situations.

Biosolids as a fuel source (e.g. cement kilns). Biosolids combusted in other types of units at other types of facilities such as cement/waste-burning kilns (besides an incinerator at a wastewater treatment facility that treats domestic sewage sludge) would most likely have to comply with other incineration standards under Clean Air Act (CAA) section 129 – unless the facility met a statutory exemption under CAA section 129 or met the legitimacy criteria for fuel under RCRA's non-hazardous secondary materials rule.

The EPA 2011 SSI regulations are summarized in this brochure: epa.gov/ttn/atw/129/ssi/ssibrochure.pdf.

NEBRA responds to biosolids issues, promotes biosolids benefits

Over the long winter, NEBRA continued to improve public understanding of biosolids:

- In Vermont, as the Deptment of Environmental Conservation considers biosolids rule changes, NEBRA is working with the Green Mountain Water Environment Association on a new weekend of wastewater treatment plant open houses, May 23 and 24. This will be a fun, participatory educational offering for the public, the media, and water quality professionals. Details at gmwea.org and nebiosolids.org.
- In western New York, where new quasar energy group anaerobic digestion and energy production facilities have stirred up public concerns, NEBRA has assisted facility managers in providing accurate information and outreach to key stakeholders, the media, and the public.

Meanwhile, NEBRA has lined up opportunities to provide diverse audiences with updates on biosolids management. This year, NEBRA is presenting at:

- Maine sustainability conference (April 1)
- Spring meetings of the Green Mountain and Maine Water Environment Associations
- WEF residuals & biosolids conference
- Northeast Resource Recovery Association (June 10)
- NEWEA microconstituents conference
- Workshops with the Northeast Recycling Coalition (NERC) and New England Interstate Water Pollution Control Commission (NEIWPCC)

NEBRA responds to proposed fertilizer regulations

The NEBRA regulatory and legislative committee and NEBRA board responded quickly in late March to draft regulations proposed by the Massachusetts Department of Agricultural Resources (MADAR). NEBRA joined the Massachusetts farm bureau and many others in criticizing the proposed regulations. "Our members are heavily involved in helping the commonwealth and MassDEP advance its goals of diverting organics from landfills and incineration and helping move our communities toward sustainability," wrote NEBRA. "The proposed regulations would have a chilling effect on these efforts."

NEBRA's comments (available for download from the left side of www.nebiosolids.org) applauded MADAR for its efforts to control non-point-source nutrient pollution, but urged the agency to work with stakeholders and MassDEP to come up with balanced fertilizer regulations that will not impede organics recycling.

Those in the wastewater and biosolids management profession are between a rock and a hard place: Federal permit limits are requiring removal of more nutrients from wastewater while states, such as Massachusetts, are hoping that water resource recovery facilities (WRRFs) with anaerobic digestion will take in organics being diverted from landfills. Those organics increase the nutrient loading in WRRFs, making it harder for them to meet stricter permit limits.

State agencies need to work together with WRRFs toward improved capture of these local nutrients, perhaps through advanced concentrated nutrient recovery systems (e.g. Ostara). Getting especially phosphorus out in a concentrated form, so that it can be shipped to places where soils need it, is a worthy goal.

Sustainability will come when nutrients in wastewater —a local source of nutrients—are carefully used where needed on local soils, any excesses are shipped in concentrated form to soils that need them, and there is a reduction in the use of fertilizers mined and synthesized, and imported from afar.

The Northeast Residuals & Biosolids Conference

October 22 & 23, 2014
Portland, Maine

Ned Beecher, Executive Director
Tamworth, N.H.
603-323-7654 | info@nebiosolids.org

For more information or to subscribe to NEBRAMail, NEBRA's email newsletter visit nebiosolids.org

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North East Biosolids & Residuals Association

Biosolids goes mainstream in the media

Greg Lewis, Stowe, Vt., on the cover of TPO magazine

Media coverage of biosolids has been increasing nationwide. Over the past year, several national public radio stories have highlighted land application programs and anaerobic digestion for energy production (just "google" NPR + biosolids). And even Organic Gardening ran a balanced article about biosolids, despite that the magazine has always been skeptical about biosolids use on soils (biosolids are not allowed in certified organic production, according to U. S. Department of Agriculture regulations); "google" organic gardening + biosolids.

Congratulations to NEBRA members in the news:

- Monadnock Paper Mills was highlighted in Forbes magazine: forbes.com/sites/peterdetwiler/2014/03/03/monadnock-paper-mills-sustainability-is-enlightened-self-interest/.
- The Stowe, Vt. biosolids program was in Treatment Plant Operator (with Greg Lewis on the cover).
- Lystek's product was the focus of articles in Ontario Farmer and Better Farming, and their win in court appears at: therecord.com/news-story/4408265-group-loses-court-fight-against-lystek/.
- Quasar energy group presented a fine op ed in the Buffalo News: buffalonews.com/opinion/another-voice/another-voice-quasar-has-improved-the-existing-process-of-applying-biosolids-20140403.
- Waste Management is involved in the Newtown Creek food waste co-digestion pilot project in New York City ("google" NPR + food waste + newtown).
- NEBRA and biosolids were the focus of major coverage by NEIWPCC—see its spring newsletter.
- And Lewiston-Auburn Water Pollution Control Authority received accolades for its new anaerobic digestion and energy production facility from Maine's two Senators, Susan Collins and Angus King. Read the senators' letter to EPA, USDA, and DOE at the left side of nebiosolids.org.

NEBRA notes

- NEBRA welcomes new member—quasar energy group
- NEBRA sends best wishes to Maggie Finn, admin & project assistant, who has moved on to a full-time position with Casella Organics. During her two years on staff, Maggie artfully advanced NEBRA's mission and programs.

Maggie Finn

- Ginny Grace, Past President of NEBRA, who is moving to new work in North Carolina.
- NEBRA congratulates founding NEBRA member Shelagh Connelly of Resource Management, Inc. and Janice Moran, NEWEA, for their Alfred E. Peloquin Awards for "New Hampshire" and "Massachusetts," respectively. Brava! Brava!

The biosolids info hub—a new NEBRA website

Please donate today. We're half way to our goal of $9,400.

The NEBRA website is the information hub for biosolids and residuals in this region. It is the public face of what we do. And it's beginning to slow us down. The board and staff have plans for neat new features:

- more videos and slide shows
- a members' area
- a responsive design—looking great on phones and tablet
- social media, and
- a sleek design—improving this repository of key information.

This is only the third time in NEBRA's 17 years that we have invested in a new site. But, it doesn't come free. Donate today: nebiosolids.org/Mission & Membership/Payment Options.

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Maine State Director Report

by Peter Goodwin
pgoodwin@woodardcurran

I would like to express my enthusiasm and pride at the honor of serving as a director in the NEWEA executive committee on behalf of the more than 650 municipal and industrial operators, superintendents, engineers, vendors, students, regulatory officials, and consultants who are Maine Wastewater Control Association (MWWCA) members. The mission of MWWCA, which represents 95 treatment facilities serving over 125 communities in Maine, is to: "Promote professional environmental management practices to protect and improve the waters and related environments of the State of Maine." As the NEWEA state director, I interact with the other hard-working New England directors on the NEWEA executive committee to build on our outstanding regional relationships.

2014 NEWEA Annual Conference

MWWCA was well represented at the NEWEA Annual Conference in Boston. Our own Brad Moore, from Bangor, Maine, was elected president for 2014. MWWCA continues to provide outstanding leadership and direction to NEWEA.

Maine professionalism was well recognized at the Annual Awards Luncheon, including:

- NEWEA Operator Award to Greg Thulen, Brunswick Sewer District
- Alfred E. Peloquin Award to Scott Firmin, Portland Water District
- NEWEA Young Professional Award to Paula Drouin, Lewiston-Auburn Water Pollution Control Authority
- NEWEA Public Educator Award to Matt Timberlake (Ted Berry Co, for MWWCA) and Jeff McNelly (Maine Water Utilities Association) for the 2013 "Water's Worth It" newspaper insert
- Clair N. Sawyer Award and a WEF Service Award to John Hart, Saco WRRD
- Past President award to Dan Bisson, CDM Smith
- Operations Challenge, Division II first place process event by team Force Maine (Dan Laflamme, Alex Buechner, Tony Ellsworth, Scott Lausier, and Stacy Thompson)
- WEF Service Award to Greg Cataldo, Woodard & Curran (retired)
- WEF Life Membership to Tom Schultz, Mechanic Falls Sanitary District (retired)
- WEF Laboratory Analyst Excellence Award and induction into the NEWEA Crystal Crucible Society for Peter Sherwood, KSTD

The 2014 MWWCA officers include:

- President Aubrey Strause of Verdant Water LLC
- First Vice President Tom Connolly of Yarmouth
- Second Vice President Scott Firmin of the Portland Water District
- Immediate Past President Travis Peaslee of the Lewiston-Auburn Sewerage District
- Secretary/Treasurer Al Jellison of the city of Bangor

In addition to those on the executive committee many un-named individuals enable the organization to continue to provide outstanding service to our membership and most important to all the residents of the great state of Maine.

Thanks, also, for the invaluable help from Joan Kiszely, Melissa Carver, and our other support staff from the Maine Municipal Association.

2014 legislative breakfast

On February 27, 2014, the annual Legislative Breakfast was held in Augusta, Maine, as a collaborative effort among water and wastewater stakeholder associations MWWCA, NEWEA, Maine Water Utilities Association, and NEIWPCC. The theme, "Water's Worth It—Everyone's Responsibility," resonated throughout the morning as stories of the successes and struggles of the water and wastewater industry were echoed by industry representatives, legislators, and regulators.

Opening remarks by 2014 NEWEA President Bradley Moore from the city of Bangor highlighted the success MWWCA and NEWEA and their collective missions have had on the environment. Following Brad at the podium was Jefferson Longfellow of the Kennebec Water District, also 2014 president of the MWUA, discussing how SRF funding is critical to maintaining infrastructure in Maine. Jefferson provided a sample section of a recently replaced water main from Waterville that was so encrusted with tuberculation that fire flows were no longer adequate. The breakfast was attended by most key legislative committee members and again was a success in reminding our state legislators that "Water's Worth It."

NEWEA 2014 Washington congressional briefing

The MWWCA executive committee again participated in the NEWEA Congressional Briefing on April 7-9, 2014. This year we joined the National Association of Clean Water Agencies and WEF to help educate national leaders on the critical importance of sustainable clean water to our economy, environment, and public health for every American. MWWCA leadership, with our own NEWEA President Brad Moore, participated in several national level discussions, meetings with senators Susan Collins and Angus King and congressmen Mike Michaud and Chellie Pingree. Former Bucksport Town Manager Roger Raymond spoke at the NEWEA breakfast about his experiences and successes with wastewater programs in Eagle Lake and Bucksport. The focus was on how funding programs from RDA and DEP benefit the communities environmentally and economically.

2013 fifth annual ski day—Saddleback ski area

The sixth Annual Ski Day was held in Rangeley, Maine, at Saddleback Ski Area. This year we invited our

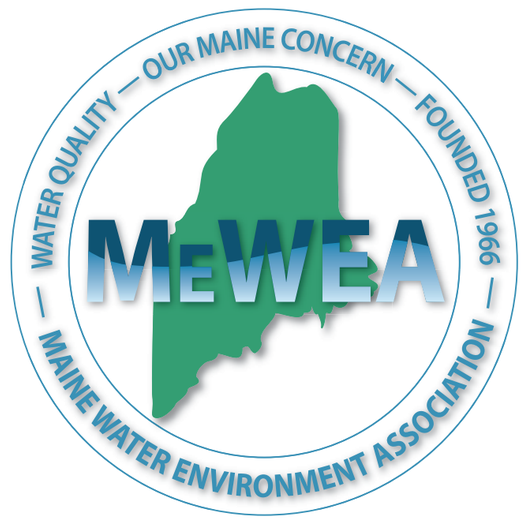
New Hampshire Water Pollution Control associates and had more than 60 downhill enthusiasts enjoying a magnificent event. While the commute to Saddleback may have challenged some, the 20 inches of outstanding snow and a sunny, windless day provided historic conditions. The operations challenge team benefited from the raffle of a beautiful Adirondack ski chair and a wine rack donated by Bob Poirier.

MWWCA spring meeting-Orono—April 18, 2014

The MWWCA annual spring meeting was held at the Black Bear Inn in Orono, Maine. An outstanding technical program was developed by the professional development committee focused on wastewater and stormwater initiatives. The executive committee convened on April 17, 2014, to conduct the annual planning session that focused on long-term strategic initiatives for the organization. In addition, MWWCA moved forward with our "name" change during this event. Based on the formal vote during the 2013 fall conference, MWWCA will transition to the Maine Water Environment Association (MEWEA).

MWWCA fall meeting Sunday River—September 17-19, 2014

Mark your calendar for the annual fall conference, which has rotated to Sunday River Resort in Newry, Maine, for September 17-19, 2014. The conference will start with the annual golf tournament on the exciting Robert Trent Jones-designed "Top 100" public golf course.



The newly approved logo for the re-branded Maine Water Environment Association (formerly Maine WasteWater Control Association).

New Hampshire State Director Report

by Fred McNeill
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The New Hampshire Water Pollution Control Association's (NHWPCA) membership for 2014 consists of more than 320 water professionals, from operators, to consultants, to vendors, to regulators, to contractors, who all share one common bond: to promote the water industry positively to better serve the public. NHWPCA sponsored and participated in several educational and association activities as we wrapped up 2013 and entered 2014; details are shared below.

Winter meeting

The city of Nashua hosted the NHWPCA winter meeting. In the morning about 100 guests toured the 16-mgd Nashua wastewater treatment plant (WWTP), constructed in 1959 and upgraded several times over the years. It has the state's only anaerobic egg-shaped digester and the state's only wet weather treatment facility, with recently completed dewatering, aeration, and clarifier upgrades.

After the morning tours, the meeting continued at the Crowne Plaza Hotel with technical presentations, our annual business meeting, and a visit from Santa. Andy Morrill of Wright-Pierce presented an overview on the Nashua dewatering project and Erik Osborn of Woodard & Curran presented the Nashua aeration and clarifier upgrades. After lunch new officers were elected, including NHWPCA's new president, John Adie, a 22-year water professional veteran who is Nashua's WWTP operations supervisor. A big thank you to Past President Kristin Noel of the Concord WWTP for all of her hard work, dedication, and passion during her 2013 presidency. The gathering recognized the 12 recent graduates of the Department of Environmental Services (DES) management boot camp school, our next generation of leadership. The Allenstown WWTP was honored with the NHWPCA's plant of the year award. After the business meeting, our old friend Santa (a.k.a George Neill) raffled off goodies donated by our strong supporters and by the association.

NEWEA Annual Conference

NHWPCA was well represented at the NEWEA Annual Conference. Several members presented technical papers and participated in committee meetings. NHWPCA is proud to recognize the following professionals who received awards:

- Tom Moran – Operator of the Year
- Shelagh Connelly – Alfred E. Peloquin Award
- George Harrington – James J. Courchaine Collection Systems Award
- Ray Vermette – WEF Operator Ingenuity Award
- Alvin Firm – WEF Life Membership
- Paul Sutton – WEF Life Membership
- Deepika Kurup – Stockholm Junior Water Prize state winner
- Seacoast Sewer Snakes – WEF Operations Challenge first place, national process event

Legislative breakfast

On March 5, NHWPCA, in association with 10 other professional water associations, sponsored an annual legislative breakfast. This was our most successful legislative breakfast, with 42 legislators among our 92 attendees. The focus was Senate Bill 60 (SB-60), which recommended a modified bottle bill to fund a $40 million annual water trust fund. Several legislators, regulators, and water advocates shared their support of SB-60 during the breakfast. We thank our key speakers, Dave Bernier of North Conway Water Precinct, John Boisvert of Pennichuck Water Works, and DES Commissioner Thomas Burack, for sharing our industry's message.

Association events

On April 10 we hosted our annual trade fair at Manchester's Executive Court Club. The trade fair is an important event to support our vendors and equipment suppliers, a critical component of our professional team. Equipment demonstrations were made during the fair. At lunch, NHWPCA recognized our recent NEWEA award winners and annual grade school clean water poster contest winners.

On April 7, a New Hampshire delegation joined hundreds of other water professionals in Washington, D.C., to attend Water Week, which culminated with NEWEA's congressional breakfast on April 9. The objective of Water Week and the congressional breakfast is to promote the water industry's interests, increase awareness of the importance of water, and establish a source of sustainable funding for water projects. This is a national effort and water professionals from all over the country brought our unified message to their congressional delegations.

On April 19, NHWPCA continued its educational outreach program by participating in "Discover Wild NH Day." This fun filled educational day is sponsored by the New Hampshire Fish and Game Department. Along with educating our residents about the state's wildlife and recreational opportunities, the day also focused on the criticality of clean water to New Hampshire's wildlife.

On June 13, NHWPCA will hold its annual summer meeting on the cruise ship MS Mount Washington on beautiful Lake Winnipesaukee in Laconia. This cruise ship departs from our traditional summer outing but will confirm recreationally how clean water is critical to the economic well bring of New Hampshire.

On August 7, NHWPCA will host its 24th annual golf tournament at the historical Beaver Meadow Golf Course in Concord. The association is proud to support the city of Concord's 118-year-old municipal course, one of the three municipal courses in New Hampshire. We look forward to a great day of golf that will help support our scholarship fund and our Operations Challenge team.

On September 23, NHWPCA will help sponsor a one-day workshop, a "Wipes and FOG" seminar in Concord. DES has championed this critical issue and will bring its important message to water professionals during this workshop.

NHWPCA's fall meeting will be in October in the beautiful Lake Sunapee region. In addition to fall foliage, we will tour the Sunapee WWTP, which has been recently upgraded. The meeting will conclude with lunch at the scenic Mount Sunapee ski area. A highlight of the fall meeting will be hosting our operator exchange with our sister state of Connecticut.

NHWPCA's winter meeting will take place in early December in our capital city of Concord. We will tour the city's WWTP and, if everyone has been good, we can expect another visit from Santa.

1. Allenstown staff and their supporters pose with the 2013 NHWPCA Plant of the Year award. 2. Current NHWPCA President John Adie received the gavel from Past President Kristin Noel at the December 2013 meeting. 3. Tom Moran and Donna Hanscom of Keene, N.H. at the 2014 NEWEA annual conference in Boston. 4. "Santa" George Neill delivers his usual spicy raffle repartee as he announces winners of the tableful of prizes at the December 2013 NHWPCA meeting.

Current issues

NPDES permits with nutrient limits and the draft MS4 stormwater permit continue to be the critical current issues facing our industry. Five seacoast WWTPs are all being issued stringent nitrogen limits in their NPDES permits. The state's internal WWTPs, which discharge into the Merrimack River, are being issued phosphorus limits. The estimated cost of compliance with the proposed nutrient limits is in the hundreds of millions of dollars. The draft MS4 stormwater permit will regulate stormwater in more than 45 southern New Hampshire communities, which are home to 75 percent of the state's pollution. The MS4 permits will cost additional hundreds of millions to achieve compliance. NHWPCA continues to promote rational, reasonable, and cost-effective environmental regulations based on sound science.

NHWPCA committees remain active, with education, newsletter, safety, and permit committees meeting regularly. The association is also contemplating a name change, to New Hampshire Water Environmental Association. This branding follows regional and national trends as our industry continues to sharpen our message that "Water's Worth It!" We hope to implement this name change in 2015.

Vermont State Director Report

by Bob Fischer
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Many exciting things happened at Green Mountain Water Environment Association (GMWEA) during 2013, including a new logo, a new Web site and a new tradeshow booth. We have two new members on the board of directors, Michele Eisenstein and Bruce Hoar, and we also hired our first independent executive director, Mary Ellen Parkman. We had a successful spring meeting and fall trade show, and attendance at both continues to grow. During 2013 and now in 2014 we have been busy on many water and wastewater fronts. I have personally attended numerous meetings including: public comment on Lake Champlain phosphorus TMDL; Vermont water quality standards, pre-rulemaking stakeholder meeting; and Vermont water monitoring council. Also, I was appointed by Governor Shumlin to the Vermont citizens' advisory committee on Lake Champlain's future.

Government affairs

The GMWEA government affairs committee has once again been very active. On February 21, we set up the GMWEA booth across from the cafeteria in the state capitol and interacted with many politicians over coffee and bagels. The "coffee meet and greet" was followed up by a legislative lunch that was held at Capital Plaza on February 26. The legislative lunch was our third annual legislative meal and was our most successful yet with more than 50 in attendance, 19 of whom were state representatives and senators. NEWEA president, Brad Moore presented the regional perspective. Members of the committee also attended many meetings on the upcoming Lake Champlain phosphorus TMDL. In late March, I testified in front of the Vermont house fish, wildlife and water resources committee on the potential costs, monetary as well as environmental, associated with the upcoming TMDL. I also had several email exchanges with the Environmental Protection Agency (EPA) over the Tetra Tech study that EPA had commissioned. GMWEA believes that the projected costs in the study were highly underestimated. We were also concerned that the methodology was flawed because it assumed costs, based on just adding a cloth filter system to each facility, with no physical knowledge of the individual facilities, and expecting to attain an effluent total phosphorus discharge limit below 0.1 mg/L.

On March 13, GMWEA sent a letter (excerpts of which are included below) to EPA, Vermont Department of Environmental Conservation (VT DEC), Vermont legislators, senators Leahy and Sanders, and representative Welsh.

Dear Governor:

We are . . . deeply concerned that the Environmental Protection Agency (EPA) appears poised to require enhanced phosphorus removal at Vermont's wastewater treatment facilities (WWTFs) as part of its revised total maximum daily load (TMDL). . . .In effect, it appears that the EPA is asking Vermont to make a firm commitment to non-point source controls without knowing what, if any, credit the EPA intends to award the State for that commitment when considering requirements for point source controls, specifically upgrades to WWTFs. In public meetings on the Lake Champlain TMDL held this past December, EPA noted that Vermont's WWTFs currently contribute just 3.1% of total phosphorus loading to Lake Champlain. If all WWTFs in the Champlain basin implemented best available technologies, GMWEA estimates that this would only account for 2.6% of the required reduction in total phosphorus load to the lake. EPA's initial estimates indicate that capital costs to upgrade WWTFs in order to realize this minute reduction are approximately $35 million (Lake Champlain Phosphorus Removal – Final Report, Tetra-Tech, 2014). Several of our members have had facility-specific evaluations prepared for them [that] indicate that the cost for these upgrades could actually be five to ten times higher than the EPA estimate. Given these facts, we are writing to implore you to condition your support for Vermont's basin-wide implementation plan on EPA limiting its point source pollution control actions to those that are clearly explained and justified based on a robust cost-benefit analysis that compares the predicted improvements in lake water quality with the total cost of WWTF upgrades. This would mean, for example, that if EPA were to propose that all WWTFs in the Champlain Basin be required to meet the limit of technology, then Vermont's commitment to non-point source control measures would be null and void, thus requiring that all parties return to the drawing board to reevaluate the proposed watershed management measures.

1

2

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1. Ashley Lucht, VT DEC, promotes Vermont Drinking Water Week to spectators at the GMWEA trade show 2. During the NEWEA 2014 annual conference awards event, EPA's David Chin presents the EPA's Outstanding Operator award to Jim Jutras of Essex Junction, Vt. 3. The Vermont Water Week water drop (Ashley Lucht) and Elizabeth Walker wave to attendees in the exhibit hall at the 2013 GMWEA trade show

On March 31, as required, Vermont DEC submitted its Phase 1 implementation plan for the Lake Champlain TMDL to EPA. Of particular interest was this excerpt on page 3 of the cover letter:

"This draft Phase One Plan does not allocate any phosphorus reductions to wastewater treatment plants in the Lake Champlain Basin. The load associated with these plants is small, approximately three percent, and is dwarfed by other sources. Further, Vermont's communities and businesses have made substantial progress in reducing phosphorus from these plants over the past four decades and it is increasingly difficult to justify further investments in reducing phosphorus from these sources given the relatively high cost of installing additional phosphorus removal. With optimization of operations to maximize phosphorus removal, these plants should remain a minor source of phosphorus pollution for many years to come without any major new capital investments."

Although this is just one step in the TMDL process, the strenuous efforts of many members of the GMWEA government affairs committee, including the executive director of Vermont Rural Water Association and the legislative liaison from Vermont League of Cities and Towns, helped get our message to Vermont DEC that "bang for the buck" is not just about money but about the environment. For people who live in the core areas with centralized water and wastewater systems, those systems are often the most expensive things they own. If cost increases cause a "flight" from the core service areas into the non-centralized areas, is that increasing "sprawl" into non-urban areas good for the environment? If the facilities take in septage but at a greatly increased cost, will that reduce frequency of septage tank pumping and increase the number of failed systems? Will increased land application of septage raise nutrient levels in stormwater? Well intentioned, but practically flawed legislation may well do more harm to the environment than good.

NEWEA Annual Conference

GMWEA members took several awards at the Annual Conference: Erik Bailey of Winooski received the plant operator award; Chris Robinson of Vergennes received the Alfred E. Peloquin award; Basundhara Mukherjee of South Burlington received the Vermont Stockholm Junior Water Prize for the second time; and James Jutras of Essex Junction was awarded an EPA wastewater treatment plant operator excellence award.

Upcoming events

The annual GMWEA Vermont Lake Monsters baseball game will take place July 17, at Centennial Field in Burlington.

The annual George Dow memorial golf tournament will take place August 22, at the Cedar Knoll country club in Hinesburg.

GMWEA's first "visit your wastewater facility day" is scheduled for May 24.

The GMWEA spring meeting will be held at Killington resort on May 22. This is the business meeting, where awards are given out and association officers elected for the coming year.

Rhode Island State Director Report

by Janine Burke
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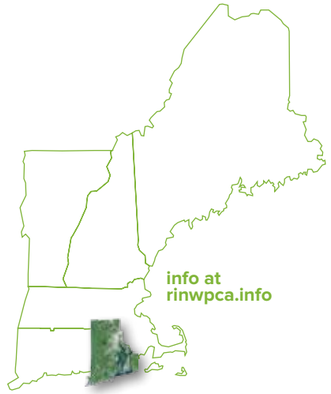

Annual holiday party

Narragansett Water Pollution Control Association (NWPCA) members gathered for the annual holiday party at the Kelley Gazerro Post in Cranston on December 3, 2013. The room was full and the food was great, and thanks to the generosity of all the attendees, NPWCA donated 500 pounds of food and a check for $365 to the Rhode Island Food Bank. NWPCA members in attendance elected the following officers for 2014:

- Doug Nettleton, president (town of Narragansett)
- Scott Goodinson, vice president (Warwick Sewer Authority)
- Joe LaPlante, treasurer (Narragansett Bay Commission)
- Kathy Perez, secretary (town of South Kingstown)

Also elected (or in some cases re-elected) to the executive board were Bernard Bishop (town of West Warwick), Peter Eldridge (United Water, Bucklin Point facility), Bob Mack, director of vendor/consultant coordination (New England Environmental Equipment, Inc.), and Jim Deluca, director of vendor/consultant coordination (Aqua Solutions, Inc.). Continuing in their two-year terms on the executive board are Tom Ciolfi (United Water, Bucklin Point facility) and Mike Spring (Narragansett Bay Commission). Paul Desrosiers (Narragansett Bay Commission) will continue as representative to the board of certification of operators for Rhode Island. In addition, various committees have been established and chairs selected for 2014.

Pictured in front of the living NEWEA logo are Rhode Islanders Peter Sullivan, Scott Goodinson, Joe Crosby, Sara Nadeau, and Dave Nigris

New training program

NWPCA is working on a new training program for 2014. The training committee is lining up short but focused two-hour sessions to increase operator knowledge and skills. Training topics being considered include operator awareness, biological nitrogen removal and activated sludge processes, solids control and removal, and team building. In addition, the previously successful preparatory class for the grade two operator license began again in April in time for the license examinations on May 14.

Annual Conference in Boston

NWPCA sent a large contingent to NEWEA's Annual Conference in Boston in January. NWPCA provided numerous scholarships for its operator-members to attend the conference and vendor exhibition on Operators' Day, January 28. Joe Crosby and Sara Nadeau from the Narragansett Bay Commission and Peter Sullivan from the Warwick Sewer Authority presented at the Tuesday technical session highlighting operator ingenuity.

Stockholm Junior Water Prize

NWPCA promoted the Stockholm Junior Water Prize (SJWP) in Rhode Island again this year. NWPCA sent judges to the Rhode Island Science & Engineering Fair on March 15 to review water-related projects and encourage high school students to participate in the State SJWP competition. NWPCA recognized two of the high school students with young water scientist certificates. The impressive and promising water scientists were Angus Nathan (Grade nine/Warwick Veterans Memorial High School) whose project, "The Effects of Sewers on Fecal Contamination," compared water quality in sewered and non-sewered areas in his community. Jacqueline Ray, a freshman at LaSalle Academy in Providence, also won in the microbiology category for asking the question, how do the microorganisms used in the sewage treatment process affect the pH, nitrogen, and phosphorus levels in Narragansett Bay?

Rhode Island clean water legislative breakfast

NWPCA held its third annual Rhode Island clean water legislative breakfast on March 25 at the Crowne Plaza in Warwick. Senator Jack Reed sent a video greeting and speakers included Ronald Poltak, executive director of the New England Interstate Water Pollution Control Commission (NEIWPCC), Thomas Borden, Narragansett Bay estuary program director, Janet Coit, director of the Rhode Island Department of Environmental Management, William Sequino, executive director of the Rhode Island Clean Water Finance Agency, Edward Ladouceur, city councilman representing Ward 5 in Warwick, and Jamia McDonald, director of the Rhode Island Emergency Management Agency. Although there were not too many legislators in the audience, the event was fairly well attended and garnered local press coverage.

NEWEA Vice President Ray Willis, Susan Sullivan and Ron Poltak of NEIWPCC chat before the event begins

NEWEA Government Affairs Committee Chair Peter Grose talks with speakers Jamia McDonald and Tom Borden after the legislative breakfast

Connecticut State Director Report

by Jay G. Sheehan
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It is certain that 2014 will prove an important year for wastewater in Connecticut. There have already been significant happenings this winter/spring, and we expect many more important activities before the year is out, due to hard work and tremendous collaboration among the many water and wastewater leaders within the state.

This is a great time for NEWEA's Connecticut-affiliated association, the Connecticut Water Pollution Abatement Association (CWPAA). CWPAA has been rejuvenated and is gaining momentum around the areas of professional collaboration, legislative action, and professional training. The association has ambitious near-term goals to increase membership, expand public outreach, and develop a proactive regulatory agenda. CWPAA will also participate in the upcoming statewide policy planning process.

Statewide water policy planning

Connecticut is undertaking a significant, multi-year planning effort in 2014 by starting a statewide water policy. Unlike the other New England states, Connecticut has been operating without a comprehensive water policy forever. Recognition of the need for a statewide water policy came to a boiling point in 2013, when a major Connecticut utility proposed the transfer of water from one river basin to another to supply water to a challenged entity. The court of public opinion highlighted the need for better guidance and strategy around water issues such as this, as there are no regulations or policy to either encourage or prohibit such an action. Representative John Hampton (D-Simsbury) garnered support from the governor's office for convening a non-partisan water policy forum and initiated what will turn out to be a multi-year planning effort involving hundreds of water and wastewater professionals.

CWPAA is positioning itself to secure a seat at the table during this process, which so far has had primary participation from water utilities. CWPAA will ensure that the renewal side of water policy is not forgotten and that important topics such as aquifer recharge, wastewater reuse, green infrastructure, and other wastewater issues are considered.

Jane Madden of CDM Smith shares a break with Tom Tyler of MDC, Hartford, Conn.

Collaboration

CWPAA has recognized that success will require collaboration with many partners. The association is partnering with NEWEA, the Connecticut Association of Water Pollution Control Authorities (CAWPCA), New England Interstate Water Pollution Control Commission, the state Department of Energy and Environmental Protection (CTDEEP), Save the Sound, the Connecticut River Watershed Association,

2013 Connecticut Wastewater Managers Training—Graduates of the 2013 Manager's Training class pose with one of their principal instructors, Art Enderle (4th from right)

the Connecticut Conference of Municipalities, and many others. In particular, a close partnership with CAWPCA will benefit both organizations and is well underway. The two organizations are jointly developing a more proactive legislative and regulatory agenda that includes continuing training, education, clean water funding allocations, funding set-asides, statewide water policy planning, and other developing interests of our associations' members.

Legislative action

CWPAA has successfully increased its efforts at legislative action, both locally within the state as well as nationally with Connecticut's congressional delegation. In March, CWPAA co-sponsored its third annual legislative breakfast in Hartford with NEWEA and CAWPCA. In April, CWPAA sent their fifth team from Connecticut to meet with our federal allies. The result is that the Connecticut clean water fund has the largest budget in history with nearly $1 billion being allocated for fiscal years 2014 and 2015.

Professional training

Many are unaware that Connecticut is one of only five states in the nation and the only New England state without continuing education requirements for wastewater operators. CWPAA and CAWPCA recognize that continuing education for operators has significant advantages, including ensuring consistency and continuity of operator qualifications, helping to attract and retain quality operators, and creating a forum for bringing professionals together. As such, CWPAA is partnering with CTDEEP to advance the continuing education program. CTDEEP has offered a commitment to ensure this decade-old challenge advances in 2014 and 2015.

The Nutmeg State's Mike Bisi of Glastonbury and Virgil Lloyd of Fuss & O'Neill converse at the NEWEA Annual Conference.

Other Connecticut wastewater activities

The Connecticut wastewater team has several other meaningful activities planned for 2014, including:

- CWPAA ski classic (ski and ride event)
- CWPAA sewer open (golf outing)
- CWPAA scholarship awards
- CWPAA annual trade show and exhibition
- CAWPCA spring and fall technical sessions
- NEIWPCC fall managers forum
- 2014 wastewater management leadership training program

...and several more!

Massachusetts State Director Report

by Mike Moreau
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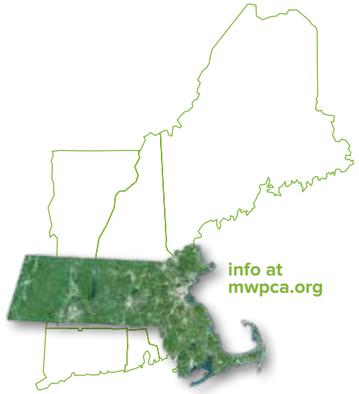


Since the last director's report in the autumn of 2013, the Massachusetts Water Pollution Control Association (MWPCA) has hosted numerous events to provide educational opportunities to members and promote the water quality industry.
I would like to acknowledge the efforts of our former state director and now past president, Ray Willis. Relinquishing the MWPCA presidency was a decision that Ray did not take lightly. Ray's ambitious agenda as MWPCA president exceeded all our expectations, and his tireless efforts have put MWPCA on a solid road toward a fruitful future.

Upcoming events

The next MWPCA quarterly meeting will be held on June 18, 2014, at the Log Cabin, in Holyoke. An interesting technical program is planned, and this is also the association's annual election meeting.

Driven by last year's success with the venue, Golf Committee Chair Bob Mack has informed us that the Shaker Hills Country Club in Harvard will once again host our annual golf tournament. The 2014 golf tournament is scheduled for June 13.

The annual fall trade show will once again be held at the Wachusett Mountain Resort in Princeton on September 24, featuring a busy trade floor, ski lift rides, raffles, and more.
Please mark your calendar with these events and keep your eyes open for future events on the MWPCA Web site (www.mwpca.org), Facebook (www.facebook/mwpca), or Twitter (@MWPCA).

Golf tournament	June 13, 2014	Shaker Hills, Harvard
Summer quarterly meeting	June 18, 2014	Log Cabin, Holyoke
Annual trade show	Sept. 24, 2014	Wachusett Resort, Princeton

Recent events and MWPCA news

The winter quarterly meeting was held on December 3, 2013, at Bristol Community College located in Fall River. This meeting was a change of both venue and format, as we extended invitations to local vocational high schools, colleges, and veterans as part of our outreach to inform those groups about the fulfilling opportunities available in the wastewater field. A job fair/career information seminar followed the morning session, where individuals could approach company representatives to discuss career paths this industry has to offer.

Wachusett Mountain resort will again be the site for the MWPCA trade show this year

The spring quarterly meeting was held on March 20 at the Devens Common Center in Devens. Technical topics included sludge dewatering alternatives and the anatomy of pump curves. A representative from the state Department of Energy Resources also presented on wastewater treatment energy use and clean energy in Massachusetts.

Aimee Powelka of Mass. Dept of Energy Resources speaks about energy grant opportunities

At the NEWEA Annual Conference in January, NEWEA's Janice Moran and Adams, Mass. operator Joseph Fijal were Massachusetts winners of the Alfred E. Peloquin Award and the NEWEA Operator Award, respectively, and were presented their awards at the NEWEA award luncheon.

The MWPCA 2014 legislative event at the Omni Parker House in Boston

Officers

During the February board of directors meeting, MWPCA President Ray Willis, elected vice president of NEWEA in January, resigned. Mike Foisy acceded to president for the remainder of Ray's term to allow Ray to focus on his new role with NEWEA. Ray will remain active as an MWPCA director and chair of the MWPCA government affairs committee. Bob Greene of BISCO Pumps was appointed vice president. Charlie Tyler agreed to serve as secretary, and Roger Hammond was appointed treasurer, now that Lynn Foisy has moved into the position of executive director.

Upon their resignations, the board acknowledged the service of two long-time directors—Eric Smith and Joe Witts. Trina Picardi of Hach and Henry Albro of FR Mahony both joined the board and will fulfill the balance of the terms left by Joe and Eric.

Government affairs

The MWPCA government affairs committee, in association with NEWEA and the New England Interstate Water Pollution Control Commission (NEIWPCC), held its fourth annual legislative event at the Omni Parker House in Boston on March 6, More than 75 people attended, including state senators and representatives, MassDEP and the state revolving fund (SRF) program representatives, mayors and local officials from various cities and towns, environmental advocates, and water quality professionals. Speakers for the event included Massachusetts Representative Carolyn Dykema, committee on the environment natural resources and agriculture; the Honorable Kim Driscoll, mayor of Salem; the Honorable Richard Kos, mayor of Chicopee; and the Honorable Gary Christenson, mayor of Malden.

Representative Dykema delivered the keynote speech that focused on a bill recently approved by the Senate and soon to reach the House, regarding drinking water and wastewater infrastructure funding, while mayors Driscoll, Kos, and Christenson spoke about how their cities are struggling with the need to fix aging water and sewer systems while also responding to mandates from the national level to comply with evolving and more stringent discharge regulations.

Training

MWPCA continues to offer a number of classes, and in 2014 we added a three-day pipeline assessment and certification program (PACP) class. PACP is an internationally accepted method for recording pipeline defects and observations in a standardized fashion to better manage infrastructure deterioration and renewal. The instructor, MWPCA Director Justin deMello of Woodard & Curran, did such a great job that the three-day PACP class will be offered again in June.

Classes being offered this year are noted, with dates, in the table below:

Class	Date(s)	Location
Water/wastewater utility safety training	April 23, 2014	Millbury
Writing effective sop	May 7, 2014	Millbury
Collection system O&M	May 28, 2014	Millbury
Wastewater process control using microbiology	June 2, 2014	Millbury
PACP	June 24-27, 2014	Millbury

2014 NEWEA student scholarship essay winners

Shane Sullivan

Fairfield University, Non-Major Scholarship Winner

Maria George

Northeastern University, Undergraduate Scholarship Winner

Peter Kang

Massachusetts Institute of Technology, Graduate Scholarship Winner

"Scientists have recently discovered a "plastic island" in the great lakes which is made up of microscopic plastic particles. Some research suggests these may be the micro-beads found in beauty products and face wash, which are too small to be filtered out in normal wastewater treatment processes. Another recent news item is the rising popularity of "flushable pre-moistened wipes" which are wreaking havoc on many municipal sewer systems and grinder pumps. How would you suggest we combat emerging technologies such as these, which create wastewater treatment issues, before the problem arise. Also, do you see any other emerging trends which may have a negative effect on municipal wastewater treatment systems and the environment?"

Although my mother, Susan Sullivan, has worked for the New England Interstate Water Pollution Control Commission (NEIWPCC) and has been a NEWEA member for over 20 years, I never saw a link to her chosen profession and mine until I read the article "Where's the green for blue?" in the September 2013 issue of Water Environment & Technology Magazine. Until this time, I did not understand that innovative capital financing may be a critical path for water and wastewater structure improvements in future years. In fact, based on the current political climate for government wastewater investments; innovative financing may be one of the only paths forward.

"Please discuss how human waste management (or mismanagement) in the future might affect the field in which you expect to be working within the next ten years, and make suggestions based on your chosen field as to what you can to do ensure that the effects of waste and water management remain positive."

Waste water treatment plants are a modern luxury that is taken for granted. Too often, people are content with the "out of sight, out of mind" mantra, literally flushing their cares down the drain. In the past few years, there has been an increased trend of using facial scrubs with plastic micro-beads, and using "'flushable pre-moistened wipes". Most people are not aware of the destructive, enduring forces they unleash on waste water treatment plants and the environment when they use these products. The micro-beads easily pass through treatment, only to accumulate in wetland resources. Wipes are responsible for countless equipment malfunctions in the treatment plants, with the seemingly indestructible wipes clogging pumps in the treatment systems, costing towns hundreds of thousands of dollars in maintenance and repairs. This problem needs to be addressed at the source. The only way to fight this, and other related destructible practices, is through public education, and stricter regulations.

The seductive facial cleansing commercials lure customers in with the promise of micro-beads that can give people the deep exfoliation that they crave. Most don't consider what those micro-beads are made of, and the gross accumulation they contribute to in the

Municipal wastewater treatment plants have traditionally been designed to treat conventional contaminants found in sanitary wastewaters. However, many contaminants of emerging concern (CECs), such as pharmaceuticals and personal care products, also enter the wastewater stream. Such CECs are hard to detect and remove with traditional wastewater treatment plants. For example, in summer 2013, a toxic 15-ton ball of wet wipes and hardened cooking oil was discovered and removed in a London sewage system. The ball was blocking 95 percent of the 2.4-meter-diameter sewer pipe, causing difficulty flushing toilets in the nearby area. If the ball was not discovered in time, raw sewage could have flushed out of manholes and contaminated drinking water sources. Moreover, recent studies show that the discharge of certain steroids and pharmaceutical products into waterways can negatively impact aquatic organisms. Clearly, CECs are causing negative environmental impacts.

To combat this threating issue, CECs should be tackled with a holistic approach. The key aspects are detection technologies, fast evolving regulation to incorporate newly identified CECs, effective monitoring program and technologies to remove CECs. First, many CECs exist in low levels (parts per

Shane Sullivan (continued)

The development of alternative finance models using private capital relates directly to my double major in accounting and finance. Within the next ten years, I anticipate working in a private investment firm that should be aware of the potential for long-term investments in the water sector. I imagine the challenge is in demonstrating those linkages to other business majors (whose mother has not worked in the water field her entire career) and in getting them to see the potential in this type of investment strategy. Don't they say "water is the new gold?" Gold has always proven to be a sound investment strategy; water can too.

By having some knowledge of the municipal water sector, its potential to be a relatively safe, long-term investment, I anticipate that I will be able to work towards the goal of linking water infrastructure investors with the human waste sector. To be successful however, the water sector must acknowledge the challenges associated with improvements to its infrastructure network, concerns related to water-related risks and human waste management stresses and liabilities. The finance industry looks for strong returns on its investments. That is a goal for the water sector. Also, in my opinion, the water sector should never call itself the "human waste sector."

Financial organizations will be looking for assurances that the expanding risks facing water utilities are manageable and that information is available on issues related to asset management and water quality. If both industries work towards the goal of innovative financing for the water sector, we can make strides in managing our resources.

Maria George (continued)

Great Lakes. Micro-beads are about the size of a grain of sand. Their ecological impact is still yet to be determined, but Dr. Marcus Eriksen, lead author of "Micro-plastic Pollution in the Surface Waters of the Laurentian Great Lakes," worries about fish consumption of these suspended micro-bead particles, and the anticipated bio-magnification of pollutants adhering to the micro-beads. If the public can be made more aware of these concerns, through campaigns like 5 Gyres' "Beat the Micro Bead," then they may feel more encouraged to only buy organic micro-bead scrubs with sea salt or crushed apricot seeds.

Public education is the most significant step towards change. The biggest problem with "flushable pre-moistened wipes" is that they give customers the false sense of security that flushing these wipes is acceptable, when in reality they can survive the waste water treatment process, near completely intact. The INDA organization proposed setting standards for material qualifications to be called "flushable." In order to make that information available, then the next step is regulating these hazardous products. If government policies were established to regulate the labeling of "flushable" products, then trust in the accuracy of label information can begin to develop in these products. Similarly, if big facial cleanser brands had to conform to a policy requiring their products have organic micro-beads in them, then the Great Lakes can begin to recover from the load it carries.

Encouraging cultural change, or asking for new policy, is a glacially slow task that can be disheartening to have to wait for. We can install the best treatment systems to date, only to be surpassed by newer, more durable sanitary byproducts when the next trend comes around. Or we can be proactive, and push for change, no matter how slow it seems to move.

Change starts and ends with us.

Peter Kang (continued)

billion or parts per trillion). However, continuous exposure to even low levels can impact aquatic and humans in complex ways. Therefore, precise and efficient detection technologies are first priority to identify CECs. Once the CECs are detected and their impacts are identified, regulation should be updated in a timely manner. So far, CECs are a perfect example of how regulations lag behind the technology. After CECs are detected and included in regulation, they have to be effectively monitored. Many sources of CECs are non-point sources that are very challenging to monitor. According to the Environmental Protection Agency, the leading sources are from agriculture runoff which is non point source. To qualify as effective monitoring systems, monitoring devices need to cover wide range of regulatory areas. Also, effective data management system is important to properly respond to the detected CECs. Last key component is the removal technology. Some new technologies, such as membrane bioreactors, advanced oxidation, ozonation and carbon filters, are shown to be effective at removing CECs but all are costly. Therefore, research on price reduction is important.

Effective ways to improve aforementioned aspects are by investing in research in national labs and universities. Also, nationwide open competitions that foster innovative and creative approaches to combat CECs are important. If some aspects can be proposed as profitable undertakings, it can be a "win-win" solution. For instance, to reduce the sewer clogging and water contamination due to waste oil, McDonald's is converting substantial amount of cooking oil from its London restaurants into biodiesel.

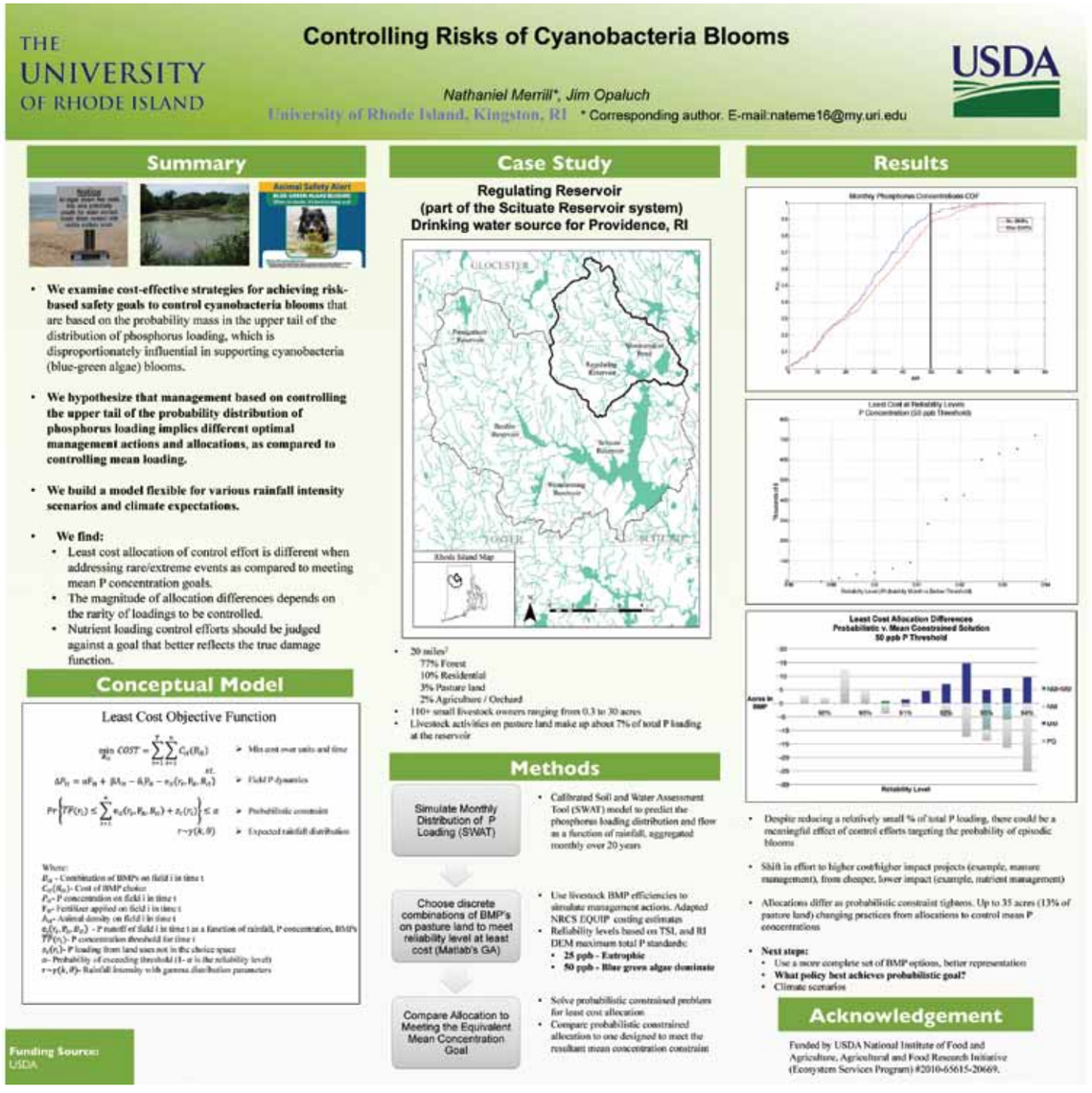
As human society evolves, there will be exponential increase in CECs and their impact can be catastrophic. Nuclear waste, pharmaceuticals, antibacterial agents and pesticides are just a few examples of many exploding CECs. Now it is time for human society to innovate municipal wastewater treatment systems to combat CECs.

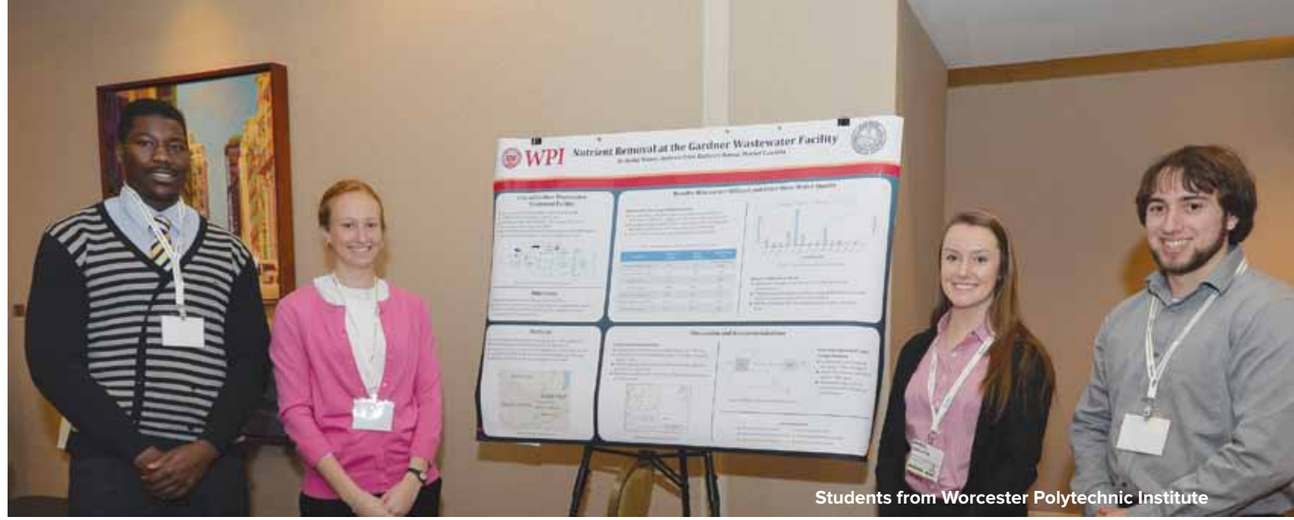
NEWEA
WORKING FOR WATER QUALITY

2014 NEWEA student poster board display winners

Controlling risks of cyanobacteria blooms

Nathaniel H. Merrill, Department of Environmental and Natural Resource Economics, University of Rhode Island

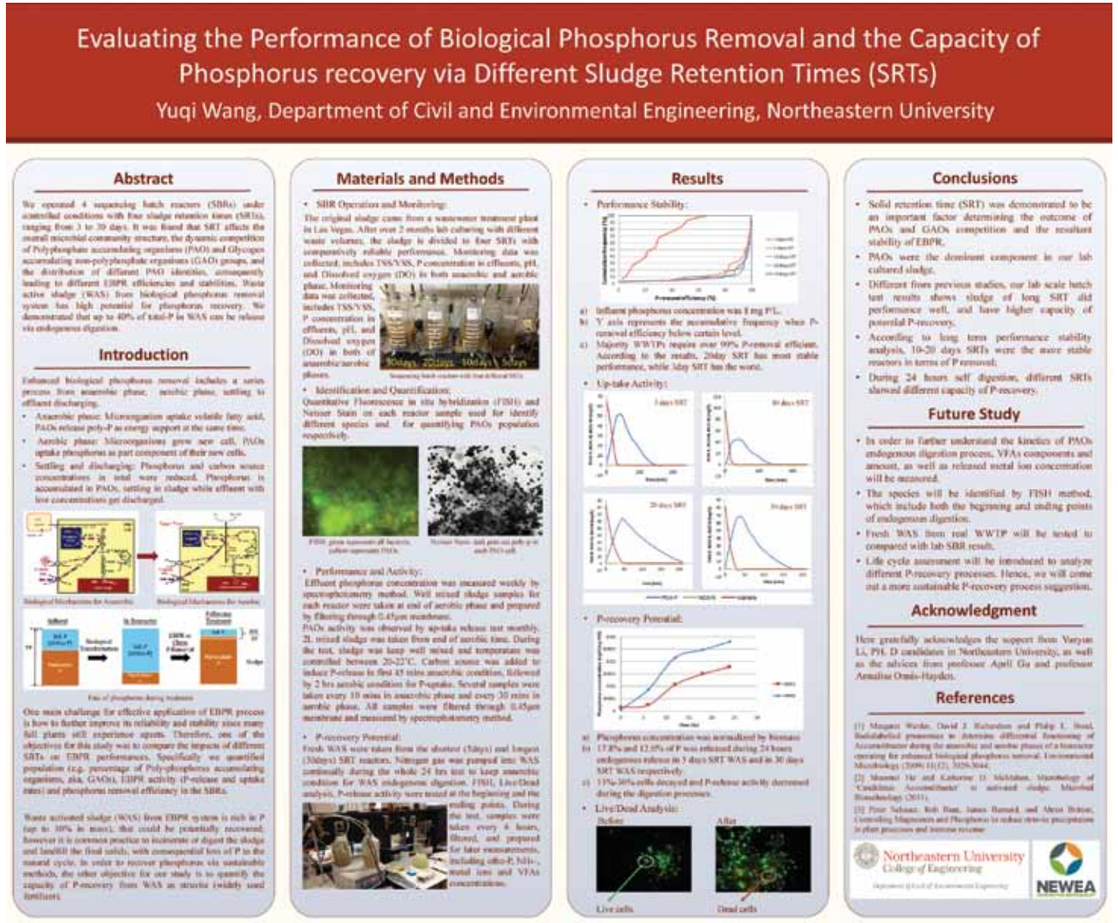




Students from Worcester Polytechnic Institute

Evaluating the performance of biological phosphorus removal and the capacity of phosphorus recovery via different sludge retention times (SRTs)

Yuqi Wang, Department of Civil and Environmental Engineering, Northeastern University



EVENT

2014 Annual Conference & Exhibit

Boston Marriott, Copley Place
Boston, MA • January 26–29

PROCEEDINGS

The 2014 NEWEA Annual Conference convened with a meeting of the full Executive Committee on Sunday, January 26, 2014. A total of 1,763 people registered for the conference. The three-day event featured 209 exhibits booths and 33 technical sessions. In addition, the Association held a special farewell reception for retiring Executive Director Elizabeth Cutone.

The Annual Business Meeting was held on Monday, January 27, 2014, with 53 in attendance. Nominating Committee Chair Howard Carter presented the slate of officers for 2014, as approved at the September 25, 2013 Executive Committee Meeting, as follows

- *Vice President*, Raymond Willis
- *Treasurer,* Frank Occhipinti (2nd year)
- *Secretary,* Jerry Potamis (1st year)
- *Council Director—Communications* James Barsanti (2nd year)
- *Council Director—Meeting Management*, Meg Tabacsko (2nd year)
- *Council Director—Collection Systems & Water Resources,* Virgil Lloyd (1/14 – 1/17)
- *WEF Delegate,* Daniel Bisson (10/14 - 10/17)
- *Connecticut Director,* Jay Sheehan (1/14 – 1/17)
- *Massachusetts Director,* Michael Moreau (1/14 – 1/17)

There being no further nominations, on motion duly made and seconded the slate was accepted and the executive director was instructed to cast one ballot in favor of the slate as presented.

As a point of information, nominating committee chair Howard Carter stated that in accordance with the provisions of Article 9.3.2 of the New England Water Environment Association's Constitution & Bylaws the following officers will advance to:

- *President*, Bradley Moore
- *President-Elect,* Matthew Formica
- *Past President,* Michael Bonomo

Carter further noted that the remaining incumbents are fulfilling unexpired terms:

- *WEF Delegate*, Jennifer Lachmayr (exp. 10/14)
- *WEF Delegate,* Howard Carter (exp. 10/15)
- *WEF Delegate,* Phyllis Rand (exp. 10/16)
- *Council Director—Outreach,* Thomas Groves (exp. 1/15)
- *Council Director—Treatment, System Operations, and Management,* Priscilla Bloomfield (exp. 1/16)
- *Rhode Island Director,* Janine Burke (exp. 1/15)
- *Vermont Director,* Robert Fischer (exp. 1/15)
- *Maine Director,* Peter Goodwin (exp. 1/16)
- *New Hampshire Director,* Fred McNeill (exp. 1/16)

Respectfully Submitted by the NEWEA Nominating Committee: Howard Carter (Chair), Roger Janson, Daniel Bisson, James Barsanti, Meg Tabacsko

WEF President-elect Ed McCormick assisted NEWEA President Michael Bonomo cutting the ribbon and officially opened the exhibit area. The exhibit area comprised almost 220 vendor and non-profit displays. The Opening Session featured keynote speaker Richard K. Sullivan Jr. Secretary, Executive Office of Energy and Environmental Affairs, Commonwealth of Massachusetts.

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1. The exhibit hall is officially opened as Mike Bonomo cuts the ribbon with the help of Amy Anderson, Ed McCormick, and Dan Bisson **2.** An attentive session audience **3.** Monday morning at the registration desk **4.** Dr. Sharon Zelmanowitz of the U.S. Coast Guard Academy in Connecticut briefs her cadre of cadets

33 Technical Sessions

SESSION 1

HOT TOPIC—Regulatory Challenges

Moderators:
- Nicholas Tooker, Northeastern University
- Vinnie Melendez, GSRWA

Nutrient Regulation—One Size Never Fits All
- Thomas Amidon, Kleinfelder

Change is Coming—Understanding the Proposed New Requirements of the NPDES MS4 General Permit
- Rebecca Balke, Comprehensive Environmental Inc.

NPDES Aluminum Limits—Are We Chasing the Wrong Anim-Al?
- Pamela Westgate, Kleinfelder
- Paul Hogan, Woodard & Curran

Evaluating the Impact of Upgrading Wastewater Treatment System for Biological Nutrient Removal (BNR) Processes on Algal Blooms in the Receiving Estuary
- Chul Park, University of Massachusetts
- Heonseop Eom, University of Massachusetts
- Douglas Borgatti, Springfield Water & Sewer Commission
- Jane Brooks, Springfield Water & Sewer Commission

SESSION 2

ASSET MANAGEMENT—Programs in Action

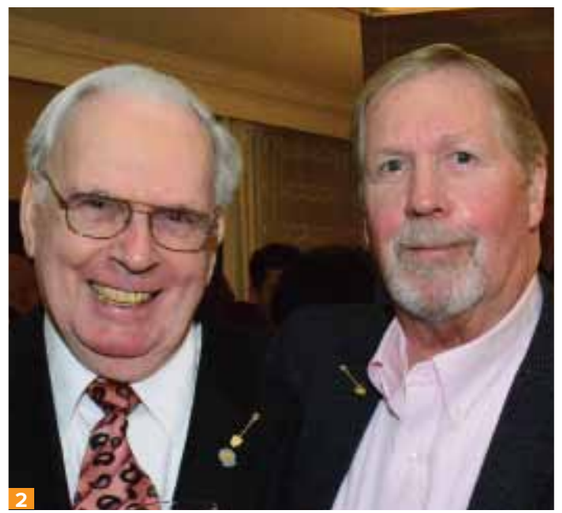
Moderators:
- Gary Arthur, FRPI
- John Rogers, CH2M HILL

How to Maintain Asset Reliability—Hope is Not a Plan
- Kevin Campanella, City of Columbus, OH DPU
- James Gross, City of Columbus, OH DPU

Protecting a Major Investment in Wastewater Treatment by Implementing a Preventive Maintenance Program
- Jeffrey McDonald, Fuss & O'Neill
- Robert Hydock, Fuss & O'Neill

Sustainable Capital Improvement Planning, Town of Framingham
- Paul Brinkman, Wright-Pierce
- Diane Stokes, Town of Framingham, MA
- Eric Johnson, Town of Framingham, MA

Shocking!—Electrical Infrastructure Vulnerabilities at Treatment Facilities
- Alan Wells, Kleinfelder
- David Elliott, RDK Engineers



1. Attendees at Sunday's Executive Committee meeting pose for the traditional post-meeting group photo **2.** Past Presidents Phyllis Arnold Rand and Robert Dunn at the President's Reception **3.** The treasurer's report is offered by Frank Occhipinti

SESSION 3

CSO/WET WEATHER I—
Establishing the WW Baseline Monitoring and Modeling

Moderators:
- Steven Freedman, AECOM
- Matthew St. Pierre, Tata and Howard

New York City's Pilot Project to Measure CSO Flows
- Patrick Stevens, ADS Environmental Services
- James Mueller, NYC Department of Environmental Protection
- Michael Armes, ADS Environmental Services

Extensive Flow Monitoring and Detailed Hydraulic Modeling of Eight Sewersheds in Baltimore County, MD
- Charles Wilson, Hazen and Sawyer
- Bruce Pierstorff, Hazen and Sawyer
- Lisa Eicholtz, Baltimore County
- David Bayer, Baltimore County

Fort Point Channel Water Quality Assessment
- Matthew Davis, Brown and Caldwell
- Paul Keohan, Boston Water & Sewer Commission

Long-Term Stormwater Sampling Downstream of a CSO Abatement Facility and Initial Findings—Dorchester, MA
- Neal Price, Horsley Witten Group, Inc.
- Kris Houle, Horsley Witten Group, Inc.

SESSION 4

RESIDUALS—The Whole Kitchen SinkExcept for Food Waste

Moderators:
- Jonathan Keaney, Brown and Caldwell
- Elaine Sistare, CDM Smith

Case Study—Producing Class A Biosolids and Combined Heat and Power at Two Vermont Wastewater Treatment Facilities
- John Reilly, Hoyle, Tanner & Associates, Inc.
- Michael Schramm, Hoyle, Tanner & Associates

Taking Waste Out of WAS—Sludge Pretreatment for Beneficial Uses
- Matthew Van Horne, Hazen & Sawyer
- Mark Bottin, Hazen and Sawyer
- Ya-Chi Tsao, Philadelphia Water Department
- James Grandstaff, Henrico County

From Disposal to Beneficial Use—10-Years of Sustainable Biosolids Management at GLSD
- Michael Walsh, CDM Smith
- Richard Hogan, Greater Lawrence Sanitary District
- Ben Mosher, CDM Smith

Bio-Energy Technology Advances that Promote Wastewater Utility Energy Independence
- Michael Wilson, CH2M HILL
- Dru Whitlock, CH2M HILL

1. Assessment and Development Committee chair Deb Mahoney at the Executive Committee meeting **2.** Alfred Schiff and Terry Campbell at the President's Reception **3.** Exhibits chair Amy Anderson at the President's Reception

SESSION 5

Water Reuse & Reclamation—
What Goes Around Comes Around!

Moderators:
- Meredith Zona, Fay, Spofford & Thorndike
- Alan Slater, MassDEP

The Costs and Options Available for Total Organic Carbon Removal—Cape & Islands Case Studies
- Marc Drainville, GHD Inc.
- Anastasia Rudenko, GHD Inc.

Performance Evaluation of a Reclamation Plant Treating Domestic Wastewater Using Membrane Processes
- Mohamed Hamoda, Kuwait University

City of Tavares Florida—Identifying Funding Sources for Comprehensive Utility System Improvements
- Brad Hayes, City of Tavares, FL
- Alexis Stewart, ARCADIS

Building the Future at the University of Connecticut—Powering UConn's Campus with Reclaimed Water
- Nicholas Ellis, Hazen & Sawyer

SESSION 6

Sustainability Planning and Tracking—
Tools of the Trade

Moderators:
- Elizabeth Watson, United Water
- Courtney Eaton, Carollo Engineers
- James Barsanti, Town of Framingham, MA

Sustainability Performance Reporting: Why It Is Useful?
- Courtney Eaton, Carollo Engineers

Putting It All Together: Sustainable Project Case Studies—Sustainability Reporting
- Elizabeth Watson, United Water

Envision Rating System—How and When to Use it
- Jane Madden, CDM Smith

Putting It All Together: Sustainable Project Case Studies—Envision
- Shallan Fitzgerald, Dewberry

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1. Richard Sullivan, Massachusetts Secretary of Energy and Environmental Affairs, delivers the opening session keynote address **2.** WEF President-elect Ed McCormick speaks at the opening session **3.** Karla King and Deb Mahoney **4.** Monday morning technical session **5.** Elizabeth Cutone catches up with Tom Tyler **6.** Jennifer Lachmayr and Daniel O'Brien enjoy the opening session

SESSION 7

HOT TOPIC—Looking To the Future—Digestion and Source-Separated Organics

Moderators:
- Jessica Cajigas, Comprehensive Environmental, Inc.
- Mickey Nowak, United Water

Investigating Anaerobic Co-Digestion of Sewage Sludge and Food Waste Using a Bench-Scale Pilot Study
- Wenye Camilla Kuo-Dahab, University of Massachusetts, Amherst
- Chul Park, University of Massachusetts
- Parviz Amirhor, Fay, Spofford & Thorndike
- Meredith Zona, Fay, Spofford & Thorndike
- David Duest, MWRA

Utilizing Excess Anaerobic Digester Capacity to Process Source Separated Organics—Three Case Studies
- Anastasia Rudenko, GHD Inc.
- Marc Drainville, GHD Inc.

Source Separated Organics to Energy—Emerging Opportunities
- Steven Torres, Pannone, Lopes, Devereaux, & West LLC
- Bruce Tobey, Pannone Lopes Devereaux & West LLC
- Teno West, Pannone Lopes Devereaux & West LLC

Evaluating Co-Digestion for the Smaller Community
- Art Umble, MWH Global
- William Nelson, MWH Global
- Steve Poulos, Valparaiso City Utilities

SESSION 8

COLLECTION SYSTEMS I—Knowledge is Power—Assessing Your System

Moderators:
- Peter Garvey, Dewberry
- Thomas Loto, ARCADIS

How to Achieve Infiltration/Inflow Removal Goals with a Comprehensive Approach
- Jonathan Kunay, CDM Smith
- Paul Ross, CDM Smith

Ten Thousand Pine Tree Air Fresheners or One Vortex PVC Flow Insert?—Walpole's Solution to Sewer Odor Complaints
- John Potts, Weston & Sampson
- Kevin Read, IPEX USA

A System-wide Approach to Collection System I/I Reduction, Asset Management and CMOM in the Town of Durham, NH
- Laurie Perkins, Wright-Pierce
- Peter Atherton, Wright-Pierce
- David Cedarholm, Town of Durham, NH
- Dan Peterson, Town of Durham, NH

Beyond CMOM and Asset Management: Enhancing Portland's Integrated Infrastructure Renewal and Operations Activities Brings Change to an Old City
- Mike Stein, Woodard & Curran
- Eric Labelle, City of Portland, ME
- Seth Garrison, Woodard & Curran

1. Northeastern University student Man Hu explains her poster to John Dold **2.** Council Director Priscilla Bloomfield at the Awards Committee meeting **3.** The Exhibit Hall **4.** Young professionals Adam Butler and Paula Drouin share ideas as volunteer mentor Vivian Matkivich looks on **5.** Stormwater Committee Chair Virginia Roach presents Maria Rose with the Golden Raindrop award

SESSION 9

PLANT OPERATIONS I—Phosphorus—Limits—Testing and Technology

Moderators:
- David Press, Kleinfelder
- Thomas Hazlett, Woodard & Curran

Is it 0.2 or 0.8?—Flexible Limit Piloting for Phosphorus Removal on Lagoon Effluent
- Jack Myers, Stantec
- Kaytee Manchester, Stantec
- Alec Tuscany, Village of Waterbury, VT

Pre-Selection of Ballasted Flocculation Equipment for Phosphorus Removal
- Craig Wagner, CDM Smith
- William Lengyel, CDM Smith

Making Effective Use of the Myriad of In-House Phosphorus Testing Methods
- Justin Skelly, Tighe & Bond
- Nicholas Tooker, Northeastern University

Multiple Benefits of Harvesting Phosphorus from Sidestreams in Des Moines
- William McConnell, CDM Smith
- Cameron Clark, CDM Smith
- Scott Carr, CDM Smith
- Royce Hammitt, Des Moines, IA, WRA

SESSION 10

STORMWATER I— Rip Up the Pavement Stormwater Management and CSO Control in 2014

Moderators:
- Maria Rose, City of Newton, MA
- Katherine Weeks, Town of Framingham, MA

Retrofitting 22 Impervious Acres in the Long Creek Watershed Management District
- Rich Niles, AMEC

Lessons Learned from RDA Applications in MA and ME—What's Next for Impaired Watersheds in New England?
- Rosalie Starvish, GZA GeoEnvironmental
- Robyn Saunders, GZA GeoEnviornmental

Pilot Implementation and Testing of Innovative Green Infrastructure Project in Chelsea, MA
- Richard Claytor, Horsley Witten Group
- Pallavi Mande, Charles River Watershed Association

The Green Apple—Systematic Implementation of Widespread Green Infrastructure Solutions in NYC
- Margot Walker, NYC DEP
- Magdi Farag, NYC DEP
- Raymond Palmares, NYC DEP
- Virginia Roach, CDM Smith

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1. Susan Viera poses by the rotating, botanical NEWEA logo **2.** Mickey Nowak makes a conference presentation **3.** Incoming Executive Director Mary Barry, Adam Yanulis and Elizabeth Cutone **4.** MaryLee Santoro pins the Crystal Crucible Award onto a proud Peter Sherwood as his wife stands by

SESSION 11

UTILITY MANAGEMENT I—Let's Talk about Utility Management Issues

Moderators:
- Brian Armet, The Mattabassett District
- Bethany Leavitt, CH2M HILL

Creating Change Starts with an Organizational Assessment—A Field-Tested Approach
- Seth Garrison, Woodard & Curran
- Dan Lahiff, City of Lowell, MA
- Robert Ward, City of Haverhill, MA
- Eric Labelle, City of Portland, ME

Planning and Executing a Comprehensive and Flexible Response to Severe Weather at Operations Sites
- David Dedian, Woodard & Curran

Training, Growth & Development Strategies for Operational Success
- Thomas Tyler, The Metropolitan District Commission (MDC);
- Jeffery Bowers, MDC

EUM and Framework into Award Selection
- Carolyn Hayek, USEPA Region 1
- Sean Brennan, Veolia Water NA

SESSION 12

Water for People

Moderators:
- Mary White, MWRA
- Hugh Tozer, Woodard & Curran

The Liberia Municipal Water Project: Developing Cost-Recoverable Water Treatment and Distribution Systems in a Recovering Country
- Travis Watters, Tetra Tech

Clean Production Technology in Sao Paulo, Brazil Industries—Market Leadership through Environmental Stewardship
- Marina Fernandes, CDM Smith

Achieving "Everyone Forever" in West Bengal, India—A World Water Corps Trip Report
- Katie Chamberlain, CH2M HILL

Technology and Community Issues of a Water Project in Rural Honduras
- Clair Barker, Engineers Without Borders

SESSION 13

HOT TOPIC—Flushables/Non Dispersibles

Moderators:
- Katherine Mello, CDM Smith
- Joseph Nerden, MassDEP

The Issue with Flushables and Non-Dispersibles—A National Perspective—The WEF House of Delegates Non-Dispersibles Workgroup
- Gary Hunter, Black & Veatch

A Dry Dispersible Nonwoven Towel Solution for Wastewater Management Systems
- Martyn Davis, Sellars Nonwovens

The New Wastewater: Collection System Challenges Caused by Today's Modern Trash
- Robert Domkowski, Xylem, Inc.

Non-Dispersibles—The Maine Experience and its Pilot Education Campaign
- Aubrey Strause, Verdant Water, PLLC
- Thomas Connolly, Town of Yarmouth, ME
- Scott Firmin, Portland Water District
- Jen McDonnell, Casella Organics

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1. The Spouses' Program Hawaii theme included a tropical mixology lesson **2.** Vendor Trina Picardi discusses product applications with conference attendees **3.** Non-dispersibles expert Aubrey Strause drives home a point in a conversation between sessions

SESSION 14

CSO/WET WEATHER II—Wet Weather Constructed Case Studies

Moderators:
- Melissa Recos, Tetra Tech, Inc.
- Thomas Sgroi, Greater New Haven WPCA

Lower Beacon Street Sewer Separation—Meeting the Constructability Challenge
- William Skerpan, BETA Group, Inc.

Solving Sanitary Sewer Overflows—A Unique New Jersey Approach
- James Cosgrove, Kleinfelder

The Mad Dash from Consent Decree Approval to CSO Elimination
- Laurie Perkins, Wright-Pierce
- Paul Birkel, Wright-Pierce
- Joseph Jordan, City of Fitchburg, MA

Five Years and 5 Billion Gallons: Evaluating the Narragansett Bay Commission CSO Abatement Project
- Catherine Oliver, Narragansett Bay Commission
- Christine Comeau, Narragansett Bay Commission
- Pamela Reitsma, Narragansett Bay Commission

SESSION 15

Instrumentation & automation—Better Operations Thru Improved Communication & Information Technology

Moderators:
- John Trofatter, Accusonic Technologies
- James Spitzer, CDM Smith

Leveraging Cloud Technology for Managing a FOG Program
- Mark Moreau, Advanced Enterprise Systems Corporation

Cellular Telemetry—Yes, Another Communications Option in our Toolbox
- Paul Birkel, Wright-Pierce
- Phil Arnold, Wright-Pierce

Process Simulator Use to Model Aeration Control Valve Position & System Pressure
- Matthew Gray, BioChem Technology, Inc.

Software Solutions for Collecting Data with Mobile Devices
- Matthew Davis, Brown and Caldwell

SESSION 16

PLANT OPERATIONS II—Plant Operations Process Performance

Moderators:
- Ben Levesque, CDM Smith
- Lindsey Brough, Wright-Pierce

Experiences with State Point Calculators
- Mickey Nowak, United Water
- Jack Barry, United Water

Mixing Energy-Reduction Case Studies Using Large Bubble Methods
- Eric Spargimino, CDM Smith
- Stuart Humphries, EnviroMix, Inc.
- Terry Cote, Narragansett Bay Commission

Why More is Not Always Better in Nitrogen Removal—Lessons Learned and the Tools Needed to Combat Microthrix Parvicella
- Frederick Mueller, Tighe & Bond
- Peter Stallings, Town of Stratford, CT

The Impact of Upstream Process on Meeting Permit Limits with UV Light
- Gary Hunter, Black & Veatch

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1. Elizabeth Cutone offers a farewell speech as she attends her last NEWEA awards luncheon as NEWEA executive director
2. Stockholm Junior Water Prize winners from New England rise to be recognized at the NEWEA awards luncheon
3 Mr. and Mrs. Fish (Jeff and Deb Sandler) entertain and educate elementary school children on Wednesday morning

SESSION 17

PUBLIC EDUCATION—Raising Public Awareness

Moderators:
- Leonard Young, MWRA
- Isabel Tourkantonis, Town of Billerica, MA

Celebrate Water—Educate, Collaborate, Participate
- Clary Coutu, CDW Consultants, Inc.
- Elena Proakis Ellis, CDM Smith (Part 1)
- Meg Tabacsko, MWRA (Part 2)

Greening the Grass—Using Social Marketing to Encourage Mainers to Adopt Healthy Lawn Care Practices
- Jami Fitch, Cumberland County Soil & Water Conservation

Everyday Examples in Engineering—An Evolving Trend in Engineering Education and STEM Program Development
- Francis Hopcroft, Wentworth Institute of Technology

SESSION 18

SAFETY—Utility Hazards Assessment—Is Your Safety Program Keeping Up?

Moderators:
- David Aucoin, Narragansett Bay Commission
- Alfred Jellison, City of Bangor, ME

Top 10 Safety Failures
- David Wright, Weston & Sampson

Strengthening Treatment Facility Chemical Process Safety
- David Horowitz, Tighe & Bond

Understanding Arc Flash Safety Requirements and Hazard Mitigating Techniques
- Bryan Lisk, Hazen and Sawyer

Responding to Weather Related Incidents—Utility Perspective
- Michael Koza, Portland Water District

SESSION 19

HOT TOPIC—Funding

Moderators:
- Geraldine Ciardelli, City of Nashua, NH
- Edward Whatley, Vanasse Hangen Brustlin

Reducing the Impacts of Mayhem—How to Increase Infrastructure Resiliency in a Changing Environment, and Get it Funded
- Peter Garvey, Dewberry
- Deborah Mills, Dewberry

Up the Creek—Developing a Public-Private Partnership to Clean Up an Impaired Stream in the Face of a Citizen Suit
- Tamara Lee Pinard, Long Creek Watershed Management District

Dealing with the Elephant in the Room—Getting Value for Road Restoration on Sewer Projects
- David Partridge, Tighe & Bond
- Christina Jones, Tighe & Bond

Financing a Wastewater Collection and Treatment Capital Improvement Plan without Raising Rates or Taxes
- Mark Thompson, Kleinfelder
- Gus O'Leary, Kleinfelder

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1. After many years of bestowing EPA recognition, David Chin of EPA makes his final speech representing EPA at the NEWEA awards luncheon 2. Jeffrey McDonald presents at a session on nitrogen removal 3. 2013 president Mike Bonomo hands off the NEWEA gavel to Brad Moore, the 2014 NEWEA president

SESSION 20

Collections systems II—If It's Broke, Fix It—Construction Repairs

Moderators:
- Robert Domkowski, Xylem
- Marilyn Baron, Epoxytec

100 Year Storm—$1.0 Million Fix
- Frederick McNeill, City of Manchester, NH - EPD

Batten Down the Hatches—Evaluating Rehabilitation Options to Protect the Springfield Water and Sewer Commission's Largest Assets for the Long Haul
- Bryan Walsh, Kleinfelder
- Laura Robinson, Kleinfelder

On the Brink of Collapse—Rehabilitating Sewers in the Town of Weymouth
- Paul Hoye, Weston & Sampson

Between a Neighborhood and a Salt Marsh—Trunk Sewer Replacement Along a Tidal River
- Stephen Olson, Environmental Partners Group, Inc.

SESSION 21

ENERGY I—Planning and Researching for Sustainability and Energy Neutrality

Moderators
- Thomas Schwartz, Woodard & Curran
- Cynthia Castellon, Tighe & Bond

Planning for the Future—Developing a Comprehensive Energy Management Master Plan
- Bryan Lisk, Hazen and Sawyer
- Joseph Rohrbacher, Hazen and Sawyer
- John Dodson, City of Durham, NC

Leadership Challenges in Improving Energy Performance
- Madeline Snow, University of Massachusetts, Lowell

Energy Neutral Water Resource Recovery Facilities—Results from Recent WERF Research
- Christine Polo, Black & Veatch
- Ralph Eschborn, AECOM
- Paul Kohl, Philadelphia Water Department
- Lauren Fillmore, Water Environment Research Foundation

Primary Treatment is the Key to Attaining Energy Neutrality
- Edmund Kobylinski, Black & Veatch
- Gustavo Queiroz, Black & Veatch
- Hari Santha, Black & Veatch
- Patricia Scanlan, Black & Veatch

SESSION 22

Operator Ingenuity

Moderators:
- Timothy Vadney, Wright Pierce
- Ed Rushbrook, Process Analysts
- Ray Vermette, City of Dover, NH

Sample Cart
- Peter Sullivan, Warwick Sewer Authority

Innovative Pin Press and Other Items
- Joe Crobsy, Narragansett Bay Commission

Check Valve Bypass Connection
- Kevin Cini, City of Groton, CT

Sampler Hanger
- Sara Nadeau, Narragansett Bay Commission

Keeping the Samples Clean and On-time, 5 Minute Fixes to Make Life Easier
- Mike Carle, Town of Hampton, NH

SESSION 23
SMALL COMMUNITY SMORGASBORD—Compliance, Cooperation, and Costs

Moderators:
- Sean Osborne, OSD LLC
- Marc Drainville, GHD

Obstacles to Sustainability—Issues Facing Tribes and Small Communities Nationwide, and Techniques to Overcome Them
- Mark Nelson, Horsley Witten Group, Inc.
- Matthew Richardson, US EPA

Scalable Wastewater Treatment for Watershed Compliance
- Joshua Lindell, Aquapoint.3 LLC

Survey of Construction Costs for New England Drip Dispersal Systems
- Mike Giggey, Wright-Pierce

State of Connecticut and the Private Sector Work Together to Turn Two Wrongs into One Right
- Anthony DeSimone, Weston & Sampson
- Gene Ely, Heritage Village Water Company
- Aaron Pethic, Weston & Sampson
- Carl Stone, Weston & Sampson

SESSION 24
STORMWATER ii—Planning for Climate Change

Moderators:
- Glenn Haas, Brown and Caldwell
- Aubrey Strause, Verdant Water, PLLC

Climate Change and Stream Crossing Structures Part 1—Habitat Integrity Implications
- Scott Jackson, University of Massachusetts
- Beth Lambert, Massachusetts Division of Ecological Restoration
- David Nyman, Comprehensive Environmental, Inc.

Climate Change and Stream Crossing Structures Part 2—Fluvial Processes and Stream Morphology Considerations
- Beth Lambert, Massachusetts Division of Ecological Restoration
- Scott Jackson, University of Massachusetts
- David Nyman, Comprehensive Environmental, Inc.

Climate Change and Stream Crossing Structures Part 3—Resilient Stream Crossing Design
- David Nyman, Comprehensive Environmental, Inc.
- Beth Lambert, Massachusetts Division of Ecological Restoration
- Scott Jackson, University of Massachusetts

Multi-Event Natural Disasters—The New Normal Challenging Infrastructure Resiliency Planning
- John Henz, Dewberry

SESSION 25
HOT TOPIC—Green Infrastructure

Moderators:
- Virginia Roach, CDM Smith
- Tilo Stahl, BioChem Technology, Inc.

Capturing the Green Infrastructure Credit for CSO Abatement Compliance
- Dingfang Liu, CH2M HILL; Nicholas Warrens, CH2M HILL
- Rita Fordiani, CH2M HILL; Nicholas Capozza, Onondaga County, NY

Collaborative Planning for Green Infrastructure in the Mystic River Watershed
- Lori Kennedy, Bioengineering Group
- Patrick Herron, Mystic River Watershed Association
- Jeffrey Walker, Tufts University

A Comprehensive Approach to Urban Water Quality Restoration—Roger Williams Park Ponds
- Brian Kuchar, Horsley Witten Group

Integrating the Latest Industry Trends into “Old Style” Projects
- Patricia Passariello, Weston & Sampson
- Andrew DeSantis, City of Chelsea, MA

SESSION 26
PROJECT DELIVERY ALTERNATIVES—Selecting Project Delivery to Maximize Value

Moderators:
- Michael Walsh, CDM Smith
- John Lanzoni, Siemens Industry Inc.

Case Study—Project Delivery Alternatives in the Context of a Financially Handicapped Municipality
- Bruce Tobey, Pannone Lopes Deveraux & West LLC

Pioneering Design-Build in Ohio
- Stephen Gates, Brown and Caldwell

Pushing the Limit Without Breaking the Bank: Selection, Procurement and Testing of a Phosphorus Removal Process
- Jon Pearson, AECOM; Dennis Dievert, Town of Cheshire, CT
- Matthew Formica, AECOM; Donald Chelton, AECOM

Easton’s P3 Models to Maximize Public Value
- Joseph Shea, Woodard & Curran; Daniel Smith, Town of Easton, MA

SESSION 27
INDUSTRIAL WASTEWATER—The Cycle of Compliance

Moderator:
- Donald Kennedy, NEIWPCC

Unraveling the Intersections, Overlap, and Gaps of MassDEP and MWRA Industrial Pretreatment Regulations
- Sandra Perry, Triumvirate Environmental

Efforts to Reduce Waste FOG Discharges to the Narragansett Bay Commission Wastewater Treatment Facilities
- Brendan Cunha, Narragansett Bay Commission

Mercury—An Old Problem with New Implications
- William Potochniak, Capaccio Enviromental Engineering
- David Foye, Beth Israel Deaconess Medical Center

Thirty Years Later—Evaluation of Heavy Metals Contamination in Bivalves After Successful Load Reduction in Narragansett Bay
- Christine Comeau, Narragansett Bay Commission

SESSION 28
ENERGY ii—Energy Efficiency Improvements Through Planning and Continuing Improvements

Moderators:
- Denise Breiteneicher, MWRA
- Erik Osborn, Woodard & Curran

Pilot Study to Reduce Energy Use with Bonus Nutrient Reduction
- Mark Allenwood, Brown and Caldwell
- David Green, City of Rochester, NH

Aeration System Optimization/Dissolved Oxygen Study at the Deer Island Treatment Plant
- Carina Hart, Fay, Spofford & Thorndike
- Parviz Amirhor, Fay, Spofford & Thorndike
- Sun-Nan Hong, Consultant
- Ethan Wenger, MWRA

Sustainable Aeration Design—“Right Sizing” Blowers and Aeration Systems to Facilitate Energy Efficient Operation of WWTF
- Joseph Rohrbacher, Hazen and Sawyer
- Paul Pitt, Hazen and Sawyer
- Diego Rosso, University of California

Traditional and Non-Traditional Energy Initiative at The Greater Lawrence Sanitary District
- Richard Weare, Greater Lawrence Sanitary District

SESSION 29
SUSTAINABILITY II—Sustainability A to Z

Moderators:
- Kimberly Woodward, Tighe & Bond
- Wayne Bates, Capaccio Environmental Engineering

Aquifier Vulnerability and Fire Flow Impact—The VIPER Emergency Management Project
- Gabrielle Belfit, Tighe & Bond

Planning for Future Floods—Sea Level Rise Impacts for Three Shore Communities
- André Martecchini, Kleinfelder

Evolving Trends in Sustainability and the Potential Impacts on Publicly Owned Treatment Plants
- Julie Muszalski, Capaccio Environmental Engineering
- Wayne Bates, Capaccio Environmental Engineering

Sustainable Energy Planning Update at the Narragansett Bay Commission
- Barry Wenskowicz, Narragansett Bay Commission

SESSION 30
HOT TOPIC—Integrated Water Resources Planning

Moderators:
- Nicholas Ellis, Hazen and Sawyer
- Patricia Passariello, Weston & Sampson

A City at Crossroads—Chicopee Pursues a New Path Toward Integrated Water Resources Management Planning for CSO Abatement
- Todd Brown, Tighe & Bond
- Thomas Hamel, City of Chicopee, MA
- Tiffany Labrie, Tighe & Bond

In the Eye of the Perfect Storm—Integrated Resource Planning in Medway, MA
- Betsy Frederick, Kleinfelder
- Thomas Holder, Town of Medway, MA
- Kirsten Ryan, Kleinfelder

Model Partnership to Pursue Integrated Permit in Durham, NH
- Zach Henderson, Woodard & Curran
- David Cedarholm, City of Durham, NH
- William Arcieri, Vanasse Hangen Brustlin

Integrated Planning—How is it Being Done Across the Country and How is it Working Out?
- Bethany Leavitt, CH2M HILL
- William McMillin, CH2M HILL

SESSION 31
COLLECTION SYSTEMS III—Academic My Dear Watson—Learn Something New Each Day

Moderators:
- Ryan Wingard, Wright-Pierce
- Paul Barden, Town of Framingham, MA

Ownership of Pressure Sewer Systems—“The Only Thing We Have to Fear, is Fear Itself”
- Henry Albro, F. R. Mahony & Associates
- Michael Vosnakis, Town of Chelmsford, MA
- Frank Cooper, Town of Marion, MA

Hydrophilic Gasket Sealing Technology—A Solution to Sealing Deficiencies in Cured In-place Pipe Lining
- Sahar Hasan, Hazen and Sawyer

Submersible Pump Design & Selection Considerations
- Gary MacDonald, Mechanical Solutions

Competitive Evaluation of Biological Control for FOG Control for Oklahoma City, OK
- Andrew Newold, In-Pipe Technology Company, Inc.
- Kenny Davis, Oklahoma City Water Utilities Trust
- Ricky Snodgrass, Oklahoma City Water Utilities Trust
- Rich Schici, In-Pipe Technology Company
- Mike Williams, In-Pipe Technology Company

SESSION 32
PLANT OPERATIONS III—Nitrogen Removal Case Studies

Moderators:
- Jon Hume, Wright-Pierce
- Michael Emond, Town of Manchester, CT

Improving Process Performance, Startup Issues & Lessons Learned in the Upgrade of a Conventional Activated Sludge Plant to a Four-Stage Bardenpho Process
- Jeffrey McDonald, Fuss & O’Neill, Inc.

Factors for Successfully Reducing Effluent Total Nitrogen Below 2.5 mg/L Using Conventional Nutrient Removal Strategies
- Joseph Rohrbacher, Hazen and Sawyer
- Katya Bilyk, Hazen and Sawyer
- Rosalyn Matthews, Hazen and Sawyer
- Paul Pitt, Hazen and Sawyer

Denitrification Filters—Case Study of Seven Installations Along the East Coast, Performance and Lessons Learned
- Karen Wong, GHD Inc.
- Marc Drainville, GHD Inc.

Nitrogen Removal Without pH Adjustment in an Alkalinity Deficient Wastewater: Amherst, Massachusetts
- Grant Weaver, The Water Planet Company
- James Laford, Town of Amherst, MA

SESSION 33
STORMWATER III—The Rising Sea Of Wet-Weather Mandates And Challenges

Moderators:
- Jeff Cantwell, Flow Assessment Services
- Stacey DePasquale, SDE, Inc.

ALERT: A TMDL Compliance Management Tool
- Jean Haggerty, AMEC

Modeling the Way Toward TMDL Compliance in Boston
- Mitchell Heineman, CDM Smith
- Paul Keohan, Boston Water and Sewer Commission

Strategic Flow Deflection for Phosphorus Control in Stormwater
- David Bedoya, MWH
- William Pisano, MWH
- Owen O'Riordan, City of Cambridge, MA

Does it Rain Before or After A Flood?—Analysis of Coincidental Rainfall and River Elevations Leads to a Cost-effective Replacement of a CSO Pump Station for Flood Protection
- Derek Etkin, CDM Smith
- Mark Young, Lowell Wastewater Utility
- Michael Stuer, Lowell Wastewater Utility
- James Drake, CDM Smith

POSTER BOARD DISPLAYS

Energy Usage Reduction from Enhanced Nutrient Removal Efficiancy During Cold Water Temperatures
- Bulbul Ahmed, In-Pipe Technology Company, Inc.

Extended Bases—The Importance of Manhole Stabilization
- Rebecca Ducharme, Tighe & Bond

Mixing Zones and NPDES Permit Effluent Limitations
- Raymond Ferrara, Kleinfelder/Omni

Non-Destructive Evaluation & Condition Assessment of Sewer Force Mains
- Michael Funk, Pure Technologies

The Decentralized Model: A Lean and Green Future for Utilities
- Dennis Hallahan, Infiltrator Systems, Inc.

Green Infrastructure for Sustainable Wastewater Treatment: A Phyto Technology Demonstration Project
- Tabitha Harkin, Cape Cod Commission

NBC Stormwater Mitigation Program—A Comprehensive Approach to the Urban Stormwater Problem
- Stephen Lallo, Narragansett Bay Commission

Using Disefilter Technology to Treat Primary Wastewater
- Quang Ly, Kruger Inc.

Interim Glycerol Addition at the 26th Ward WWTP
- Michael Lynch, Hazen and Sawyer

Detention/Infiltration Facilities for Partial Separation Projects, Chicopee, MA
- David Partridge, Tighe & Bond

Relocating a Wastewater Treatment Facility and Meeting the Increased Capacity Demands for a Growing Region
- Robert Polys, Woodard & Curran

Cold Temperature Nitrification of Lagoon Effluent Using Biologically Active Filter (BAF)
- Edward Quann, F.R. Mahony & Associates

Managing Growth in Nitrogen Sensitive Watersheds Can Reduce Cape Cod Wastewater Infrastructure Costs
- Carole Ridley, Ridley & Associates, Inc.;
- Michael D. Giggey, Wright-Pierce

Eliminating Stormwater from Neighborhoods and Homes through Watershed-friendly Property Certifications
- Ross Saxton, Tethys Environmental

Worry-Free Chemical Phosphorus Removal
- Melody White, Hach Company

The Sewering of an Entire Town—How Chatham, MA is Planning to Gain Complete Control of their Wastewater to Protect their Drinking Water Supplies & Restore the Local Environment
- Karen Wong, GHD Inc.

2014 Awards & Recognitions

The Annual Awards and Recognitions Ceremony was held on Wednesday, January 29, 2014. This ceremony recognizes the 2013 Award recipients of: the EPA Regional Awards Program, NEWEA members who have received a WEF Award or are recipient of a WEF Member Association Award and NEWEA awards.

U.S. EPA REGION I NEW ENGLAND AWARDS

2013 Regional Wastewater Treatment Plant O&M Excellence Award
- Pittsfield, New Hampshire Wastewater Treatment Plant (Ronald Vien, Superintendent)
- Plymouth Village, NH Water and Sewer District Wastewater Treatment Plant (Kirk Young, Superintendent)

2013 Regional Wastewater Treatment Plant Operator Excellence Award
- James Clifton (retired) Simsbury, CT Water Pollution Control Facility
- Lorraine Sander Billerica, MA Wastewater Treatment Plant
- Harry Butland Marlborough (West), MA Wastewater Treatment Plant
- David Green Rochester, NH Wastewater Treatment Plant
- James Jutras Essex Junction, VT Wastewater Treatment Plant

2013 Regional Wastewater Association Excellence Award
- New England Water Environmental Association (Elizabeth Cutone, Janice Moran, and Linda Austin)

NEWEA RECOGNITIONS

Scholarship Recipients 2013

Undergraduate Student
- Maria George Northeastern University

Graduate Student
- Peter Kyungchul Kang Massachusetts Institute of Technology

Non-environmental Student
- Shane Sullivan Fairfield University

Stockholm Junior Water Prize
- Gabrielle Liflander Riverside, CT
- Nathan Dee Bangor, ME
- Amy Kopec Princeton, MA
- Deepika Kurup Nashua, NH
- Basundhara Mukherjee South Burlington, VT

Crystal Crucible (C2) Society*
- Tim Hurteau Milton, VT
- Peter Sherwood Waterville, ME

NEWEA AWARDS

NEWEA Operator Award

Connecticut
- Michael Dudek Enfield, CT

Maine
- Gregory Thulen Brunswick, ME

Massachusetts
- Joseph Fijal Adams, MA

New Hampshire
- Thomas Moran Keene, NH

Rhode Island
- Barry O'Brien Warwick, RI

Vermont
- Erik Bailey Winooski, VT

Alfred E. Peloquin Award

Connecticut
- Everett Weaver Manchester, CT

Maine
- Scott Firmin Portland, ME

Massachusetts
- Janice Moran Woburn, MA

New Hampshire
- Shelagh Connelly Holderness, NH

Rhode Island
- Michael Bedard West Warwick, RI

Vermont
- Chris Robinson Vergennes, VT

NEWEA AWARDS

Asset Management Award
- Narragansett Bay Commission

Clair N. Sawyer Award
- John Hart, Saco, ME

E. Sherman Chase Award
- Dennis Dievert, Sr. Cheshire, CT

Energy Management Achievement Award
- Narragansett Bay Commission

Founders Award
- Roger Janson Winchester, MA

James J. Courchaine Collection Systems Award
- George Harrington Goffstown, NH

Operator Safety Award
- Kyle Arnold, Woonsock, RI

Past President's Plaque and Pin
- Daniel Bisson, N. Yarmouth, ME

Paul Keough Award
- Susan Spencer Worcester, MA

Public Educator Award
- Jeff McNelly Maine Water Utilities Association
- Matt Timberlake Maine WasteWater Control Association

Wastewater Utility Award
- Warwick Sewer Authority

Young Professional Award
- Paula Drouin, Lewiston, ME

Prior to the WEF Awards presentation, NEWEA President Michael Bonomo asked that NEWEA Executive Director Elizabeth Cutone come forward to be recognized. Bonomo announced that, by Executive Vote, the NEWEA senior management team established a special award in recognition of Cutone and her many years of service as Executive Director and acknowledgement of her announcement of retirement. Bonomo read the following:

This award is named in honor of ELIZABETH A. CUTONE, executive director (1993-2014) who led the New England Water Environment Association (NEWEA) into the premier member association of the Water Environment Federation (WEF).

It was announced that Elizabeth Cutone is the first recipient of this award and that it may be given annually for outstanding achievement in environmental non-profit management.

WEF RECOGNITIONS

Operations Challenge Div. I – Process Control 2nd Place**
- NH – Seacoast Sewer Snakes: Paula Anania {coach}, Mike Carle, Tim Vadney, Mike Baker, John Sykora

Operations Challenge Div. II – Process Control 1st Place**
- ME – Force Maine: Daniel Laflamme (coach), Alex Buechner, Anthony Ellsworth, Scot Lausier, Stacy Thompson

Gascoigne WWTP Operational Improvement Medal**
- Gary Johnson Windsor, CT

WEF Service Awards
- John Trofatter West Wareham, MA

Operator Ingenuity Award*
- Alfred Waitt, Lynn, MA
- Ray Vermette Dover, NH

WEF Fellows**
- Robert Marini Cambridge, MA

WEF Life Membership
- Alvin Firmin New Hampton, NH
- Bruce King Prospect, CT
- Paul Sutton Campton, NH
- Thomas Schultz Mechanic Falls, ME

WEF – MA AWARDS

Quarter Century Operators' Club
- Gary Kuczarski Windsor Locks, CT
- Rich Persson Windsor Locks, CT
- Tom Sciarrino Windsor Locks, CT
- Bob Wood*** Hinesburg, VT

Arthur Sidney Bedell Award
- Meg Tabacsko Chelsea, MA

George W. Burke, Jr. Award
- Town of Provincetown, MA

Laboratory Analyst Excellence Award
- Peter Sherwood Waterville, ME

William D. Hatfield Award
- Erwin "Art" Enderle East Windsor, CT

WEF Service Award
- Greg Cataldo Scarborough, ME
- John Hart Saco, ME

*Presented during the Lab Practices Committee meeting scheduled for Jan. 28, 2014

**Presented at WEFTEC 2013

***Awarded posthumously

The following retiring NEWEA Officers and Committee Chairs were acknowledged

OFFICE	OFFICER
Past President	Daniel Bisson
Secretary	Joseph Witts
WEF Delegate (10/11)	Jennifer Lachmayr
Director—Connecticut	Kevin Cini
Director—Massachusetts	Raymond Willis III
Council Director—Collection Systems/Water Resources	Michael Wilson

COMMITTEE	CHAIR
Awards	Paul Dombrowski
Collection Systems	Kevin Olson
Committee Member Appreciation	Melissa Recos
Government Affairs	Susan Sullivan
Humanitarian Assistance	John Dold
Nominating	Howard Carter
Operations Challenge	André Brousseau
Plant Operations	Benjamin Levesque
Sustainability	Geraldine Ciardelli
Utility Council	John Adie
Young Professionals	Matthew St. Pierre

EXHIBITORS

ADS Environmental Services
Advanced Drainage Systems, Inc.
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Asahi/America, Inc.
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Ayer Sales, Inc.
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Bilfinger Water Technologies
BISCO Pump Systems
Blake Equipment Co
Boyson and Associates, Inc.
Brentwood Industries, Inc.
Burt Process Equipment
Cabot Norit Americas Inc.
Carl Lueders & Co.
Carlsen Systems, LLC
Carus Corporation
Casella Organics
Coyne Environmental Services
Cretex Specialty Products/ Quadex
CSI Controls (PRIMEX)
CUES
David F. Sullivan & Associates
DN Tanks
Duke's Root Control, Inc.
Eastern Pipe Service LLC
Electroswitch Corp
Environmental Operating Solutions
Epoxytec
eRPortal Software Group, LLC
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ETTI
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FlowWorks, Inc.
Flygt – Xylem
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G.L.Lyons Associates
Geomembrane Technologies Inc.
Godwin Pumps – Xylem Dewatering Solutions
Green Mountain Pipeline Services
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Hach Company
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Hanna Instruments
Hawk Measurement America
Hayes Pump, Inc.
Hazen and Sawyer, PC
HOBAS Pipe USA
HOLLAND COMPANY
IDEXX Laboratories
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J. F. McDermott Corp
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National Filter Media
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New England Environmental Equipment
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Pavers by Ideal
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Russell Resources, Inc.
Scherbon Consolidated Inc.
Schulz Group of Companies
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Sealing Systems, Inc.
Sentrol, Inc.
Shea Concrete Products
Sorensen Systems
Sprayroq, Inc.
Stacey DePasquale Engineering, Inc.
Statewide Aquastore, Inc.
StormTrap
Synagro Northeast LLC
Technology Sales Associates Inc.
Ted Berry Company, Inc.
The MAHER Corporation
ThermaStor, LLC/Quest
Trelleborg Pipe Seals Milford, Inc.
Troup Environmental Alternatives, LLC
Trumbull Ind.
United Concrete Products
USABlueBook
Vari-Tech, LLC
Victaulic Company
Walker Wellington, LLC
Wastecorp Pumps LLC
Water & Waste Equipment Inc
WEBB Kentrol SEVCO
WeCare Organics, LLC
Wescor Associates, Inc.
WhiteWater, Inc.
Winters Instruments
Woodard & Curran

The following companies received award of recognition of continuously exhibiting at the NEWEA Annual Conference:

25-Year Award
- BAU/Hopkins
- Flygt – Xylem
- Technology Sales Associates Inc.
- Walker Wellington, LLC

10-Year Award
- Cretex Specialty Products/ Quadex

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G.L. Lyons Associates
Green Mountain Pipeline Services
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Synagro Northeast LLC
The MAHER Corporation
Tighe & Bond, Inc.
Underwood Engineers
United Water
Weston & Sampson
Woodard & Curran
Wright-Pierce

Upcoming meetings & events

THE NEWEA 2014 SPRING MEETING & EXHIBIT

June 1–4, 2014 • Samoset Resort, Rockport, Maine

The NEWEA 2014 Spring Meeting & Exhibit offers three days of technical sessions, exhibit displays, tours, the Operations Challenge competition and a chance to network with other wastewater professionals in a relaxed setting.

EXECUTIVE COMMITTEE MEETING
June 6
Samoset Resort
Rockport, ME

OPERATIONS CHALLENGE GOLF TOURNAMENT
September 18
Stow Acres
Stow, MA

COLLECTION SYSTEMS SEMINAR AND EXHIBIT
September 10
Westford Regency Inn
Westford, MA

WEFTEC ANNUAL CONFERENCE
September 27–October 1
New Orleans, LA

WATERSHED MANAGEMENT AND STORMWATER SEMINAR
October 16
Marriott Mystic Hotel
Mystic, CT

ANNUAL NORTH EAST RESIDUALS & BIOSOLIDS CONFERENCE & EXHIBIT
October 22–23
Marriott Sable Oaks
Portland, ME

NEWEA ANNUAL CONFERENCE
January 25–28, 2015
Boston Marriott Copley Place Hotel
Boston, MA

AFFILIATED STATE ASSOCIATIONS AND OTHER ASSOCIATION MEETINGS

GMWEA SPRING MEETING
May 22, 2014
Killington Grand Hotel
Killington, VT

MWPCA MIKE ACKERMAN GOLF TOURNAMENT
June 13, 2014
Shaker Hills Country Club
Harvard. MA

MWPCA QUARTERLY MEETING
June 18, 2014
Log Cabin
Holyoke. MA

CWPAA SEWER OPEN (GOLF OUTING)
June 20, 2014
Skungamaug River Golf Club
Coventry, CT

NHWPCA GOLF TOURNAMENT
August 7, 2014
Beaver Meadow Golf Course
Concord, NH

GMWEA GEORGE DOW MEMORIAL GOLF TOURNAMENT
August 22, 2014
Cedar Knoll Country Club
Hinesburg, VT

NARRAGANSETT WPCA CLAMBAKE AND EXHIBITION
September 12, 2014
Twelve Acres
Smithfield, RI

MWWCA (MEWEA) FALL CONVENTION, GOLF TOURNAMENT AND TRADE SHOW
September 17–19, 2014
Sunday River Resort
Newry, Maine

MWPCA TRADE SHOW
September 24, 2014
Wachusett Mountain Resort
Princeton, MA

GMWEA FALL TRADE SHOW AND CONFERENCE
November 6, 2014
Sheraton
Burlington, MA

Thank you

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  - Green Mountain Pipeline Services
  - Hazen and Sawyer, PC
  - Kleinfelder
  - The MAHER Corporation
  - RH White Construction
  - Weston & Sampson
- Silver
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  - Brown and Caldwell
  - CH2M HILL
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  - Dewberry
  - Duke's Root Control, Inc.
  - Environmental Partners Group, Inc.
  - Fay, Spofford & Thorndike
  - Hayes Pump, Inc.
  - Hoyle, Tanner & Associates
  - Martinez Couch & Associates
  - NEFCO

NEWEA appreciates these industry leaders who have helped make a positive impact on the water environment this year. **Is your company ready to join us in 2015?**

Sponsorship benefits at all levels include:

- Increased corporate visibility and marketing opportunities to a wide audience of water quality industry professionals
- Relationship-building access to key influencers involved in advancing water quality industry services, technology, and policy
- Recognition as an environmental leader among peers and customers
- Exposure at NEWEA's most popular events including the Annual Conference and golf tournaments

For more information or to join NEWEA's 2014 Annual Sponsor Program, contact Mary Barry:

EMAIL: mbarry@newea.org
CALL: 781-939-0908

NEWEA
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Advertiser index

NEWEA Membership Application 2014

Water Environment Federation the water quality people®

NEWEA WORKING FOR WATER QUALITY

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

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**By joining NEWEA you also become a member of the Water Environmental Federation (NEWEA is a member Association of WEF)

Employment Information (see back page for codes)

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Signature (required for all new memberships) *Date*

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Membership Categories (select one only)

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☐ **Professional Package**	Individuals involved in or interested in water quality	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online*	$139
☐ **Young Professional Package**	New WEF members or formerly WEF 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.	■ *WE&T* (including *Operations Forum*) ■ *WEF Highlights Online*	$66
☐ **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.	■ WE&T (including *Operations Forum*) ■ *WEF Highlights Online*	$86
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☐ **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*	$10
☐ **Executive Package**	Upper level managers interested in an expanded suite of WEF products/services.	■ *WE&T* (including *Operations Forum*) ■ *World Water* ■ *Water Environment Research* (Online) ■ *Water Environment Regulation Watch*	$335
☐ **Dual**	If you are already a member of WEF and wish to join NEWEA		$38
☐ **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*	$390

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

NEWEA Membership Codes 2014

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) (ORG)

1
Municipal/district Water and Wastewater Systems and/or Plants

2
Municipal/district Wastewater Only Systems and/or Plants

3
Municipal/district Water Only Systems and/or Plants

4
Industrial Systems/Plants (Manufacturing, Processing, Extraction)

5
Consulting or Contracting Firm (e.g., Engineering, Contracting and Environmental)

6
Government Agency (e.g., U.S. EPA, State Agency, etc.)

7
Research or Analytical Laboratories

8
Educational Institution (Colleges and Universities, libraries, and other related organizations)

9
Manufacturer of Water/Wastewater Equipment or Products

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

11
Stormwater (MS4) Program Only

12
Other _____
(please specify)

What is your Primary JOB FUNCTION?

(circle one only) (JOB)

1
1. Upper or Senior Management (e.g., President, Vice President, Owner, Director, Executive Director, General Manager, etc.)

2
Engineering, Laboratory and Operations Management (e.g., Superintendent, Manager, Section Head, Department Head, Chief Engineer, Division Head, etc.,)

3
Engineering and Design Staff (e.g., Consulting Engineer, Civil Engineer, Mechanical Engineer, Chemical Engineer, Planning Engineer, etc.)

4
Scientific And Research Staff (e.g., Chemist, Biologist, Analyst, Lab Technician, etc.)

5
Operations/Inspection & Maintenance (e.g., Shift Supervisor, Foreman, Plant Operator, Service Representative, Collection Systems Operator, etc.)

6
Purchasing/Marketing/Sales (e.g., Purchasing, Sales Person, Market Representative, Market Analyst, etc.)

7
Educator (e.g., Professor, Teacher, etc.)

8
Student

9
Elected or Appointed Public Official (Mayor, Commissioner, Board or Council Member)

10
Other _____

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

1
Watershed/Surface Water Systems

16
Water/Wastewater Analysis and Health/ Safety Water Systems

17
Other _____

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)

Year of birth? _____

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 are 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.

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