Session Abstracts
28th Annual Nonpoint Source Pollution Conference, Northampton, Massachusetts

Wednesday, April 12, 2017

9:45-10:45
Keynote Address:

**"Your Best Teacher Is Your Last Mistake (or Success!):
Franklin County's Lessons Learned"**

Kimberly Noake MacPhee, P.G., CFM, *Land Use & Natural Resources Planning Program Manager, Franklin Regional Council of Governments*

Healthy watershed or impaired watershed – they both can face the same challenges. The list is long and includes: untreated stormwater runoff, sediment from fluvial erosion, compromised riparian buffers, cows wading in the river, and possibly the biggest challenge of all – will I meet my grant match requirements? So, how can we design, build and fund projects that address these challenges in communities that are struggling to meet their municipal budgets and have a list of other priority projects that demand their attention and limited resources? In Franklin County, we've developed projects that approach these watershed and fiscal problems in new and innovative ways, learning some valuable lessons from our mistakes and successes along the way. The challenge of conceptualizing watershed issues and potential solutions from the perspectives of a variety of different watershed stakeholders helps to ensure long-term success and, hopefully, replication of project results.

11:15 – 12:00
General Session 1: **Making Change Happen: How to Increase Adoption of Stormwater Practices**

"Community Decisions about Innovations in Nonpoint Source Pollution Management"

James Houle, *University of New Hampshire Stormwater Center*

The purpose of this study was to investigate the social, economic and technological factors that influence rates of adoption of innovative stormwater management approaches in municipal organizations in the Great Bay watershed, NH. The scope of this study was to investigate how innovations spread through municipal populations in a specific region and watershed area of the US. The methodology used mixed qualitative methods, including semi-structured interviews, case studies, and surveys to examine perceptions, attitudes, and beliefs that influence the adoption of innovative stormwater management solutions, as well as the governance characteristics of municipalities at different stages of adoption. Major findings include: adopter categories can be relatively easily and quickly categorized into early and late majorities as a preliminary means to identify populations of ready and willing audiences interested in and capable of advancing innovations; early and late adopter classifications followed general diffusion theory, but differed in substantial ways that could influence overall project or program success; and finally that early majority communities have more internal and external capacity to advance innovations as well as higher levels of peer-to-peer trust to offset perceptions related to economic risk that can either advance or stall innovative stormwater management solution adoption. This research offers insights on how to allocate scarce resources to optimally improve water quality through stormwater management solutions, and makes recommendations for how to effectively and

efficiently generate a greater understanding of complex barriers to adoption that thwart innovation in municipal governance organizations. One significant implication is that agents of change who want to move innovations through a broad municipal population should focus their efforts on working with innovators and early adopters that have status within relevant peer networks and who have capacity to evaluate the strengths and weaknesses of innovations.

1:00-2:45

Concurrent Session 2.1: **Planning, Tracking and Designing – Oh My!**

"*Massachusetts Watershed Based Plans: A New Web-Based Tool for Statewide Watershed Planning*"

Bob Hartzel, *Geosyntec Consultants, Inc.*

A completed Watershed-Based Plan (WBP) is a prerequisite for Massachusetts communities or organizations that wish to apply for Section 319 grant funding for watershed restoration projects. Development of a WBP typically requires a high level of technical expertise to provide required information such as modeled pollutant loading estimates and cost estimates for proposed improvements. As a result, the pool of potential Section 319 grant applicants is limited to those with access to the technical and/or financial resources needed to complete a WBP. To promote statewide development of WBPs, the Massachusetts Department of Environmental Protection (MassDEP) selected Geosyntec to develop a web-based tool for statewide WBPs. Geosyntec's vision was to create an innovative watershed planning tool at the crossroads of science, water resources engineering, public policy, and public education. The interactive WBP web-based tool provides a template for any selected watershed to help users develop WBPs that meet the nine elements required by the U.S. Environmental Protection Agency. The WBP template provides the building blocks of a WBP for thousands of watersheds across Massachusetts - instantly - by simply selecting a watershed by location on a map. The WBP template can be used at a variety of planning scales, such as small pond or stream subwatersheds, HUC-12 subwatersheds, or major river basins. The resulting maps, data, and analyses generated for the selected watershed provide useful information for preparing a WBP, and for many other planning efforts at the state and local level. Additional information to complete a 9-element WBP is provided through a series of guided exercises, interactive web-based tools, and related technical resources. The WBP tool allows users to complete a technically robust WBP very efficiently, and allows the state to focus a greater share of its limited Section 319 funding on watershed restoration efforts. It facilitates implementation projects in high-priority watersheds and will increase the range of opportunities for partnership projects that leverage funding from multiple sources. The WBP website also provides specialized options, tools, and guidance that are tailored to the unique watershed planning requirements of communities with urbanized areas regulated under a NPDES MS4 stormwater permit. This presentation will give an overview of the WBP tool, provide a real-time demonstration of its key features, and discuss potential adaptations for use in other states.

"*Microbial Source Tracking in the Navesink River Watershed in New Jersey: A Rapid, Cost-Effective Method Using Scent-Trained Canines*"

Swarna Muthukrishnan, *Clean Ocean Action*

The Navesink River, located in Monmouth County, New Jersey, is a beautiful 8 mile long tidal estuary, and its approximately 95 sq. mile watershed encompasses seven municipalities and diverse land uses (urban, agricultural, and green space). However, its waters do not consistently meet fecal coliform standards, especially during rain events (New Jersey Department of Environmental Protection, NJDEP). Recently, 565.5 acres of the river were downgraded to "prohibited" for shellfish harvesting, and other recreational activities such as swimming, paddling etc. are declared "unsafe" after a rain event. Clean Ocean Action (COA), a broad-based environmental coalition authored a report, which identified nonpoint source pollution as the primary source of pathogen contamination and impairment of the Navesink. Aging infrastructure, leaking septic systems, and stormwater runoff from urban, agricultural, and rural areas all exacerbate bacterial contamination in the Navesink watershed. In 2016, COA began an innovative, collaborative investigation with Environmental Canine Services (ECS) on microbial source tracking in the Navesink watershed using scent-trained canines, with a specific focus on identifying human wastewater contamination in stormwater runoff and sewer infrastructure that discharge into the river. ECS canines are specifically trained to alert only to the presence of human waste. During Phase I of this investigation in June 2016, water samples were collected from eight locations along the river and were scent-tested separately by two canines off-site (ship and sniff method). Both canines positively alerted to the presence of human wastewater in five of these samples. A parallel qPCR BacHum assay of these samples corroborated the canine alert results. The canine test results were also consistent with NJDEP's analyses using antibiotic resistance analysis and conventional methods for fecal indicators. A more detailed onsite field investigation of areas identified in Phase 1 was conducted in September 2016 when three ECS canines investigated multiple locations in three municipalities in the watershed over the course of a week. The Phase II investigation encompassed hundreds of likely sources upstream of stormwater outfalls (e.g. catch basins, sewer lines, manholes etc.), covering an approximate area of 35 sq. miles in both wet-and dry-weather conditions. This canine alert investigation confirmed that failing sanitary infrastructure is a potential contributor to human fecal contamination in the Navesink River and was generally verified by side by side lab tests. Canine scent-tracking is a rapid and cost-effective screening method to identify and source-track the presence of human wastewater contamination in stormwater systems or watersheds such as the Navesink.

"*Stormwater Retrofitting in Lamoille County, Vermont – Collaboration for Project Planning, Design, and Implementation*"

Andres Torizzo, *Watershed Consulting Associates*
Kimberly Jensen, *Lamoille Country Conservation District*

Stormwater retrofitting of developed lands in Lamoille County, Vermont has become an important tool for reducing nonpoint source pollution, downstream erosion, and flooding impacts. Several successful retrofit best management practices have been installed in Hyde Park and Morrisville, Vermont by unique and effective collaborations between non-profits, private landowners, municipalities, state agencies, and consultants. Case studies of the implementation of an infiltration chamber, a regenerative stormwater conveyance, a sand filter swale, and a bioretention area will be presented along with a discussion of the key stakeholders involved, the various roles of the collaborators, and the long term considerations for operating and maintaining these systems.

1:00-2:45
Concurrent Session 2.2: **Getting It All Together: Effective Collaboration**

"*Community Collaboration on Cost-Effective LID Solutions: Challenges and Opportunities*"

Stefanie Covino, *Mass Audubon*

Communities today are facing many pressures. More jobs and housing are needed, while the costs of providing essential services often rise faster than revenues. Water and transportation infrastructure maintenance costs are growing. In the midst of these challenges, we also need to address persistent NPS pollution and increased flooding due to more intense storms. While stormwater regulations are important, solutions also need to be cost-effective. We will share lessons learned in a collaborative approach to municipal assistance. Local communities do have primary control over one key factor: land use. Well-planned land use can create housing and jobs while containing municipal costs, as well as preserving community character and the capacity of the natural landscape to provide clean air, water, and a host of other "free" services. Mass Audubon, working with a multidisciplinary team of nonprofits, public agencies, and private consultants, developed information about Low Impact Development (LID) and smart land-use techniques that can meet numerous challenges all at once, including funding. We've also built simple tools, such as our three-clicks system for identifying priority conservation areas in your town. Our projects illustrate how the development of resources from one grant, with thoughtful planning, can be used as a jumping off point for additional funding and further outreach and engagement with an even broader set of communities. We have also experienced a number of challenges for municipalities that want to implement change, even when we've worked together to identify local priorities. Staff time and resources are tight; bylaw and regulations changes require a local champion to make the long term commitment necessary for implementation; and public safety concerns or simple inertia and reliance on the status quo often challenge the viability of road diets and innovative design standards. Even with these challenges, our collaborative partnerships provide ongoing networks of support. Sharing local success stories also provides a model for other municipalities to follow. *This project was funded by an agreement (CE96184201) awarded by the Environmental Protection Agency to the New England Interstate Water Pollution Control Commission on behalf of the Narragansett Bay Estuary Program. Additional sources of funding include the Lookout Foundation, Foundation for MetroWest, Open Space Institute, and private individuals.*

"*Building Bridges Over Troubled Waters: Tools for Effective Collaboration in a Bi-State Watershed*"

Kira Jacobs, *U.S. Environmental Protection Agency Region 1*

The Salmon Falls River flows from an ecologically diverse land area shared by the states of Maine and New Hampshire, and drains into the Great Bay estuary, a coastal ecosystem of national importance. Approximately 41,000 people rely on public water systems in the Salmon Falls watershed to provide clean drinking water. Although the watershed is an important drinking water source, it faces water quality impairments. It is also threatened by future increases in polluted runoff resulting from population growth and the associated conversion of forested land to developed areas. The U.S Forest Service 2009 report "**Private Forests, Public Benefits**" identified the rivers in the Piscataqua Region as the most threatened in the nation with regard to a potential decline in water quality due to conversion of private forested lands to housing (the land in the watershed is more than 90% privately owned).

"Implementing Green Infrastructure in Boston's Central Square: A Case Study in Overcoming Challenges and Multi-Agency Coordination"

Charlie Jewell, *Boston Water and Sewer Commission*
Daniel Wible, P.E., *CH2M*

The Boston Water and Sewer Commission (the Commission), under the obligations of its NPDES permit and Consent Decree (CD) to ensure compliance with the Clean Water Act (CWA), is required to develop, implement, and maintain many stormwater-related management and best management practices (BMPs). In addition to its ongoing activities related to stormwater compliance, the Commission was required to submit a BMP Recommendations Report in 2016 that outlined its plan to implement Green Infrastructure (GI) throughout the city over the next 30 years to improve stormwater quality and comply with the CD and CWA. While this program is still in development, it is expected to result in a substantial increase in capital and operating expenses once approved by the U.S. EPA and implemented by the Commission. This program will also require both significant coordination between various city agencies and innovative technical solutions to overcome challenging urban conditions.

As one of the first major GI projects undertaken by the Commission, the Central Square Complete Streets and Park Improvements Project, which is currently under construction, may offer insight as to how the Commission's stormwater program will be implemented. Central Square, which is an urban park located in a thriving commercial district in East Boston, was identified as a priority project in the 2008 East Boston Transportation Action Plan. The renovation of Central Square was initiated to improve the area with multiple traffic, pedestrian, parking, and recreational design objectives identified by the community. In 2012, the Commission identified the project as a potential demonstration site for different types of GI technologies and began coordination with the Boston Transportation Department (BTD), Boston Public Works Department (PWD), and Boston Parks Department (BPD) to include GI elements in the park improvements project.

In cooperation with the BTD, PWD, and BPD, the Commission and its consultant CH2M incorporated a variety of GI measures into the Central Square project. The GI measures, which were designed to capture and infiltrate the first one inch of rainfall, included the following: permeable pavement sidewalks and parking stalls, aggregate infiltration trenches, sand-based structural soil trenches, and various combinations of these. This presentation will provide an overview of this project, with an emphasis on the multi-agency coordination, unique design strategies required to overcome significant technical challenges (working around numerous existing utilities, providing adequate tree rooting volume, addressing tidal impacts, etc.), addressing maintenance considerations, and the Commission's plans for future monitoring.

3:15-5:00
Concurrent Session 3.1: **Implementation: What Are We Learning?**

"Boston's Green Infrastructure Revolution – I Love That Dirty Watah!"

Kate England, *Boston Water and Sewer Commission*

The 1965 Standells musical tribute to the polluted Charles River and beloved Boston sports anthem may soon need a new chorus. This presentation will discuss the enormous potential of a strategic public-sector partnership to advance city-wide implementation of green infrastructure (GI) and multi-functional landscapes. The Boston Water and Sewer Commission (Commission) and Boston Public Schools (BPS) have joined forces on a pilot program to manage stormwater runoff, provide additional creative play space, and engage students at five Boston public schools. Many schools are located within the Charles and Neponset River watersheds where the Commission is responsible for phosphorous and bacteria water quality improvements. The Commission requires management of the first inch of runoff for all construction and reconstruction projects in the City. BPS is in the process of completing a 10-year Educational and Facility Master Plan for improvements at over 130 city schools. The objective of this partnership is to provide, in the short-term, examples of how GI strategies can fit into educational programming and capital investments over the next 10 years while simultaneously improving river water quality. This presentation will describe the process of formalizing interagency agreements and the role each partner is playing in GI implementation from financing, project selection and design, bidding, construction oversight, and long term maintenance. A fundamental driver of this project is the recognition that GI is not just about improving water quality or volume reduction at the site-scale, it's about creating engaging and functional urban landscapes that provide a broad range of services. The partners are collaborating with a team of engineers, landscape architects, watershed advocates, education specialists, and students on this effort. A suite of GI practices, outdoor classrooms, play space, phytoremediation, and pavement reduction options are being implemented at each of the schoolyards. One of the most exciting components of this project is the integration of stormwater and local watershed issues into the science curriculum. The educational and interactive elements of the project, as well as direct input from teachers and students, offers a new twist on GI engineering and landscape design approaches.

"Roger Williams Park – Episode 2: The Park Awakens"

Brian Kuchar, *Horsley Witten Group, Inc.*

This presentation will serve as a sequel to the 2014 NEIWPCC Presentation entitled "Incorporating Green Infrastructure within Historic Roger Williams Park." Brian Kuchar RLA, P.E. from the Horsley Witten Group, Inc (HW) and Brian Byrnes, the Deputy Superintendent for the Providence Department of Parks and Recreation (PDPR), will provide an update on the ongoing innovative stormwater management work being completed in Roger William Park (RWP). The historic park, located in the southern part of Providence, Rhode Island contains a seven-lake complex, which comprises approximately 100 acres. Water quality of the ponds is severely degraded and suffering from impacts associated with densely urban areas that drain into the ponds. Since its inception, this project has been a true collaboration between federal, state and local agencies, non-profits, design consultants and contractors and highlights the benefits of public/private partnerships. In 2011, the City of Providence received funding from the U.S. Environmental Protection Agency (U.S. EPA) Region 1 to improve the water quality and biodiversity conditions of the RWP Ponds. HW was hired to collaborate with the Narragansett Bay Estuary Program (NBEP) and the PDPR to develop a comprehensive Water Quality Master Plan to address pond nutrient pollution in the ponds of Roger Williams Park in Providence, RI. As part of that project, HW worked closely with the PDPR and designed and permitted six stormwater retrofit sites. In 2013, construction was completed on five of the six retrofit practices, which included a meadow-grass surface sand filter, vegetated wet swale, a staged bioswale,

with both wet and dry swale practices, a bioretention area, and road replacement with pedestrian shoreline walk with bioswales. Although much work was accomplished in the first phase, the challenge began upon completion of the U.S. EPA funded WQMP and constructed retrofit sites. This presentation will focus on the ongoing implementation of the WQMP recommendations within the park and will include: Lessons learned from 2014-2016 for design and construction based upon two-years of operation and maintenance of the constructed practices. Construction of the sixth designed and permitted retrofit site, terraced bioretention with pedestrian bridge in 2016. Collaborating with RIDOT for additional funding for the construction of two more retrofit sites through Narragansett Bay and Watershed Restoration Fund (BWRF) and Section 319 grants in 2016. Partnering with a local non-profit, the Rhode Island Foundation, and the creation of the Rhode Island Park Conservancy to assist with the planning and funding of park wide improvement projects in 2016.

"The Long Road to Big Shortcuts in NPS Stormwater Management"

James Houle, *University of New Hampshire Stormwater Center*

In 2006, Berry Brook became famous for the wrong reason: testing showed that water quality in the brook was severely compromised, and it was deemed "impaired" by the United States Environmental Protection Agency (U.S. EPA) and no longer fit for human contact. A good chunk of the watershed surrounding this short, hardworking urban stream was covered by impervious surfaces, which had been channeling polluted stormwater runoff into the brook for decades. Today, Berry Brook is famous again as a model for how scientists and public works departments can collaborate to improve water quality in an urban watershed by using low impact development (LID) and green infrastructure (GI) retrofits, stream restoration, community outreach, persistence, and good old fashioned ingenuity. Since 2006, researchers and City staff have installed 12 bioretention systems, a tree filter, a subsurface gravel wetland, day-lighted and restored 1,100 linear feet of stream, installed two subsurface detention/infiltration systems, and installed 4 filtering catch basin, a new innovation that improves the water quality performance of conventional deep sump catch basins. Together these innovative stormwater controls remove over 19 tons of sediment, 710 lbs of nitrogen, and 127 lbs of phosphorus annually from the watershed. This presentation will quickly cover work that has happened over the past decade, results, and shortcuts discovered along the way. Using largely only NHDES, Section 319, and ARM funding, project partners had to a to adapt "text book," research-based designs with what is practical for a public works department working in an urban setting. Researched and monitored throughout the ten year implementation time frame, municipal leadership has transitioned the City from demonstration of updated stormwater management infrastructure to implementation of stormwater innovations that are more effective, better understood, and more economical to implement than previously imagined.

Concurrent Session 3.2: **Adapting to Change and Thinking Ahead**

"Tools for Climate Change Adaptation and Flood Risk Management"

Andrea Braga, *Geosyntec Consultants, Inc.*

Extreme meteorological events in urban coastal settings often result in storm surge and related overland flooding. These events can cause considerable hazards to infrastructure, businesses, and

citizens. As we see more and more extreme events hitting urban settings it is clear that new and innovative approaches to stormwater management are needed to combat the effects of climate change. Traditional flood mitigation measures (e.g., detention basins, tide gates, etc.) are becoming increasingly difficult to construct, permit, and maintain. As a result, existing flood mitigation measures are being identified as opportunities for potential retrofit projects to improve or expand their function. New and innovative approaches to stormwater and coastal storm surge management are needed to maximize the effectiveness of existing passive controls, minimize risk, and increase opportunities for restoration of coastal ecological resources. Recent advances in information technology, infrastructure, hardware systems, and software are providing a foundation for a future of digitally connected and dynamically monitored and controlled infrastructure. Real-time monitoring and dynamic control of stormwater and coastal infrastructure is now a viable, cost-effective option to provide enhanced resiliency to flooding while meeting competing goals such as maintaining and improving our existing fragile natural resources. This presentation will provide an overview of the tools available for intelligent control of infrastructure and will focus on projects that have used this technology. In particular, this presentation will highlight a project where innovative real-time controls have been used to retrofit an existing retention pond to minimize flooding risk, will discuss the application of real-time controls on tide gates for adaptive management, and will conclude with a discussion on an internet connected resiliency network capable of providing system-wide real-time visualization of flood risks and recommended flood risk mitigation actions.

"Climate Change Impacts on Stormwater Best Management Practices and Recommended Design Considerations"

Cristina Kennedy, *MA Office of Coastal Zone Management*

Coastal and inland areas are becoming more vulnerable to climate change. The function of stormwater Best Management Practices (BMPs) will be impacted by flooding and inundation, storm surge, salt water intrusion, changing magnitude and frequency of storms and precipitation, rising sea and groundwater levels, and shifts in vegetation. The Massachusetts Office of Coastal Zone Management and the Massachusetts Department of Environmental Protection funded a study of twenty-six Massachusetts coastal BMPs to assess their vulnerability to climate change, and provide recommendations to municipalities to ensure long term BMP resiliency and effectiveness. Field evaluations were conducted by the Horsley Witten Group to identify potential siting and design factors subject to climate change pressures. Sea level rise and storm surge risk projections, provided by the Woods Hole Group, were used to evaluate the flood risk at each site. For several specific practices, conceptual drawings of proposed design modifications were developed to provide examples of how some of these recommendations could be implemented. Flooding and storm surge due to climate change are likely to impact a majority of sites by 2030 and some sites are already experiencing a 100% risk of flooding. Over half of the sites observed required some level of maintenance and the need for routine maintenance will only increase as climate change begins to impact BMPs. BMP vulnerabilities to climate change include: submerged outfalls due to rising sea level; rising groundwater decreasing separation distances; physical damage and clogging due to storm surge inundation; and chronic exposure to wind, salt and sand. Recommendations include: using a planning horizon of fifty years to account for increased flooding and inundation in design; considering storm exposure, increasing groundwater levels and the risk of spreading invasive plant species when siting and selecting practices; choosing appropriate construction/landscaping materials; redundancy and flexibility in design to adapt to changing conditions; choosing green over grey infrastructure; and the even greater importance of

maintenance. While the study focused on coastal BMPs, many of the recommendations apply to inland BMPs as well. The purpose of these recommendations is to guide decisions about funding, siting, selection and engineering design for stormwater improvement projects. Consideration of these common-sense recommendations will help communities increase the effectiveness of stormwater BMPs under present and future conditions.

"Integrating Long Term Operation and Maintenance into Design through Stakeholder Collaboration"

Daniel Bourdeau, *Geosyntec Consultants, Inc.*

Demonstration projects are an important component to building long term acceptance of nonpoint source control and stormwater management including green infrastructure in our communities. These projects, largely implemented through Section 319 grant programs, help build public awareness on nonpoint source pollution control. Structural practices, often located in highly visible areas to the public, can be effective at demonstrating this concept when properly designed and maintained. Alternatively, poorly designed or unmaintained practices can be an eyesore in the community and can have a negative effect on the overall goal. Successful implementation projects begin with a stakeholder engagement process bringing input from property owner(s) as well as the personnel performing long term operation and maintenance. In addition, long term operation and maintenance costs need to be evaluated at the beginning of a project and planned over the life cycle of the practice. This presentation will describe integrating stakeholder collaboration in the design process using multiple example Section 319 implementation projects to highlight how this process has worked effectively and how this process can be improved for future projects.

Thursday, April 13, 2017

8:30-10:00
General Session 4: **Nutrient Reduction and Reuse**

"A Regional Collaboration to Maximize Resources and Accelerate the Advance of Non-Proprietary Nitrogen Reducing Wastewater Treatment Technologies"

Harold Walker, *Stony Brook University*

Nitrogen and other contaminants emanating from decentralized wastewater management systems are a leading source of water quality degradation throughout coastal areas. Awareness of this issue and the resources available to address it has varied significantly by state, county and town, making widespread improvements difficult to achieve. However, a collaboration between the Massachusetts Alternative Septic System Testing Center (MASSTC) and the New York State Center for Clean Water Technology at Stony Brook University (CCWT) has emerged as an ideal opportunity to leverage multi-jurisdictional resources, promote knowledge sharing, and help develop, refine, and advance affordable, high performance, non-proprietary systems for removing nitrogen and other contaminants from onsite wastewater. The MASSTC is a unique and important resource as one of only four testing centers for onsite wastewater treatment systems in North America, and the only testing center in the New England region. For nearly two decades, it has been an epicenter of knowledge regarding existing and emerging innovative alternative

onsite wastewater treatment systems, however its resources to perform additional research and development have been limited. The CCWT is a leading a new initiative funded by New York State and Bloomberg Philanthropies to marshal public and private resources with the goal of accelerating innovation in water technology to address water quality degradation issues regionally and beyond. A joint venture between the top ranked School of Marine and Atmospheric Sciences and the College of Engineering and Applied Sciences at Stony Brook University, its multi-disciplinary team is equipped with unique resources and talent, and charged with facilitating the development and commercialization of more cost-effective wastewater treatment technologies. Together, the MASSTC and CCWT have identified a passive, non-propriety approach known as a Nitrogen Reducing Biofilter (NRB) as an affordable, high performance solution to consistently achieve high rates (up to 90 percent) of nitrogen removal, as well as efficient removal of other contaminants such as pharmaceuticals and personal care products. This presentation will explore how these entities have collaborated to share costs, knowledge and resources, as well as to engage other collaborators in order to refine and optimize the performance of these systems, and to work towards achieving buy-in and regulatory approvals in multiple jurisdictions for widespread system deployment.

"Managing Phosphorus Loads from Agricultural Cranberry Bogs to Restore White Island Pond"

Mark Mattson, *Massachusetts Department of Environmental Protection*

The historical increase in phosphorus fertilizer application on commercial cranberry bogs from approximately 1960-2008 is associated with the decline in water quality of White Island Pond, Plymouth/Wareham, MA. A Total Maximum Daily Load (TMDL) and a Memorandum of Agreement (MOA) with cooperating groups required specific cranberry bog management practices to restore the lake. We used a cooperative approach with the University, the growers, and the town that included a series of United States Environmental Protection Agency (U.S. EPA) Section 319 program grants focusing on reduced fertilizer rates, discharge diversions, and an aluminum treatment of the lake to address the excess phosphorus inputs. There are few examples of a lake, river, or estuary recovering from eutrophication following a reduction of agricultural inputs of nutrients. In particular, White Island Pond in Plymouth/Wareham, Massachusetts has experienced a decline in water quality, initiation of frequent cyanobacteria blooms, and subsequent violations of Water Quality Standards. In a sensitive seepage lake the bogs can contribute up to 40 percent or more of the total phosphorus load, and a majority of the anthropogenic phosphorus load to lake and lake sediments. This study correlates the changes in recommended fertilizer rates with trends in total phosphorus and associated eutrophication impacts before, during, and after the fertilizer rates were reduced. In the East Basin where total phosphorus summer concentrations averaged 82 ug/L, significant reductions of 40 percent were observed after fertilizer reductions and diversions occurred at the cranberry bogs. A partial dose of alum plus aluminate was applied to the East Basin and subsequently concentrations fell an additional 35 percent to a concentration of 21 ug/L in 2013, and largely eliminated the frequent cyanobacteria blooms of the past decade. A final alum dose was applied in March of 2014 to both basins, and the lake is now clear. Furthermore, the lake meets water quality uses with the average TP concentration of 13 ug/l and the TMDL target has been met.

"The Regional Compost Feasibility Study and Pilot Project '*Building Unconventional Partnerships through Innovation to Solve Water Quality Issues on the Scituate Reservoir*'"

Kate Sayles, *Northern Rhode Island Conservation District*

In 2015, the Northern RI Conservation District (NRICD) was awarded a Conservation Innovation Grant (CIG) through NRCS for the Regional Compost Facility Study and Pilot Project in the Scituate Reservoir Watershed to address water quality and manure management in an important public drinking water supply. Through CIG, NRCS partnered with NRICD, Providence Water (PW), Roger Williams University (RWU), and The Compost Plant (TCP) to implement a pilot project to determine if it was both feasible and cost effective to assist small-scale livestock producers with the removal and composting of manure within the Scituate Reservoir Watershed, which provides over 60% of Rhode Islanders with their drinking water. Additionally, NRICD will work with PW on determining the best location for a composting facility within the Scituate Reservoir Watershed. The results of limnlogical studies performed by the ESS Group on the Scituate Reservoir revealed elevated levels phosphorous in 2011 and 2013, and after several cyanobacteria blooms, PW began looking for ways to address this immediate threat to drinking water quality. For the last 30 years, NRICD has partnered with PW to educate the landowners, farmers, and students who use the majority of the land in the Scituate Reservoir Watershed through the Scituate Reservoir Watershed Education Program. NRICD investigated new and innovative methods to address nutrient loading head on through the removal of manure from these farms (40 in the most critical sub-watersheds). The majority of these producers have small herds of livestock with little ability to spread, compost, or remove manure in a cost-effective way, and often the manure is mismanaged – piled on the ground, uncovered, potentially affecting ground and surface waters. In 2014, NRICD partnered with The Compost Plant (TCP), the first full-service commercial compost operation in Rhode Island, who offered to haul manure from the watershed for processing at Earth Care Farm in Charlestown, RI. Through this pilot (which began at the end of October), each farm participating fills 96-gallon toters, and TCP picks up the manure weekly to bring for processing. Farms throughout the watershed were surveyed on their willingness to participate, and currently there are six producers implementing the program. We've learned much about our methods thus far – about the small response for this free service, that most producers find value in their manure and are looking for assistance with on-site composting, and about the importance of educating producers on the connection between water quality and manure.

10:30-11:45

General Session 5: **Watching The River Flow**

"Self-Forming Streams"

Daniel Ketzer, *PrincetonHydro*

Classic channel evolution models describe a succession of stages including a widening stage with an entrenched over-wide channel followed by the formation of a meandering narrower channel and active floodplain developed principally by aggradation. The form and function of the final stage is similar to the original stage but at a lower elevation. Constructing channels in a similar over-wide condition with the expectation that the self-forming stream will follow is explored for its potential for channel work including; relocation, naturalization, revitalization and drainage. These project sites act as significant sediment traps during the formation of the floodplain benches, allowing these sites to trap nutrients and excessive sediment. Seven restoration projects have been constructed in the Midwest with the intent of inducing self-forming processes. This

presentation looks at photographic documentation of how these sites were constructed and how they have developed over the years since construction with a focus on the factors that have led to the self-formation of channel banks, channel substrate, and vegetated floodplains.

"To Restore or Not to Restore, that is the McQuesten!"

Michele Tremblay, *New Hampshire Rivers Council*

When an eight year-old girl comes to you with dead, wild, and native eastern brook trout and asks why they died, there is no question about restoration. Such was the case on McQuesten Brook in Manchester, NH, during a watershed trash cleanup event organized by the New Hampshire Rivers Council. Six healthy, naturally reproducing brook trout were buried and trapped in debris and sediment against the face of a dam on a flashy reach of the brook. The trout were unable to free themselves and died a day before the cleanup. Everyone united to save this important and unlikely population of brook trout in one of the most urbanized areas of the state. There was no McQuesten about it! A third of the McQuesten Brook watershed is covered by impervious surface. The brook squeezes through a series of culverts. One had so much road fill runoff packed into the channel that it met the state definition of a dam. A second reach of the brook had been impounded in three locations to create McQuesten Pond, blocking the spring-fed brook from flowing, as well as trapping sediments. The pond and the brook failed to meet designated uses for Aquatic Life and Primary Contact Recreation according to the 2014 list of impaired waters. The New Hampshire Rives Council is leading efforts to protect and restore McQuesten Brook and its watershed. The cornerstone for this effort is the U.S. EPA-approved McQuesten Brook Geomorphic Assessment and Watershed Restoration Plan published in 2013. The Plan identifies practices that have yielded dramatic improvements in stream quality, aquatic organism passage, and the generation of another NPS success story. It could only happen with the broad partnerships and diverse portfolio of funding and creative match sources. Fast forward to summer 2016: McQuesten Brook flows now with four dams removed, one stream crossing completely eliminated, and a second stream crossing upgraded from a 36-inch culvert to fourteen foot wide bridge. The project budget was a tapestry of partners and funding sources ranging from U.S. EPA Section 319 Watershed Assistance Grants, state Aquatic Resource Mitigation Program, and municipal funds, along with in-kind services such as Manchester's heavy equipment and operators, jack-hammers, the purchase of a home and relocation of the resident, crossbows with willow stakes, a bucket of acorns, and a pair of sling-shots. You can't believe these are sources of match? Check out this presentation and McQuesten no more!