Wednesday, April 25, 2018

11:00 – 12:00
General Session 1: Watershed Innovation

“MS4 Retrofit Implementation in the New York City Drinking Water Reservoir Watershed”

Robert Capowski, New York State DEC
Kenneth Kosinski, New York State DEC

New York State issued an MS4 Stormwater General Permit in 2008 which required MS4 Operators (Towns, Villages, County Highway Departments and NYS DOT) in the phosphorus-impaired NYC East of Hudson (EOH) Watershed to retrofit their MS4s to reduce total phosphorus.

To provide guidance for this retrofit program, NYSDEC developed the Croton Watershed TMDL Implementation Plan, issued in 2009, which disaggregated watershed MS4 phosphorus loads to all the respective MS4 Operators. The implementation plan further specified that EOH MS4 Operators were required to reduce 1,200 kg/yr of total phosphorus through construction of stormwater retrofits, over a 10-year time period.

In December 2009, the MS4 Operators submitted comprehensive Retrofit Plans and an implementation schedule. Though stormwater BMP implementation is often challenging, due to property access issues, funding uncertainties and design constraints, the MS4 Operators in the EOH Watershed have constructed over 200 retrofits calculated to reduce phosphorus by over 500 kg/yr thus far. The program continues to this date, and retrofits calculated to reduce another 700 kg/yr are anticipated to be constructed in the next 5 year permit cycle.

This presentation will discuss NYSDEC’s efforts working with the MS4 Operators to form a multi-jurisdictional stormwater coalition to address their combined phosphorus reduction requirement regionally (bubble compliance) as well as the technical criteria that was established to determine phosphorus loading and reduction credits for the variety of retrofit practices that were installed. “Lessons learned” will also be discussed including the best “bang for the buck” retrofits.

“Partners + Data + GIS = Science! Developing Environmental Indicators for the Narragansett Bay Watershed”

Eivy Monroy, Narragansett Bay Estuary Program

Narragansett Bay and its watershed are located within Massachusetts and Rhode Island. Since the Industrial Revolution, this bi-state watershed has been transformed from relatively undeveloped areas to urban centers along coastal regions and key river basins (the Blackstone, and Taunton Rivers). These transformations have re-shaped the landscape altering the quality of its freshwaters and the bay. The Narragansett Bay Estuary Program developed 24 environmental indicators to analyze these transformations, using a stressor-condition framework, through an inclusive partnership and data-driven process.
Over 50 partners assisted with data sharing and analysis, method validation, and report writing and review. All indicators were analyzed for current conditions (status), and trends when data were available. To tackle inherent challenges of data consistency and compatibility across state lines, the Estuary Program used national, regional, state, and local datasets to standardize and create seamless datasets representing key indicators.

Using state-of-the-art methods and technologies such as GIS, indicator status and trends were analyzed at different geographical scales (HUC10, HUC12, bay segments, etc.) and time steps, shedding light on new and exciting conclusions. Comparing these results at different spatial scales, indicator-metrics show spatial patterns and gradients of conditions and changes throughout the bay and watershed. For example, using dasymmetric analysis, gradients of population density depict where people live, integrating US Census and land use data within the watershed boundaries, thus overcoming the spatial limitations of the Census data. Additionally, kernel analysis was performed to show patterns on 1) how the population has migrated throughout the watershed from 1990 to 2010; and 2) high density areas of buildings not connected to sewer systems.

A variety of products from the report showcase these and other results. The goal of the Estuary Program is to bring partners and data together, developing sound science, and using data for project and policy implementation. Tangible outcomes include our partners utilizing the data and results to implement their own projects and outreach. Moving forward, this process provides feedback to the Estuary Program as indicators are updated and when new data emerge, thus continuing the cycle of collaborative effort, through this formula P+D+GIS (also other tools and methods).

1:00-2:45
Concurrent Session 2.1: Innovation

“Innovative and Cost-Effective Groundwater Treatment Using PRBS for Nitrogen Removal to Achieve Site Net 100+ % Nitrogen Removal and Watershed TMDL Compliance”

Pio Lombardo, Lombardo Associates, Inc.

The presentation will discuss actual and proposed installations of permeable reactive barriers (PRB) for groundwater nitrogen removal to achieve site net 100+ % nitrogen removal and watershed Total Maximum Daily Loads (TMDL) compliance. Nitrogen removal performance data as independently measured by the Woods Hole Marine Biological Laboratory for PRB that has been operating for 12+ years on Cape Cod will be presented. Planning design and nitrogen removal of PRBs that has been operating for 2 years for septic plume nitrogen removal will be presented. Two projects, located in NY and CT, in which the PRB has been designed, and are expected to be operational by January 2017 and March 2018 will be described and performance data presented. The design procedures of site characterization and PRB sizing will be discussed, along with costs and permitting. Costs will be normalized and stated as capital, annual O&M and Life Cycle Costs on an equivalent residential unit (EDU) basis.

The results of a PRB feasibility study for TMDL compliance for a Pond watershed on Martha’s Vineyard will be presented. The study determined that PRBs could technically achieve TMDL compliance at a life cycle cost of approximately 10% of the cost of sewering.
“RIDOT’s Innovative Approaches to EPA Consent Decree Compliance”

Theresa McGovern, VHB
Annie Bastoni, VHB

This talk will present the tools developed to assist in the efficient implementation of Rhode Island Department of Transportation RIDOT’s RIPDES MS4 obligations. Since an EPA Audit and Consent Decree, Rhode Island DOT (RIDOT) data collection and reporting obligations have increased dramatically. The fast timeline and aggressive scope of the compliance requirements has led RIDOT, with the help of VHB, to develop and implemented many innovative approaches to meet the requirements, track progress, and document compliance to EPA. Many of these requirements and the challenges in meeting them are common to MS4 dischargers and the use of technology and innovation is the means for cost-effectively remaining in compliance.

RIDOT has implemented multiple robust programs that require innovative tracking and reporting tools, including:

- a stormwater infrastructure inventory, inspection, and maintenance program;
- an illicit discharge and elimination inspection and monitoring program; and
- a program to address RIDOT discharges to impaired waters through development of stormwater control plans (SCPs) for each watershed.

This presentation will focus primarily on innovative development and implementation of tools to support the tracking, reporting and planning elements of the SCPs. Through the development of SCPs, information on RIDOT roads by catchment area is compiled including, but not limited to: impervious cover; existing and potential stormwater controls; and water quality reduction targets and treatment credits.

Thoughtful planning and innovation has allowed this process to be a success. By using templates and a centralized GIS database the information developed in the SCPs is standardized and the process is made efficient. However, to be able to fully understand RIDOT’s stormwater activities and to cost-effectively plan water quality improvements across the state, RIDOT must expand its data collection beyond the direct Consent Decree compliance activities. RIDOT has developed the Water Quality Data Form (WQDF) to provide an online forum to collect stormwater data that directly updates the RIDOT central GIS database with proposed BMPs, including the water quality treatment credits.

In addition, the form informs and guides RIDOT roadway and bridge designers on stormwater requirements within their project area and allows recommendations to be sent from RIDOT’s Office of Stormwater back to designers.

The WQDF was developed to enhance and streamline the existing RIDOT project development process. Working closely with the RIDOT team and seasoned RIDOT designers, VHB ensured that: the process fit with the RIDOT Work Breakdown Structure; the data collected ties to the RIDOT work order system (VueWorks); and information needed for various environmental permits was not duplicated. The presentation will highlight how these programs help RIDOT to efficiently make decisions, implement new projects, and develop reports to show compliance with the Consent Decree.
"Source Water Protection – 20 Years of On-Site Wastewater Treatment Programs in the NYC Watershed"

Michael Meyer, New York City DEP

For more than 20 years, DEP has worked cooperatively with a number of watershed partners including Catskill Watershed Corporation, NYS Environmental Facilities Corporation, counties, municipalities, and private entities to develop and implement a number of programs that reduce the potential water quality impacts associated with improperly treated wastewater in the upstate water supply watershed. Collectively, these programs have resulted in nearly 9,000 on-site wastewater treatment systems (OWTS) that have either been repaired, rehabilitated, or connected to a centralized wastewater treatment system.

Ultimately, these programs improve the quality of the drinking water supplies within the NYC Water Supply System and are a critical component to DEP’s Long-term Watershed Protection Strategy. The repair or conversion of these OWTSs is equivalent to millions of gallons of wastewater flow per day that is now properly treated before discharge into the water supply watershed. Since the 1997 Watershed MOA, the overall contribution by DEP to implement the extensive OWTS rehabilitation or conversion programs is approximately $300 million.

The presentation will provide an overview of the various DEP-funded programs that have been implemented to reduce the potential water quality impacts associated with improperly treated wastewater. The DEP-funded programs that have been implemented to reduce the impacts from OWTSs include septic repairs, new sewage collection systems, and new or expanded wastewater treatment systems. The presentation will conclude with a discussion of lessons learned and the cost-effectiveness of the various protection programs that DEP has implemented.

1:00-2:45
Concurrent Session 2.2: Agricultural & Rural Practices

“Developing a Riparian Forested Buffer Legacy of Work”

Lydia Brinkley, Upper Susquehanna Coalition

Getting riparian forest buffers planned and implemented from start to finish is not easy work. It takes understanding the land and landowner goals, patience, grit, and the ability to see the future landscape for the next generations. While we know buffers is an effective practice, in concert with land management, to improve water quality and create biodiversity, practical technicians often struggle with getting landowners to say yes to implementation. Priorities and programs need to align to create a template for implementation. The Upper Susquehanna Coalition has developed and is employing several programs and holistic approaches to overcome programmatic and real-time barriers on the ground in reaching water quality goals throughout the watershed. Join us for an inspirational story of life on the land and learn about the development of these programs, their application, and be part of the conversation for getting this living practice on the ground.
“Cover Crop Mix Seeding Rate Calculator for the Systematic Evaluation and Development of Cover Crop Mixes”

Paul Salon, USDA-NRCS

There is increasing interest by farmers in planting cover crop mixes. Mixes can be useful when planted at the appropriate time typically following the time of small grain harvest up until September first in the Northeast. Although there are other times within vegetable rotations where it may be applicable. The different plant characteristics of species in mixtures can provide multiple benefits compared to using single species. Mixes may lead to improved soil health due to the diversity of their plant composition and root exudates leading to a more diverse soil biology impacting soil function and processes. Mixes due to differing growth characteristics can also buffer against variable weather conditions during establishment and growth. A review of these characteristics and combinability of different species will be discussed.

It is important that species in mixtures do not outcompete each other, so that each species can provide the maximum potential benefit. An excel cover crop calculator was developed and will be demonstrated that can be used to plan mixes and test them across multiple conditions. Using adaptive management, competition factors can be adjusted to improve the effectiveness of the calculator. The competition factor is a percentage multiplied against a set monoculture rate which determines the seeding rate in lb/ac for each species. The competition factor was subjectively determined using plant characteristics over multiple years of observation.

The cover crop mix is constructed by first selecting the purpose. Based on the purpose each species is rated excellent to poor and is given an associated competition factor. After entering the purpose the species can be changed which will automatically change the seeding rate. Additional species can be selected or removed during this process to further refine the mix for its purpose. Plants are grouped into categories so that when similar species are planted in the mix their corrected rates are reduced by the number of species in that group. There is a way to modify the rates based on establishment methods.

Output from the calculator includes: 1) the seeding rate in lb/ac and seeds/ft2 for each species, and 2) percent by lb/ac and seeds/ft2 for the mix. This calculator is designed to be transparent so that species ratings and competition factors can be modified for different regions and new purposes. Species and exact costs can be easily added and adjusted.

“Evaluating the Impacts of Subsurface Agricultural Tile Drainage Systems to Water Quality in Lake Champlain”

Dave Braun, Boston Water and Sewer Commission

Subsurface tile drainage is an essential water management practice on many agricultural fields, allowing timely equipment access, reduced soil compaction, and increased crop yields in fields otherwise too wet to efficiently farm. The combined effects of drawing down the water table and providing rapid conveyance of subsurface water to an outlet can significantly change the hydrologic behavior of a field, reducing surface runoff by enhancing infiltration and groundwater transmission. Once dismissed as negligible, phosphorus (P) levels in subsurface tile drain flow are now recognized as potentially significant. Tile drain flow has been clearly shown to influence both
hydrology and P loading at the field and watershed scales in some areas of the United States.

Across the Lake Champlain Basin, little is known about the extent of tile drainage systems, and the potential impacts of tile drainage systems on water quality have not been assessed with adequate rigor. To address certain knowledge gaps in our understanding of the impacts of tile drainage systems in the Lake Champlain Basin, Stone Environmental is performing an intensive study in the Jewett Brook watershed in St. Albans, Vermont. The main objectives of this study are to quantify: 1) the degree of association between agronomic variables and nutrient concentration and loading data, and 2) the proportion of all P exported from the watershed that is contributed by tile drains.

Twelve tile drains were selected for monitoring on commercial dairy farms in the Jewett Brook watershed, considering cropping system, soil type, and the construction and layout of the tile drain system. Construction of monitoring stations near the drain outlets was completed in April 2017. Manholes were installed to intercept the tile lines and electromagnetic flowmeters were installed within the manholes. Above ground, autosamplers, dataloggers, and modems were installed in shelters to record and transmit flow data and enable collection of flow-paced, composite samples. Composite samples are processed weekly for analysis by the Vermont Agriculture and Environmental Laboratory for concentrations of total phosphorus (T, total dissolved phosphorus (TDP), and total nitrogen (TN).

Results to date demonstrate extremely high variability in phosphorus concentrations among the 12 sites and with time. Total phosphorus concentrations have ranged from 11 to greater than 4,000 µg/L). Phosphorus concentrations in tile drain flow clearly reflect both soil phosphorus concentrations and the effects of recent nutrient additions. Patterns in these data will be explored and findings regarding the relative significance of tile drain nutrient loading will be presented.

3:15-5:00
Concurrent Session 3.1: NPS Hot Topics

“Vermont’s Comprehensive Stormwater Infrastructure Mapping and IDDE Program”

Jim Pease, Vermont DEC
Dave Braun, Stone Environmental

Vermont is a rural state of small villages, many with very old sanitary and combined sewers and irregular stormwater drainage systems. The smallest of Vermont’s 255 towns have no closed drainage systems at all. Only 11 cities and towns have regulated municipal separate storm sewer systems (MS4), subject to the operational requirements of the State’s MS4 permit program. For the majority of municipalities in between, the State of Vermont is overseeing an ambitious program to map their stormwater infrastructure and perform illicit discharge detection and elimination (IDDE). Goals of the program are to enable improved infrastructure management by participating communities and to reduce water pollution. This program is now in its twelfth year. Stormwater infrastructure mapping has been completed in 147 communities and IDDE surveys have been completed in 87 of these. Over 3800 stormwater drainage systems have been mapped and assessed. A large variety of contaminated discharges have been eliminated, including 230 wastewater discharges.
In performing the mapping and IDDE work, the State and its contractors have developed certain novel approaches, tricks of the trade. The state has developed a statewide ArcMap geodatabase for the information. We extensively use agency and municipal infrastructure geodatabases, electronic and paper plan files created through a number of permitting programs, and contract plans from pollution control facility/system loans. The municipality is typically engaged early and often in the process and provides many base maps that are scanned at no cost resulting in more permanent, durable records for the municipal archives. Draft maps are checked in the field to verify accuracy of infrastructure plans and the municipality completes a final map review step.

In addition to the primary goals of this program, the maps provide municipalities with several ancillary benefits: 1) increased awareness of stormwater infrastructure maintenance needs; (2) improved hazardous material spill prevention; (3) more effective planning for combined stormwater-sewer separation projects and stormwater treatment opportunities and facilities; and (4) a solid geographic basis for local stormwater ordinances and stormwater management programs.

In IDDE investigations, extensive use of inexpensive optical brightener monitoring has enabled detection and bracketing of almost all the sanitary wastewater and washwater discharges found to date. We have then used dye and smoke testing, often in combination with camera inspection in the pipelines, to locate specific leaks and cross connections in the sanitary and stormwater pipelines. There are many tricks the contractor has developed which will be described/demonstrated. This statewide effort has been shown to reduce phosphorus at one-half the cost, in public dollars, of nutrient removed by stormwater treatment practices.

“Designing solutions for steep, erodible, constrained-corridor rural roads in Vermont - a case study of Fuller Hill Road, Warren, VT using road reshaping, ditching, and dry wells to manage runoff.”

Dana Allen, Watershed Consulting Associates, LLC

Rural roads in Vermont present a particularly difficult challenge for managing stormwater. Many times they are steep with highly erodible road surface material or erodible native soils underlying the ditches on either side. Rights-of-way are often constrained, with elevated banks to either side of the road surface, historic fences or rock walls, and mature trees that impart fundamental character to these roads. Projects that attempt to manage runoff from these roads need to take all of these factors into careful consideration when developing solutions.

The Town of Warren, VT, in the flood-prone Mad River Valley, experienced chronic road washout issues and is frequently forced to remove road sediment from its Main Street in the village center due in large part to eroding materials from Fuller Hill Road. Fuller Hill Road is steep and the road right-of-way is constrained by residential housing development and natural topography, leaving few options to manage stormwater off the the road right-of-way. Working in partnership with the Town of Warren, Watershed Consulting Associates, (WCA) developed a suite of solutions using designs adapted from the Vermont Better Backroads Program, as well as incorporate the use of 8’ diameter dry wells strategically placed along the length of the road to capture runoff and encourage active infiltration entirely within the road right-of-way in response to concerns about infringing on adjacent development. Mixing traditional road-based runoff control practices with
more structural practices like dry wells is not yet common in Vermont. This project illustrates an important departure from typical practices and represents an innovative approach to runoff management in the rural road environment.

In order to create these solutions, WCA conducted extensive hydrologic and hydraulic modeling to support the sizing and placement of these dry wells. Modeling indicates that the dry wells will fully infiltrate the 1" per 24 hour water quality volume as well as the 1.98" per 24 hour channel protection volume. Additionally, WCA performed water quality pollutant loading modeling using WinSLAMM to quantify the benefits with respect to total phosphorus (TP), total suspended solids (TSS) and bacteria (total coliforms). This modeling was conducted to predict approximate reductions with respect to the Lake Champlain Total Maximum Daily Load (TMDL) regulations.

"DAM Dashboard: Dam Assessment and Management Tool Pilot Project"

David Roman, Geosyntec Consultants

In absence of adequate supporting data, management of small water supply surface reservoirs and other impoundments is often based on rough estimates of how the reservoir and downstream system will respond to base flows, runoff, evapotranspiration, infiltration, and withdrawals. There is often a lack of reliable information to support permit performance standards and reporting associated with reservoir/dam management, making it difficult to confirm how frequently stream flow and water level is out of compliance, or how management actions could be refined to improve compliance and protect downstream habitat from extreme flow alterations. DAM Dashboard establishes an information network on the status of reservoirs/dams that includes real-time data, reporting tools customized to the infrastructure management and regulatory needs of water suppliers, and infrastructure decision support tools that are web-accessible.

This presentation will discuss the DAM Dashboard pilot project currently being implemented in three Massachusetts Communities. The presentation will include an overview of the pilot sites, instrumentation design and installation, and development of a web-based dashboard with decision support features. The presentation will conclude with discussion of future planned project applications including a streamflow restoration and source water protection plan within the pilot study area through coordinated operation of a series of existing impoundments based on actual streamflow data and model results to inform operational decisions. This project represents an innovative and groundbreaking approach towards local water resources management that will advance the overall state of the practice while creating a model with clear and quantifiable metrics of success for others across the region.

Concurrent Session 3.2: Tracking & Quantifying NPS Project Benefits

"Tracking and Communicating Vermont's Clean Water Progress"

Emily Bird, Vermont DEC

The State of Vermont has developed a statewide interagency tracking and accounting system to monitor progress implementing major nutrient total maximum daily loads (TMDLs), and to account for state investments in nonpoint source projects. This tracking system, developed in-house by
Vermont Department of Environmental Conservation (DEC), tracks the full project pipeline from planning/prioritization, to design and construction – tracking financial data and project outputs, and calculating estimated nutrient pollutant reductions. It accounts for state-funded projects, as well as projects implemented under water quality regulations, including stormwater permit programs and required agricultural practices. The system supports reporting progress under the Lake Champlain and Lake Memphremagog TMDL accountability frameworks, and meets state investment reporting requirements. The overarching goal is to provide meaningful information to the public and help make the connection between investments made, actions taken, and outcomes achieved.

This presentation will cover the legislative actions and regulatory requirements that set the stage for developing the tracking system, steps taken by DEC to build the system, and how the state is communicating clean water results to stakeholders and the public.

"Tracking Phosphorus and Sediment Reductions from Structural and Non-Structural BMP Implementation with the South Burlington Stormwater Utility"

**Tom DiPietro, City of South Burlington Department of Public Works**
**Joe Bartlett, Fitzgerald Environmental Associates**

The City of South Burlington created Vermont's first Stormwater Utility (SWU) in 2005. The SWU was charged with addressing water quality issues in South Burlington including compliance with: State issued stormwater permits, the City’s MS4 permit, multiple stormwater TMDLs, and a phosphorus (P) TMDL for Lake Champlain. The SWU is also responsible for maintaining existing Stormwater Treatment Practices (STPs) and drainage infrastructure throughout the City. This includes working with existing residential developments to upgrade old STPs so that responsibility for their permitting and maintenance can be transferred from residents to the City. In order to meet this challenge, the South Burlington SWU has developed numerous policies and practices for managing this work. Fitzgerald Environmental Associates (FEA) has partnered with the SWU to develop a range of simple tools for tracking sediment and phosphorus removal through SWU managed structural and non-structural BMPs. Accurate estimates of pollutant removal will be critical for TMDL and MS4 compliance. This presentation provides an overview of the SWU's work, efforts towards tracking phosphorus removal, and some lessons learned after managing a stormwater utility for over a decade.

"Precipitation and Streamflow Monitoring for Vermont MS4 Communities"

**Joseph Bartlett, Fitzgerald Environmental Associates**
**Serena Matt, Stone Environmental**

Since the summer of 2016, Stone Environmental (Stone) and Fitzgerald Environmental Associates (FEA) have worked with the Vermont DEC and many Vermont municipalities to implement a streamflow and precipitation monitoring program across 11 watersheds classified as impaired due to excessive stormwater runoff. The stormwater impaired watersheds requiring monitoring are: Allen, Bartlett, Centennial, Englesby, Indian, Morehouse, Munroe, Potash, Rugg, Stevens, and Sunderland Brooks. Biomonitoring data have indicated that portions of each of these streams do not fully support designated aquatic uses (aquatic life), and that the biological impairment results
from multiple impacts associated with excess stormwater runoff. Monitoring of streamflow, the primary stressor, is critical to reveal if practices intended to improve the hydrologic regime of these streams will result in the desired improvements.

Stone and FEA developed and implemented a rigorous monitoring plan that will enable Vermont DEC and the MS4s to evaluate progress towards attainment of flow targets specified in the total maximum daily load (TMDL) document promulgated for each stream. These TMDLs provide modeled flow duration curves (FDCs)—plots of the percentage of daily mean streamflow observations that equal or exceed a given magnitude or quantile—with high-flow (0.3% exceedance) and low-flow (95% exceedance) hydrologic targets. The data generated by this monitoring program will be used to compute FDCs of measured streamflow, which will be compared to the modeled flow duration curves upon which the TMDL targets are based.

Streamflow gauging stations were installed on each impaired stream in the fall of 2016. Continuous (5-minute) measurements of stream stage and water temperature are transmitted to a computer server at Stone’s headquarters in Montpelier and are displayed in near real-time on the project website (http://vt-ms4-flow.stone-env.com/FlowDev/index.htm). Through manual measurement of discharge over the range of stream stages, stage-discharge relations are being developed to derive continuous streamflow records from the 5-minute stage measurements. A network of 10 tipping bucket rain gauges was also installed to measure precipitation across the study area. Data from these gauges are interpolated and watershed average precipitation totals are computed for each stream. This monitoring program is being run for an initial 5-year term. Ultimately, the duration of monitoring will depend on the rate that the best management practices identified in the flow restoration plans are implemented and how quickly positive responses are observed in the stream biota.

Thursday, April 26, 2018

8:30-10:00
Concurrent Session 4.1: Stormwater & Green Infrastructure

“Green Infrastructure: A Major Component for Charles River Sewer Separation at Willard Street, Cambridge, MA”

Richard Claytor, Horsley Witten Group, Inc.
Roch Larochelle, HDR, Inc.

A 20+ drainage area in the historic Longfellow neighborhood of Cambridge currently drains to a combined system that drains the MWRA’s wastewater treatment plant at Deer Isle, except when it doesn’t. As part of the City’s long term control plan for combined sewer overflows and to resolve long-standing flooding issues, the City of Cambridge is completing upgrades to Willard Street that will include sewer separation, ADA compliant sidewalks, a dedicated bike lane and green infrastructure for the control of stormwater runoff.

The approximately 20 acre watershed once drained to the Charles River via a brick drainage pipe, and before there was indoor plumbing in the houses along this historic neighborhood that was probably fine. With indoor plumbing the first approach involved combining the sewage and storm flows that went to the river, and thus began a very long process to address this undesirable
condition. Beginning in the late 1800’s a flow regulator was installed to “manage” overflows. Then in the early 1970’s the old outfall was abandoned and the combined flows when downstream and ultimately to Deer Isle.

Now the City is challenged with meeting a phosphorus TMDL for the Charles River that requires an approximately 50% reduction in phosphorus loading and a unique combination to implement a “complete street” for Willard Street, that includes: off-site infiltration for some upland areas, and a phased-in approach of sewer deflection/diversion now, and more green infrastructure in the future. This presentation will document the challenges and versatility of green infrastructure to meet both regulatory and multi-model design objectives.

“High Performance Modular Biofiltration Systems - Overcoming Shortfalls of Traditional Vegetated BMPs”

Robert Woodman, ACF Environmental

High Performance Modular Biofiltration Systems (HPMBS) are scalable biofiltration systems which combine the efficiency of high flow rate engineered soils with durability and modularity of a highly pervious expandable underdrain/storage/infiltration system. HPMBS systems are complete, integrated systems with a demanding specification that insures functionality, performance and maintainability. Combined with rigorous quality assurance standards and post-construction in-situ performance verification HPMBS provide guaranteed performance.

Traditional bioretention systems have been historically plagued with issues relating to surface space consumption (limiting development opportunities on sites), large maintenance footprint, poor quality control of media and bridging of materials, clogging of underdrains, and use of clog-prone geotextiles throughout the section. HPMBS systems overcome all of the above mentioned challenges and take up far less valuable surface space than the traditional system.

Some of the identified challenges ACF is aware of that cities like New York City, Philadelphia, PG County is facing with the current traditional and urban R.O.W. bioretention systems are as follows:

- Lack of space (in order to treat/process/infiltration sufficient volume)
- Issues with trash and debris accumulation (aesthetics/maintenance)
- Tree health (either proximity of bmps to existing trees or new trees planted)
- Clogging of filtering medias and fabrics (QA/QC of media and entire bio profile)
- Energy dissipation/erosive forces from pavement
- Need for more reliable stormwater quality treatment
- Maintenance cost, ease and frequency
- Overcoming unexpected utility conflicts in the field

In the proposed presentation with green infrastructure programmers, engineering professionals, landscape architects and designers, etc. Rob will provide an overview of High Performance Modular Biofiltration systems with a primary focus on how HPMBS systems can be utilized to solve the above listed challenges with the typical GI and LID designs. The presentation will also highlight a series of HPMBS projects from Maine to Florida discuss the challenges, lessons learned and the resulting improvements to the design and implementation of these BMPs. Example projects
will include overcoming space limitations with 319 grant funded projects, Philadelphia Green Streets applications, the use of FocalPoint (HPMBS system) in the PG County MD P3 Clean watershed partnership program and award winning green streetscape projects in Pittsburgh.

“Green Infrastructure - Collaboration from Design to Post Installation”

Robert Woodman, ACF Environmental

"Green Infrastructure" is the current trendy term in the world of site development. Many large cities and communities are investing huge dollar amounts in the planning, design, construction, and maintenance (hopefully) of green infrastructure BMPs throughout busy urban right-of-ways, but are we working collaboratively to guide the success of these projects both in the short and the long-term? Are our planners calling on engineers to optimize the selection and location of candidate BMPs? Are engineers calling on contractors as they generate designs and correctly specify materials to make sure they are buildable and fit the budget? Do we understand the real cost and effort of maintenance? Too often these days, the "planning," "engineering," "installation," and "maintenance" are viewed as mutually exclusive tasks with no overlap, however if we truly want to transform cities, genuinely improve water quality, and keep Green Infrastructure as a trendy term rather than one that is frowned upon, COLLABORATION is key.

The core definition of collaboration: "Purposeful relationship in which all parties strategically choose to cooperate in order to achieve shared or overlapping objectives" -- will be introduces and reinforced as a core element of GI project success.

This presentation will cover the challenge of GI process and provide some conceptual framework for working collaboratively from start to finish to keep GI alive well into the future!

The presentation will include project experiences in Maine, New England, Baltimore and Philadelphia where collaboration was a core element of the project success.

Concurrent Session 4.2: Onsite & Nutrient Removal

“Cost-Effective Cluster and Individual Passive Advanced Septic Systems Achieving Effluent Total Nitrogen 3+/- mg/L and Total Phosphorus < 0.10 mg/L”

Pio Lombardo, Lombardo Associates, Inc.

The presentation will discuss cluster and individual passive wastewater systems achieving effluent Total Nitrogen (TN) of 3+/- mg/L and Total Phosphorus < 0.10 mg/L that have been operating for 10+ years in NY, MA, MD, VA, NC, FL & CA. The costs, footprint, O&M requirements, and effluent quality of fifteen (15) installations throughout the U.S. will be described. The treatment performance evaluations will include data collected by regulatory agencies evaluating the systems. Applications include individual residential and cluster systems serving residential and commercial developments.
“From Shellfish to Septic Systems, the Evolution of the Nature Conservancy on Long Island’s Efforts to Restore and Protect Long Island’s Waters”

Christopher Clapp, The Nature Conservancy

The Nature Conservancy on Long Island has been working to protect and restore coastal resources such as shellfish, saltmarshes, and seagrasses for nearly two decades. Accompanying those efforts was a targeted monitoring and research agenda that allowed for course correction if and when the intended goals were not met. Over the course of the past decade nearly all of the data acquired from these habitat restoration based efforts pointed towards the need to address the ultimate cause of the decline of those habitats, Nutrient Pollution, primarily on-site septic systems. Since then The Conservancy has put forth a multi-pronged approach that would bring the best technology to market, institute the policies that enable utilizing those technologies and create funding streams that make it affordable.

This presentation will document the evolution of this program from "failed" restoration effort to the leading edge of innovation in septic system technologies including advanced nutrient removal and remote sensing of those technologies.

“Feasibility Evaluation of Engineered Ecosystems to Remove Phosphorus in the St. Albans Bay Watershed, Vermont”

David Braun, Stone Environmental
Gabe Bolin, Stone Environmental

For many years, a top priority of lake managers and the agricultural sector in Vermont has been reducing phosphorus (P) runoff from farmland through the implementation of agricultural conservation practices. However, these strategies may not be adequate to address the problem in Lake Champlain’s eutrophic St. Albans Bay. The Vermont Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) Phase 1 Implementation Plan (2016) states that high nutrient loading rates from agricultural runoff in the St. Albans Bay watershed will necessitate the implementation of creative solutions and innovative restoration techniques to achieve the goals of the TMDL. An innovative P reduction technique that is starting to gain attention in Vermont is the development of treatment systems to remove P from streamflow before it reaches Lake Champlain. These systems have the potential to reduce P loading and ultimately the incidence of cyanobacteria blooms. In theory, treating streamflow in certain priority watersheds would complement existing conservation programs and achieve more certain, near-term P reductions.

Stone Environmental is working with the Lake Champlain Basin Program to evaluate the feasibility of implementing a treatment train system to remove phosphorous from Jewett Brook prior to discharge to St. Albans Bay. Jewett Brook was selected because it drains a small agricultural watershed and it has the highest median P concentrations of any Lake Champlain tributary, nearly 400 μg/L (2009-2015 period). Though technologies capable of removing significant quantities of P from surface waters are in their infancy, there have been successful applications of these systems on tributaries of Grand Lake St. Marys in Ohio. The first of these treatment trains was constructed on Prairie Creek in 2013; treats a maximum of 1.3 million gallons per day; and removes, on average, 71% of P and 31% of nitrogen (Overcash and Pfeiffer, 2014).
Implementing a treatment train on Jewett Brook would involve withdrawing and treating a portion of the streamflow through a combination of engineered and biotechnical systems. The first treatment component would be a phosphorus precipitation cell with an alum dosing unit. The water would then pass to a constructed wetland that processes and assimilates additional nutrients, before flowing into an area of restored, natural wetlands bordering Jewett Brook.

Stone Environmental has begun engaging regulatory agencies to consider the feasibility of developing a treatment train system to remove P from Jewett Brook. Assuming the treatment train concept finds support among federal, state, and local officials and the regulatory challenges can be met, the next logical step is an engineering feasibility evaluation and cost analysis. Results from the feasibility evaluations should be transferable to other small agricultural watersheds in the Lake Champlain Basin.

10:30-11:45
General Session 5: Innovation

“Getting to 10%. The long road to water quality compliance in the Berry Brook and the innovations inspired along the way”

Tom Ballestero, UNH Stormwater Center
Bill Boulanger, City of Dover, NH Community Services

In 2006, Berry Brook became famous for the wrong reason: it was deemed “impaired” by the United States Environmental Protection Agency (USEPA). A good chunk of the watershed surrounding this short, hardworking urban stream was covered by impervious surfaces that have been channeling polluted stormwater run-off into the brook for decades and it was no longer fit for human contact. Today, Berry Brook has become famous again, but now it’s held up as a model for how scientists and public works departments can collaborate to improve water quality in an urban watershed, using Low Impact Development (LID) and Green Infrastructure (GI) retrofit innovations, stream restoration, community outreach, persistence, and some good old fashioned ingenuity.

This presentation will cover the stormwater management innovations inspired from simply running out of room to install structural stormwater best management practices. The innovations will help other local and regional efforts manage stormwater more effectively, economically and opportunistically than previously thought possible.

“Sewage detection dogs as a complimentary tool in IDDE programs: A case study in VT”

Dana Allen, Watershed Consulting Associates, LLC
Karen Reynolds, Environmental Canine Services

Detection dogs have been trained to use their advanced and sensitive senses of smell to perform a wide variety of tasks such as sniffing out bombs, drugs, missing people, or even produce smuggled in airplane luggage. Making the jump to detecting sewage in stormwater systems and surface waters is not that far a leap. During the summer of 2015, Watershed Consulting Associates, LLC (WCA), based in Burlington, VT, teamed with sewage detection dogs and their
handlers from Environmental Canine Services LLC (ECS), based in Maine, to perform Illicit Discharge Detection and Elimination (IDDE) work for the communities of Bennington and Pawlet, VT as part of a pilot study sponsored by the VT Department of Environmental Conservation and the Center for Watershed Protection. Using this innovative collaborative effort led to the detection of several illicit discharges that otherwise might have gone unnoticed using standard water quality parameter testing and source tracking methods.

Karen Reynolds from ECS will explain the history of the company, how their sewage detection dogs do what they do, the various ways their skills are used for IDDE, and outline research study results on their contribution to IDDE programs.

Dana Allen from WCA will detail the IDDE study conducted in Bennington and Pawlet and how the dogs were used in that study, including how they helped with selecting outfalls or systems for advanced investigation, and how they were then used to track down the specific discharges. Mr. Allen will offer lessons learned from working with ECS and how to best leverage their services prior to conducting field work, as well as to streamline workflows once in the field to get the most out of each field day.

The presentation will end with a demonstration of how an ECS dog and handler team work together to find sewage contaminated water and track to its source.