ABSTRACTS

30th Annual Nonpoint Source Pollution Conference
Portsmouth, New Hampshire | April 18 & 19, 2019

Allen, Dana | Watershed Consulting Associates, LLC
Stormwater BMPs for constrained transportation corridors in rural areas - a case study from Vermont's country roads.
Presented: Thursday, April 18th | 1:00 pm - 2:45 pm

So much of stormwater management focuses on more developed landscapes - but many lesser-developed rural areas can pose water quality risks that are just as hazardous to natural water body ecology. Additionally, we often tend to focus on areas like parking lots or rooftops as they represent large, discrete areas of impervious cover that can be collected and treated relatively easily. But what about features like unpaved rural roads, especially those that are hydrologically connected, space-constrained, and present a constant operation and maintenance challenge due to eroding ditches and highly mobile road surface? Is the only solution stone-armored ditches? Is there anything that can be done?

Watershed Consulting Associates, LLC, is a leader in stormwater master planning work in Vermont and is constantly faced with these situations.

During this presentation we'll present a unique design strategy to control runoff from an unpaved rural road where all Best Management Practices had to be installed within the narrow road right-of-way. The project, designed in 2017 and implemented in 2018, will explore this case study, its successes and failures, as well as its costs and benefits. The lessons learned will present stormwater designers, planners, and municipal officials with an in-depth look at a valuable tool that can be used in a variety of situations and environments to effectively reduce runoff volume, preserve infrastructure, and reduce nutrient and sediment loading to water bodies using an absolute bare minimum of space.

Bird, Emily | Vermont Department of Environmental Conservation
From Bennington to Burlington: Bringing Vermont's Municipal Roads to a Common Standard for Water Quality
Presented: Thursday, April 18th | 1:00 pm - 2:45 pm

Vermont's Clean Water Act strengthened regulatory and financial assistance programs to improve water quality statewide. The Act authorized Vermont's statewide Municipal Road General Permit – the first of its kind in the United States. It requires all municipalities to bring road segments in close-proximity to surface waters (i.e., "hydrologically-connected") up to a standard that minimizes stormwater and erosion. Coupled with this innovative regulatory program, the State of Vermont has rolled out the Municipal Roads Grants-in-Aid Program for all 260 municipalities required to comply with the permit. In partnership with Vermont's regional planning commissions, the Clean Water Initiative Program has offered approximately $4.7 million in the past two years to aid municipalities in bringing whole road sections into full compliance with the permit. Funds are distributed to participating municipalities based on number of hydrologically connected road miles. The program eases municipal participation. Municipalities simply enroll and construct best management practices and regional planning commissions handle technical assistance, verification, reporting, and invoicing. This program was piloted 2017-2018 and $2.1 million in aid were dispersed to 186 participating municipalities, bringing 44 road miles into full permit compliance. In year 2 of the program (2018-2019, ongoing), $2.6 million in aid were dispersed to 211 participating municipalities (81% participation rate).

Boulanger, Bill | City of Dover, NH
Every Day Counts – Simpler, more effective and maintainable stormwater innovations from Departments of Public Works
Presented: Friday, April 19th | 8:30 am - 10:00 am

The City of Dover has a longstanding relationship with innovation and municipal leadership. Having completed a groundbreaking project reducing effective impervious cover of a small urban watershed from 30% to 10%. Working with the UNH Stormwater Center the project team has developed a number of standard details for innovative stormwater control measures implemented and reinvented throughout the region. Researches and operators have worked closely to compile design information, including typical cross-sections, system capital costs, updated operations and maintenance procedures, maintenance costs, and existing measured or modeled performance efficiencies. These innovations in Green Infrastructure are applicable everywhere in linear and urban built environments and are part of a growing toolbox of new green stormwater infrastructure. To date there have been three innovations that have been documented and will be discussed in this presentation:

Subsurface gravel filter: Mimics the hydrologic and water quality performance of Porous Asphalt systems with regular dense pavement surface. The hydraulic inlet and outlets are controlled through perforated pipes underdrains and orifice controls.

Linear infiltration trench: A simple, but effective innovation instead of solid pipe, perforated pipe is installed between catch basin structures and enveloped in stone to promote infiltration. Inlets are protected from leaf litter and gross solids by non-skimming inlet controls.

Sectional Media Box Filter: Non-proprietary Filtering Catch Basin Designed to replace conventional deep sump catch basin structures where additional water quality treatment (filtration) is required. In its third iteration this low cost structure can continue to be modified and adapted to target specific pollutants of concern.

Drinkuth, Holly | The Nature Conservancy in Connecticut
Innovative Non-point Source Pollution Management for Coastal Ecosystem Recovery on Long Island and around Long Island Sound: (Suffolk and Westchester County, New York and coastal Connecticut)
Presented: Thursday, April 18th | 3:15 pm - 5:00 pm

Nitrogen load modeling on Long Island demonstrated the bulk of coastal ecosystem degradation comes from residential wastewater loading nitrogen pollution to bays and harbors. In partnership with regional, state and local stakeholders The Nature Conservancy led an integrated approach employing solid social science, well-resourced communications, innovative government leadership and successful public and private fundraising to build momentum and capacity for non-point source (NPS) nutrient pollution reduction on Long Island. Over a period of seven years, Long Island has made rapid progress moving from academic and scientific understanding of the scope and impacts of nitrogen pollution in coastal waters to implementing restoration actions "at scale".

Long Island Nitrogen Action Plan (LINAP) successes to-date include 1) creation of state, county and town residential septic system replacement programs, including county health code changes for innovative wastewater technology; 2) generation of billions of dollars in new state and local funding; and 3) state-of-the-art 3-D groundwater nitrogen load modeling to assess transport to surface waters and establish priority areas for nitrogen reduction to support recovery of impacted near-coastal ecosystems.

On the northern shore of Long Island Sound, Connecticut and New York have made great investments over the past 20 years to reduce nitrogen discharged from sewage treatment facilities by more than 60 percent. Although the area and duration of hypoxia in open waters has diminished, monitoring and research show harmful algae blooms, fish-kills and habitat loss still occur in the Sound's coastal waters. Since technology upgrades at treatment plants began, nitrogen inputs from septic tanks and fertilizers have stayed steady or increased

leading the EPA to propose new actions that further reduce NPS nitrogen pollution. The Conservancy is building on successful communications efforts on Long Island and expanding strategies to coastal Connecticut and Westchester County, New York. By assessing the geographic, socio-political and public opinion similarities and differences between the south and north shores of Long Island Sound we're adapting social science and communications to target and accelerate NPS nitrogen pollution reduction actions and investments that restore healthy ecological conditions in the Sound's at-risk harbors and bays.

Eisenhauer, Brian | Plymouth State University
To Adopt or Not? Using Social Science in Watershed Planning to Promote the Adoption of Residential Best Management Practices (BMP)
Presented: Thursday, April 18th | 1:00 pm - 2:45 pm

NPS pollution is the nation's leading threat to clean water (U.S. EPA 2009), and due to its diffused nature addressing it successfully involves changing people's behavior. Watershed planning and implementation presents an opportunity to use social science research to engage the public in the planning process, implement selected BMPs, and collect data on residential implementation of BMPs that address NPS issues. For example, data demonstrates that fertilizer runoff from lawns is associated with many water quality concerns (Law, Band, and Grove 2004). As a result, there is a growing research tradition that is investigating lawn care behavior and the myriad issues that drive this behavior (Templeton, Yoo, and Zilberman 1999; Larson et al. 2010; Blaine et al. 2012). This example highlights just one of the important issues this type of engaged, collaborative work between social scientists as part of teams creating watershed plans and implementing them. This presentation reviews the role of social science in watershed planning with a focus on research conducted in the Newfound Lake Watershed in New Hampshire and several watersheds in Illinois to clarify the role that social science can play in watershed planning efforts to address NPS pollution through BMP adoption.

Glover, Geoffrey | Horsley Witten Group, Inc.
IT'S ALIVE! Living Shorelines Protecting our Coastal Communities
Presented: Friday, April 19th | 8:30 am - 10:00 am

Gray's Beach Park is the only public beach in Kingston, Massachusetts. Barrier beaches in Plymouth and Duxbury Bays provide for a fairly protected shoreline. The beach and associated park land is approximately 6.5 acres, comprised of grass fields, tennis courts, a playground, snack shack, parking lots, and the beach.

The restoration project replaced a failing seawall and degraded shoreline with two living salt marsh and frontal dune systems. The design also led to the retreat of the existing snack shack out of the flood zone. Not only was the seawall an eyesore, but also posed public safety concerns. Over time, storm surge and tidal encroachment had undermined the seawall, making a repair or replacement inevitable. The shoreline restoration and expansion replaced the failing seawall and incorporated soft stabilization techniques, including coir fiber logs and blankets, noninvasive duckbill anchors and native plantings. The total restoration area of both living shorelines re-vegetated 9,750 square-feet.

Other park improvements include the installation of overflow drainage systems to better convey extreme storm events, integrating several existing bioretention areas to collect and treat small storms, while by-passing larger storms; removal of invasive vegetation; re-vegetation of disturbed upland areas with native grasses; interpretive signage; enhanced beach accessibility; and sand nourishment to restore all disturbed surfaces in the vicinity of the beach after construction.

The Horsley Witten Group worked closely with the Town of Kingston, local Conservation Commission, the Land and Water Conservation, and the Office of Coastal Zone Management to fund and organize the design and implementation. The construction of the project is complete and currently undergoing a monitoring program to assess plant establishment, document lessons learned, control invasive species, and ultimately to improve our understanding of the various challenges and opportunities when working within the coastal environment.

Houle, James | UNH Stormwater Center
Advancing adoption and implementation of GSI through a Diffusion on Innovation approach
Presented: Thursday, April 18th | 1:00 pm - 2:45 pm

Developing and sustaining successful approaches toward Green Stormwater Infrastructure (GSI) implementation is an emerging science. Historically, stormwater subject matter experts have used technical design approaches and empirical data to influence the entire range of end-user audiences and promote GSI implementation. Despite two decades of data on the effectiveness of GSI changes in implementation behavior are slow. Studies suggest that cultural and social transmission processes are much more important to understanding the diffusion of innovations than is often assumed by most theorists and thus more emphasis has to be placed on linking scientific research to decision-making. The direct outreach to and participation of respected and trusted staff addresses three fundamental problems that are often associated with municipal adoption of innovative stormwater management approaches; compatibility, complexity and trialibility, or in other words, does it fit our management culture, can people understand it, and can local staff adapt the designs for greater utility?

This presentation focuses on pollutant load and runoff volume reduction objectives through GSI implementation and also advances parallel process objectives that ensure implementation sustainability, transfer of municipal ownership, and positive adoption decision within municipalities. Engagement of these audiences that have the respect and trust of staff and other administrative leadership personnel are vital to not only the continued success in adopting innovative technologies, but hold the key to complying with up-to-date management approaches in a pragmatic and economical way.

Knott, Jayne | University of New Hampshire
Potential Water Quality Impacts Associated with Groundwater Rise Caused by Sea-Level Rise
Presented: Friday, April 19th | 8:30 am - 10:00 am

Coastal communities with low topography are vulnerable from sea-level rise (SLR) caused by climate change. Coastal groundwater will rise with sea level impacting groundwater and surface-water quality, the structural integrity of infrastructure, and natural ecosystem health. A numerical groundwater-flow model has been used with groundwater observations and withdrawals, LIDAR topography, and surface-water hydrology to investigate SLR-induced changes in groundwater levels in New Hampshire's coastal region. The projected SLR-induced groundwater-rise zone (GWRZ) extends more than 3 times farther inland than projected tidal flooding from SLR. The projected mean groundwater rise relative to SLR is 68% between 0 and 1 km, 35% between 1 and 2 km, 19% between 2 and 3 km, 8% between 3 and 4 km, and 3% between 4 and 5 km of the coastline. The largest magnitude of SLR-induced groundwater rise occurs in the marine and estuarine deposits and peninsulas with tidal water bodies on three sides. Groundwater rise also produces more groundwater discharge to streams. Groundwater inundation is projected to contribute 48% of the total inundated area from both SLR-induced groundwater rise and marine tidal flooding in Portsmouth.

In areas where groundwater is already shallow, a rising water table can contribute to non-point source pollution. Studies in Waikiki, Honolulu and the outer banks of North Carolina have shown that groundwater rise caused by 1 m SLR will increase the number of failing on-site septic systems by 86% and 54% respectively. Rising

groundwater will reduce the separation between contaminated soils and groundwater. Sites where the separation was sufficiently protective of water quality at closure (landfills, septic systems, hazardous waste sites) may not be protective in the future. Knowledge of SLR-induced groundwater rise extent and magnitude can inform policy making to prevent non-point source pollution increases from groundwater discharge to surface waters.

Landry, Stephen | New Hampshire Department of Environmental Services - NPS Program
Battle of the Bads - because NPS project management and implementation is not always sunshine, rainbows, puppies, and unicorns.
Presented: Friday, April 19th | 10:30 am - 11:45 am

Let's be honest. Over the past 30 years of NPS management throughout New England, we have some tremendous success tempered with barriers, mistakes, misunderstandings, mess-ups, miscalculations, poor installations, poor performances, less than predicted outcomes, broken stuff, crying stakeholders, crying project managers, bad press, and the feeling of never-ending projects that you wish was never on your plate.

We learn from these trials, adjust, and apply the knowledge gained to improve our management and implementation skills. Some of us carry these memories like scars and it can be hard to hide them sometimes. It's better to share these experiences in a group therapy setting to fully expose the good, the bad, and the ugly side of project management and implementation. State NPS Coordinators call this exercise "The Battle of the Bads" and it is structured to reflect upon some of the worst experiences encountered in the project management and implementation arena while demonstrating to attendees that most often, these initial setbacks were overcome and the knowledge gained informed subsequent project partners, managers, and the implementation process that leads to success. What better way to evaluate great NPS work over the past 30 years than by taking an intimate look at some of the fiercest challenges posed and overcome to help guide us over the next 30 year, NPS horizon!

Each participating NPS state program will submit one or two project examples that tested their NPS fortitude and they will share that experience with attendees in one to three slides, or simply tell the tale under four or five minutes. The audience will then vote for the top 3 (or bottom in this case!), worst-case scenarios presented at the 30th Annual NPS Conference. Our NH hosts will present the 3 winners with appropriately sized and selected awards.

Landry, Stephen | New Hampshire Department of Environmental Services - NPS Program
Resiliency on the Suncook River - Perspective after 13 years of avulsion, analyses and construction
Presented: Thursday, April 18th | 11:00 am - 12:00 pm

In May of 2006, heavy rains in southern New Hampshire resulted in a large scale avulsion on the lower Suncook River in Epsom, NH. The river abandoned nearly two miles of its former course, and assumed a new path through incision and massive sediment transport. Nearby tributary channels incised as much as 20 feet as a result of the avulsion; transported sediment caused further flooding problems downstream. Since 2006, the site has undergone significant change and several studies, including a Section 319-funded geomorphic assessment and alternatives analysis, have documented the causes for the avulsion and the predicted channel evolution within the impacted river corridor. Inter-Fluve worked with NHDES and NHGS to develop designs for stabilizing headcuts in the main channel and tributaries, with the goal of preventing major damage to infrastructure and habitat. Construction on Leighton Brook was completed in 2015 and construction on the mainstem Suncook River sites completed in the fall of 2018. This talk discusses the challenges in balancing cost, infrastructure protection and in-stream habitat for the largest river stabilization and relocation project in New Hampshire with human safety and

property damage implications. We will also discuss more ecologically sensitive approaches to addressing storm resiliency in NH and around New England where opportunity arises.

Lehman, Matthew | Horsley Witten Group
Construction Junction, Wetland Function
Presented: Friday, April 19th | 8:30 am - 10:00 am

The Lower Huckleberry Brook Constructed Stormwater Wetland project, located in the Town of Milford, Massachusetts, was partially funded through a DEP 319 nonpoint source pollution grant. Located on town property, directly adjacent to the Upper Charles Trail, this constructed wetland treats stormwater runoff diverted from an existing 36" pipe with a drainage area comprising 72 acres of mostly residential neighborhoods. The wetland removes pollutants from the first half inch of runoff across more than 20 acres of impervious area, which previously discharged directly to Lower Huckleberry Brook. Huckleberry Brook, itself not currently on the 303(d) list, flows into Milford Pond and then into the Upper Charles River, both of which are impaired for nutrients, pathogens, and turbidity, among others. Beyond improving water quality, another primary objective of this project was to integrate the site with the adjacent shared-use trail and improve recreational and educational opportunities for residents and visitors of Milford. To help encourage public engagement, a walking path with informational signage circles the wetland and connects to the adjacent trail.

As stormwater professionals have learned over the years, green infrastructure designs that look great on paper often do not materialize as the priceless works of art we had envisioned; the construction phase can make or break these practices. This presentation will explore some of the failures and successes that this project experienced during its construction, including:

- The how and why of installing a shallow seven-foot manhole structure in a crowded intersection
- How to install wetland plants in a wetland that isn't wet (and keep them alive)
- Utility conflict de-escalation
- Japanese knotweed: how I learned to stop worrying and love minimal, targeted use of herbicide
- Water-tight gaskets in precast concrete structures aren't always so water-tight

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Loosigian, Lisa | NH DES
Managing a State Soak Up the Rain Program: Creating Capacity and Culture
Presented: Thursday, April 18th | 1:00 pm - 2:45 pm

Building and maintaining a state-wide residential stormwater management program takes a flexible mindset and a passion about the message. Soak Up the Rain New Hampshire (SOAKNH), an award-winning NHDES program in its seventh year of operation, will offer insights and advice to other states or organizations considering building a similar program to promote water friendly landscaping practices on a residential scale.

We will discuss the challenges of establishing and marketing the program, garnering both internal and external stakeholder support as we built capacity to ensure the program's long-term viability setting goals (and learning to let go of them at times). Issues such as identifying funding, partner organizations, and willing landowners will be covered.

SOAKNH's main mission is to create a norm regarding residential stormwater management and we will share what we have learned through years of developing and evolving our program to work toward that mission. For example we will delve into specifics of project implementation, highlighting a successful Section 319 funded effort to install ten BMPs in the Great Bay Estuary watershed; share the most effective method we've found to

determine best BMPs installation sites on private property (a work in progress); and give examples of projects that not only put BMPs into the ground but reach young people such as working with youth camps in the Ossipee Lake watershed. We will also speak to the importance of identifying the barriers from the homeowner perspective, assessing the capacity of potential partners; and integrating lessons from mistakes and failures.

Lundsted, Benjamin | Comprehensive Environmental Inc.
Brief History of Baboosic BMPS: Overcoming barriers with watershed planning… and Bulldozers. The Baboosic Lake Watershed Restoration Plan and Implementation in Amherst and Merrimack, New Hampshire.
Presented: Friday, April 19th | 10:30 am - 11:45 am

Baboosic Lake has a rich history of agriculture, commercial enterprises, and recreational use. Its rural beauty, in close proximity to population centers and transportation corridors, led to the Lake being perhaps too well loved. A shoreline settled with summer cottages which eventually became full-time residences placed a burden upon septic systems, and other infrastructure, that was not intended to accommodate such heavy use. By the early 2000s, the lake routinely experienced algae blooms, beach closures, and had a daunting list of water body impairments from the State. Not inclined to see their beloved lake in that condition, many stakeholders and the state partnered to develop a plan to guide restoration. Installation of a community septic system serving the heaviest population was spearheaded by the Town of Amherst, and volunteer groups organized through the Baboosic Lake Association (BLA) began aggressively implementing other items from the watershed restoration plan. This has resulted in improved water quality, a dramatic reduction in beach closures, and partial water body restoration, with in-lake total phosphorus attaining water quality standards for aquatic life use, and chlorophyll-a now attaining both aquatic life and primary contact recreation uses. Jeff Marcoux, the project lead from the New Hampshire Department of Environmental Services will provide a brief history and water quality overview. Ben Lundsted, representing the engineers who designed solutions to the Lake's problems, will discuss siting best management practices (BMPs) in challenging locations and on private properties while designing those BMPs with ease of implementation and maintenance in mind. Finally, Jebb Curelop, President of the BLA will discuss building and coordinating the team of volunteers that got it done. From certified scuba divers, to accountants, and heavy equipment operators, residents at the lake have provided expert level work that is the driving force for the restoration of this great lake.

Magee, John | NH Fish and Game Department
The Nash Stream Restoration Project: restoring riverine processes and connectivity.
Presented: Thursday, April 18th | 11:00 am - 12:00 pm

The Nash Stream Restoration Project is a phased, multi-year effort to restore natural channel processes so that the largely forested watershed supports an intact connected aquatic ecosystem, including native coldwater fish. The Project is located entirely within the publicly-owned Nash Stream Forest which ensures permanent protection of the restored aquatic resources and will provide lasting public benefit. It is one of the largest stream restoration efforts in the Northeast region. Most of the mainstem of Nash Stream was modified geomorphically, which greatly diminished its value for aquatic habitat and nutrient retention. On the tributaries, many stream crossings were poorly designed, blocked aquatic organism passage and were often geomorphically incompatible with the stream channel. We will present the many stream restoration techniques, some of which were developed specifically for this project, that were used to address the hydrologic and geomorphic impairments of the watershed's streams and improve aquatic habitat that was degraded for much of the past 40+ years. Because the Project is so large and novel techniques were used, we will also present findings from our research on aquatic habitat and fish.

Merrill, Nathaniel | US EPA
When and where to intervene? Coastal nutrient loading, groundwater travel times, and watershed dynamics
Presented: Thursday, April 18th | 3:15 pm - 5:00 pm

This paper presents the dynamic planning problem of addressing coastal eutrophication, with an example and parameterization for an estuary system on Cape Cod (Barnstable County, MA). Due to varying groundwater travel times across the aquifer, there is a relationship between the spatial location of nitrogen abatement efforts and the eventual effect on pollution loading at the estuary along this travel time gradient. Interventions under consideration vary from source control--upgrading septic systems and sewering--to in-estuary approaches such as increasing aquaculture. For a community, finding the right balance of these technologies is more complicated than simply implementing the option with the fastest impact first, or prioritizing the least expensive option. This is because travel time, marginal costs, scalability, and watershed dynamics combine to make efficient choices more nuanced in space and time.

We present a model of groundwater transport and estuary nutrient loading combined with an economic model of pollution abatement costs over time. This model is parameterized for the Three Bays estuary system, on Cape Cod, MA and the associated watershed. Our results inform the timing, spatial allocation and combination of treatment options by simulating the optimal control paths. The results show dynamically efficient approaches that balance source control and in-estuary efforts across a range of target pollution limit attainment dates. We discuss the trade-offs between the economic objectives and the spatial and temporal pollution abatement plans.

Mulvaney, Kate | U.S. EPA Atlantic Ecology Division
Social Acceptance of Alternative Nutrient-Reduction Technologies in Estuaries
Presented: Thursday, April 18th | 3:15 pm - 5:00 pm

Implementation of nutrient-reduction technologies to reduce loading to estuaries requires agreement by local communities to site, permit, fund, install, maintain, and monitor those technologies. This means federal, state, and local decision makers must trust the technologies to effectively reduce nitrogen in the estuarine system and communities must be willing to accept the financial and social impacts of using them. These considerations make implementing both traditional (sewering) and non-traditional (aquaculture, permeable reactive barriers, innovative septic systems, and more) nutrient-reduction technologies difficult. Communities on Cape Cod have recently completed an update to their Clean Water Act Section 208 Plan for non-point source nutrient pollution affecting more than 30 estuaries. Most of the communities are actively considering the use of both traditional and non-traditional technologies for mitigating nitrogen within their watersheds. We conducted 22 interviews with 37 participants from regional planning bodies, industry, consulting companies, and local, state, and federal agencies working on Cape Cod to highlight the barriers to social acceptance as well as to identify opportunities for moving forward with the use of alternative technologies. Perceptions of reduced costs of implementation; aesthetic, job-related, or recreational co-benefits; and possibilities for shorter time frames for implementation indicated positive potential for increasing use of alternative technologies. Key barriers included uncertainty related to the effectiveness of the technologies in reducing nutrients and their costs, siting and permitting challenges, and monitoring needs. Overall, most participants saw some role for the use of alternative technologies, but almost always as a supplement to traditional sewering.

Navitsky, Chris | The FUND for Lake George
A Model For Protection - Improving Water Quality Through Septic System Management at Lake George, NY
Presented: Thursday, April 18th | 3:15 pm - 5:00 pm

The FUND for Lake George has been monitoring the water quality of Lake George for almost 40 years and has documented negative trends impacting the Class AA-Special water classification. This can be attributed to nonpoint source pollution from land use around the watershed including almost 6,000 onsite wastewater treatment systems within the Lake George watershed, many located in the Critical Environmental Area surrounding the lake. The FUND has developed a Model for Protection implementing Partnership, Innovation and Investment for solutions the water quality impacts and preserve the Class AA-Special water of Lake George. This presentation will focus on two projects focusing on onsite wastewater treatment. The North Queensbury Wastewater Disposal District (Dunhams Bay) is the first wastewater management district established in the Lake George watershed and has utilized algae biomonitoring to document water quality impacts and improvements and a grant program from The FUND to catalyze support. This program is highlighted in the most recent edition of Onsite Installer magazine. (https://www.onsiteinstaller.com/editorial/2018/11/identifying-failing-onsite-systems-on-lake-george) The Town of Lake George Septic Initiative Program is a project to implement septic system inspection and management within the Critical Environmental Area by developing a three layer, GIS algorithm rating system based on data sets from site suitability, water quality monitoring and system inventory evaluation to create a prioritization of properties for management.

Schier, Linda | Acton Wakefield Watershed Alliance
The Elephant in the Outhouse – Failed Septic Systems and Lake Water Quality
Presented: Thursday, April 18th | 3:15 pm - 5:00 pm

Province Lake in Effingham and Wakefield, NH and Parsonsfield, ME is impaired for Aquatic Life Use due to elevated phosphorus levels and frequent cyanobacteria blooms. The Province Lake Association and the Acton Wakefield Watersheds Alliance partnered with NH Department of Environmental Services Watershed Assistance section to develop the Province Lake Watershed Management Plan published in 2014. The Plan identified Shoreland BMPs, Roads and Septic Systems to be the primary sources of phosphorus loading to the lake.

With assistance provided in part by several Watershed Assistance Grants from the NH Department of Environmental Services with Clean Water Act Section 319 funds from the U.S. Environmental Protection Agency the team sought to address the multiple sources of phosphorus loading. They have worked with the municipalities and private road associations to repair chronic road erosion issues, installed over 130 erosion control landscape features on shorefront properties, organized beach clean-ups, conducted comprehensive monitoring and delivered presentations and outreach materials to all the stakeholders. Making the step to correcting inadequate septic systems seemed like a daunting task but the team investigated options and came up with a plan.

In 2015 the Province Lake Septic System Improvement Initiative was introduced leading to the cost-share replacement of eight failed septic systems within the Province Lake shoreland zone. This presentation will detail the process to identify candidates for replacement, encourage participation, ensure proper installation compliance, and document success.

Sorenson, Jason | U.S. Geological Survey, New England Water Science Center
Potential nutrient load reductions through municipal leaf management
Presented: Thursday, April 18th | 1:00 pm - 2:45 pm

Stormwater runoff is a substantial source of sediment, metals, nutrients, and organic constituents to water bodies. Recent studies in Massachusetts have shown that the maximum yield of materials on curbed streets in urban areas is seen at the end-of-winter and in the fall. Leaf litter on impervious surfaces in Wisconsin has also been shown to contribute as much as 70 to 80 percent of the total annual phosphorus load to urban waters (winter excluded). Adjusting the frequency and/or maintenance of commonly used stormwater control measures (SCMs or best management practices (BMPs)) to better manage leaf litter may provide municipalities a cost-effective way to achieve federally mandated nutrient and sediment load reductions and improve the quality of receiving waters.

Vermont municipalities in the Lake Champlain Basin, Lake Memphremagog Basin, and in the Connecticut River Basin are faced with pollutant load reduction targets established in Total Maximum Daily Load (TMDL) implementation plans. Developing load-reduction credit programs incentivizes municipalities to employ SCMs (such as street cleaning, catch-basin cleaning, and leaf-removal programs) and move closer toward achieving water-quality improvement goals.

The ongoing research approach includes compiling and qualifying existing information into a regional database, identifying data gaps, conducting focused sample collection and analysis, developing a numerical model to estimate load reductions expected from selected SCM applications, and using the model output and regional database to develop load-reduction credits for current and future SCM strategies.
Project results will allow managers to effectively target high phosphorus source areas and achieve load reductions in the most economical manner using existing resources. The project may have regional value to other New England/northeastern municipalities by demonstrating how optimized use of common SCMs can reduce nutrient loading and improve ecologic health of impaired water bodies.

Townley, Lauren | New York State Department of Environmental Conservation
Offsetting the impacts of climate change on water quality in the Chesapeake Bay Watershed
Presented: Friday, April 19th | 8:30 am - 10:00 am

Climate change is an important factor that influences water and nutrient movement within a watershed and has largely been excluded from watershed-based plans due to the difficulty of applying national scale climate models to local watersheds. EPA's Chesapeake Bay Watershed modeling team is in the process of developing tools needed to quantify the effects in changes in fiver flows, storm intensity on the Chesapeake Bay watershed, changes in hypoxia due to increased temperature and sea level rise in the estuary. As a requirement of the Chesapeake Bay TMDL, jurisdictions (including New York) will need to account for projected effects of climate change on the Bay watershed pollutant loads and Bay waters quality. This is the first TMDL in New York that will take into consideration the impact of climate change on water quality and subsequent changes to our implementation plan. Though the level of uncertainty in modeling future climate change scenarios is high, planning and implementation on the ground cannot wait until we achieve model certainty. New York's strategy for incorporating climate change into our TMDL implementation plan will include selection of best management practices (BMPs) that capitalize on co-benefits, such as flood attenuation and carbon sequestration, alignment with other climate resilient planning efforts already occurring in the state (e.g. floodplain management programs, greenhouse gas reduction programs), and assessing vulnerability of existing BMPs.

Wain, Danielle | 7 Lakes Alliance
The East Pond Alum Treatment: a Multi-Stakeholder Approach to Lake Management
Presented: Thursday, April 18th | 3:15 pm - 5:00 pm

The largest alum treatment to date in New England was conducted on East Pond (Smithfield, ME) in two phases in June and October 2018. East Pond is a 700 ha lake with a maximum depth of 7 m. It has no significant inlets

and a small watershed to surface area ratio. Despite this, it has history of recurrent algal blooms for the past 20+ years due to intermittent stratification events that cause anoxia and consequent phosphorus release from the sediments. East Pond was a prime candidate for an alum treatment because a detailed watershed loading analysis indicated that 50% of the phosphorus available to algae came from lake sediments, not from new phosphorus entering the lake from the watershed. Prior to the treatment, 7 Lakes Alliance/Colby College conducted extensive water quality and sediment analyses to determine the proper dose for the alum treatment, in collaboration with Maine DEP, US EPA, and an outside consultant. Outreach to local stakeholders was critical in building support for the project, resulting in successful permitting and fundraising. In total, 260 ha of lake sediment were treated with 360,000 kg of Al(OH)3 with a total cost of $1.1M. Throughout the treatment, pH , alkalinity, and dissolved aluminum was monitored by 7 Lakes Alliance/Colby College to ensure the treatment did not significantly impact lake chemistry and ecology. This summer, after the first phase of treatment, East Pond had excellent water clarity (secchi depth ~ 5 m) and consequently the lake did not stratify at all, despite hot weather with low winds in August. Given the preliminary data, 7 Lakes Alliance and their partners are confident that the alum treatment will be effective for years to come. East Pond will continue to be monitored as part of the 7 Lakes Alliance/Colby College Water Quality Initiative.

West, Michelle | Horsley Witten Group, Inc.
The Designs, They Are A-Changin': Evolution of Stormwater Designs for Maintenance
Presented: Friday, April 19th | 8:30 am - 10:00 am

There are those among us afflicted with a stormwater sickness. You know who you are – you can't resist peering into catch basins as you cross the street or peeking behind the grocery store to see what sort of invasive-infected wet hole-in-the-ground awaits. You move your towel to the opposite end of the beach from the outfall you spotted, and force your family to track muddy runoff back to the source. You squeal with delight when you see a porous asphalt parking lot, and most of the photos on your phone are of green infrastructure practices you've spotted while on vacation. You are a Stormwater Geek.

But even stormwater geeks lose faith. Raise your hand if your best installations have failed over the years, either by design flaw or lack of proper maintenance, or both. This presentation is geared toward fellow stormwater geeks who have found themselves frustrated in the past by lost and abandoned BMPs. Sometimes, small tweaks in materials and a little attention to the needs of maintenance staff can be the difference between a clogged eyesore and stormwater nirvana. I will discuss our recent shift in design approach from attempting to create the most beautiful award-winning piece of stormwater art to designing for maintenance - less sexy on day one but more fulfilling in the long run. This approach includes items such as better forebays, improved inlets, strategic plant choices, mulch alternatives, filter fabric diets, and considering wet vs. dry practices. There are always ways to improve and more to learn, but the goal of this presentation is to restore hope to all you geeks out there.
