

SOUTHEAST NEW ENGLAND PROGRAM PROJECT SUMMARIES

As of September 16, 2016

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BUZZARDS BAY GRANTS

Title: Gypsum as a Phosphorus and Sediment Control Agent in Cranberry Floodwaters

The University of Massachusetts, Amherst

Funding Amount: \$98,346

Contact: Carolyn DeMoranville, carolynd@umass.edu

Completed: June 30, 2016 (Buzzards Bay NEP)

Project Description: The goal of this project is to develop a management practice to control phosphorus in discharges of cranberry bog harvest floodwaters through the addition of gypsum, a naturally occurring soluble salt of calcium and sulfur that has historically been used as a substitute for other amendments such as alum, to lower dissolved phosphorus in freshwater lakes and ponds. The project will take place on two cranberry bogs adjacent to White Island Pond, a large freshwater pond in Wareham, MA that is under a total maximum daily load (TMDL) for excessive phosphorus loads.

Results of Project: In field experiments there was no success removing phosphorus with gypsum. Modeling confirmed pH was a likely factor. Researchers undertook modeling and bench experiments with calcite (increases pH), which showed higher potential phosphorus removal. However, lab experiments showed that an impractically large amount of calcite would be needed to reduce phosphorus, which would also have pH implications. A third set of experiments evaluated the phosphorus sorbing potential of aluminum sulfate (alum) and iron sulfate. Alum and iron sulfate were found to effectively remove phosphorus at application rates that are feasible for many growers, but the extent to which elevated levels of aluminum would affect crop growth have not been determined and no such application would be advisable in the absence of that information. As a result, the study recommends the use of alum only in extreme cases and only on irrigation ponds that do not immediately discharge into other water bodies.

Title: Process Monitoring for Optimal Nitrogen Treatment and Outfall Reduction

Town of Wareham, Wareham Water Pollution Control Facility

Funding Amount: \$75,000

Contact: Guy Campinha, gcampinha@wareham.ma.us

Completed: June 30, 2016 (Buzzards Bay NEP)

Project Description: This project was seeking to further reduce nitrogen discharges of the Wareham Water Pollution Control Facility (WPCF) to the Agawam River and Buzzards Bay through the installation

of state of the art nitrogen monitoring equipment and process controls. The town installed a computerized network of monitoring probes in several critical nutrient removal processes including in the clarifiers, the effluent channel, sand filters, aeration basins, anoxic basins, secondary treatment system, and the tertiary denitrification filters. The installation of these probes and process equipment will allow for the collection and trending of data in real time, which would in turn allow immediate corrections to be made to the various treatment processes in the facility before problems arise. The new monitoring system is expected to reduce nitrogen concentrations between 0.5 and 1-ppm that will result in the reduction of up to 4,800 pounds per year when the plant is at full capacity.

Results of Project: The system was successfully installed and went online December 2015. The probes have already provided numerous warnings at stages in the process for which operators have proactively made adjustments to maintain a high level of nitrogen treatment. The probes communicate with existing software at the WPCF so that operators can have a streamlined view of the monitoring at each step of the process. The new system allows for fine tune adjustments of oxygen levels in the anoxic process and faster reaction time. The WPCF is ultimately looking to automate these adjustments by having the probes communicate with the SCADA system, which will send a signal to manipulate the WPCF controls (valves, weirs, gates, etc.) to react to nonconforming monitoring results.

Title: West Falmouth Harbor Shoreline Septic Remediation Project

Town of Falmouth

Funding Amount: \$250,000

Contact: Amy Lowell, alowell@falmouthmass.us, Sia Karplus, sia@sciencewares.com, Korrin Petersen, Petersen@savebuzzardsbay.org

Completed: June 30, 2016 (Buzzards Bay NEP)

Project Description: West Falmouth Harbor fails to meet water quality standards due to nitrogen pollution, and is listed as impaired by Massachusetts DEP. A watershed nitrogen TMDL strategy has been adopted for the watershed that includes the promotion of innovative nitrogen reducing onsite wastewater systems. The Town of Falmouth and their partner, the Buzzards Bay Coalition, proposed to encourage the replacement of 20 existing Title 5 septic systems or cesspools on properties located within 300 feet of West Falmouth Harbor. The systems will be replaced with innovative alternative nitrogen removing septic systems or eco-toilets (composting or urine-diverting systems). The town and its partner will work with the West Falmouth Village Association to secure commitments from property owners, provide grants to homeowners of up to \$10,000 to upgrade their systems, and monitor the performance of the installed systems.

Results of Project: The town of Falmouth and the Buzzards Bay Coalition worked with property owners to replace the existing Title 5 septic systems and cesspools of 20 properties with denitrifying septic systems. The following systems were installed: ten (10) Blackwater holding tanks, six (6) HOOT nitrogen-removing systems, one (1) Layer cake nitrogen-removing system, and three (3) Eliminite nitrogen-removing systems. Installed costs were significantly impacted by site conditions such as soils, lot size and existing landscaping. Due to construction delays, no monitoring was able to be completed before the contract ended.

Title: Red Brook Harbor Restoration - A Public-Private Partnership

Buzzards Bay Coalition

Funding Amount: \$50,000

Contact: Korrin Petersen, Petersen@savebuzzardsbay.org

Completed: June 30, 2016 (Buzzards Bay NEP)

Project Description: Red Brook Harborview is a planned 15-townhouse development located in Cataumet Village in Bourne, MA, within the Red Brook Harbor watershed. The watershed is being evaluated by the Massachusetts Estuaries Project for nitrogen TMDL development, and recent water quality data shows the harbor exhibits elevated nitrogen and chlorophyll concentrations. When the development is constructed, it will include a neighborhood-scale private wastewater treatment facility. This facility is required by the town to have excess capacity to allow for connections from the Kingman Yacht Center and other neighborhood properties. The Buzzards Bay Coalition will develop sewer plans to tie in the neighboring 52-home Cedar Point development, thereby eliminating Title 5 systems and cesspools in the watershed contributing to water quality degradation.

Results of Project: Three sewer design scenarios were developed and two legal entities identified (private partnership vs. municipal sewer district). The Buzzards Bay Coalition identified the preferred alternative as being the private partnership, which would contract with one or more of the homeowners associations. The project is continuing past life of grant, with public outreach to present plans and refine sewer layout as needed.

Title: Reducing Nutrient Release from Cranberry Bogs

Buzzards Bay Coalition

Funding Amount: \$165,213

Contact: Rachel Jakuba, Jakuba@savebuzzardsbay.org

Completed: June 30, 2016 (Buzzards Bay NEP)

Project Description: Nutrient discharges from cranberry bogs to groundwater and surface waters are a potential source of nitrogen and phosphorous pollution and impairments to coastal and fresh waters. With respect to nitrogen loading models to coastal watersheds used to establish nitrogen TMDLs, there is often uncertainty as to what loading rates to assign to cranberry bogs. The Buzzards Bay Coalition, in partnership with the Marine Biological Laboratory and the University of Massachusetts Cranberry Experiment Station, proposed to study the release of nitrogen and phosphorus from cranberry bogs to better understand these nutrient loadings. Automated sampling equipment will be used to collect samples when large movements of water occur, such as during harvest flooding or following heavy rains.

Results of Project: Three bogs were used in the study that are typical of the size, age, configuration, and condition of other cranberry bogs in the region. This study conducted the most detailed measurements made yet of surface water exchanges of nitrogen and phosphorus during cranberry bog water management and non-flood periods. It was determined that a 1-ha cranberry bog would be approximately equal to the nitrogen watershed contribution generated by one single-family home on a septic system. All bogs in the study were net sources of phosphorus to surface waters.

Title: Nitrogen Reduction Pilot Study at the Fairhaven Municipal Water Pollution Control Facility

Town of Fairhaven

Funding Amount: \$90,000

Contact: Linda Schick, lschick@fairhaven-ma.gov

Completed: June 30, 2016 (Buzzards Bay NEP)

Project Description: The Town of Fairhaven's Water Pollution Control Facility (WPCF) recently received a draft NPDES permit from EPA to limit nitrogen discharges to 3 ppm. Currently the facility discharges 15-ppm nitrogen to New Bedford Harbor, which is listed by DEP as impaired due to nitrogen loading. A reduction to 3-ppm nitrogen in the effluent has the potential to eliminate approximately 182,000 pounds of nitrogen per year to New Bedford Inner Harbor, when the plant is at full capacity. The Town of Fairhaven will evaluate several modifications to its wastewater treatment processes to reduce nitrogen concentrations to meet the new limits. The outcome of this pilot study will provide a framework for design and construction of new nitrogen reduction facilities at the WPCF.

Results of Project: The Town piloted a "modified" 4-stage Bardenpho process with BioMag from Sept. to Nov. 2015. Magnetite was used as a ballast material to combine with biological floc in the aeration basins, with the entire plant flow in one aeration train. Unfortunately, there were no consistent reductions in total nitrogen due to several factors. The Town's consultant determined that adjustments to the process may achieve the desired results. Other major issues were the costs and energy use of the system, in addition to damage that was caused to a clarifier rake arm from the heavier magnetite sludge. The Town has determined that the 4-stage Bardenpho process with BioMag is an effective option (with modifications), but the cost to build and operate system is too great for the Town.

Title: Multi-Community Partnership to Reduce Nitrogen in Upper Buzzards Bay

Buzzards Bay Coalition

Funding Amount: \$200,000

Contact: Mark Rasmussen, Rasmussen@savebuzzardsbay.org, Korrin Petersen, Petersen@savebuzzardsbay.org

Status: To be completed June 30, 2017 (Buzzards Bay NEP)

Project Description: The Buzzards Bay Coalition, Inc. and its partners, the Towns of Wareham, Bourne and Plymouth and the Massachusetts Maritime Academy (MMA), will evaluate the potential of relocating the Wareham wastewater outfall and to assess community sewer needs to reduce nitrogen pollution in impaired waterbodies from on-site septic systems. The Agawam/Wareham Rivers and Buttermilk Bay fail to meet water quality standards due to nitrogen pollution and are listed as impaired. Due to the sensitivity of the Agawam River, the permissible volume of wastewater discharge is limited, which therefore limits sewer expansion within the watershed. In the Buttermilk Bay watershed, the densely developed homes rely on septic systems and cesspools. The project will evaluate the feasibility of relocating the Wareham Wastewater Treatment Facility (WWTF) discharge from the Agawam River to the MMA's existing, well-flushed discharge into the Cape Cod Canal. In addition, a sewer needs analysis will be performed within the watersheds to determine how much sewerage is required to meet water quality goals and to determine whether the WWTF can accommodate the higher volume. A hydrodynamic model will also be developed to understand the water quality impacts of an increased nitrogen discharge at the MMA's Taylor's Point facility.

Progress to Date: An assessment was performed of the existing survey information for the railroad bed (the proposed location of the new sewer line) with the resulting recommendation that a full survey be done. The proposed monitoring program was assessed and redesigned, eliminating the proposed buoy. The grantees will attach a sonde to the MMA's bulkhead and add additional monitoring in other areas. A sewer needs analysis RFP was drafted and a hydrodynamic model RFP is in process.

Title: Quantifying Nitrogen Removal by Innovative Alternative Septic Systems and Potential for Enhanced Nitrogen Removal by Labile Carbon Addition

Marine Biological Laboratory

Funding Amount: \$175,918

Contact: Chris Neill, cneill@whrc.org

Status: To be completed June 30, 2017 (Buzzards Bay NEP)

Project Description: The Marine Biological Laboratory (MBL) and its partners, the Buzzards Bay Coalition, Inc. and Barnstable County Department of Health and the Environment, will quantify the nitrogen removal benefits of conversion of Title 5 septic systems to innovative alternative (I/A) systems. In addition, they will quantify whether the addition of a carbon source will increase nitrogen removal in I/A systems. MBL will compare nitrogen removal from a standard Title 5 system and two I/A systems, one of which will receive short-term addition of labile carbon designed to increase nitrogen removal. The project will take place in West Falmouth Harbor, which is listed as a nitrogen impaired Category 4a waterbody by MA DEP. All septic systems will be located within 100 m of the shoreline.

Progress to Date: Two innovative/alternative systems were selected for the study. The sites were selected from systems that were installed under the WFH Shoreline Septic Remediation Project, Round I SNEP grant. Monitoring equipment was purchased and wells were installed. The grantee submitted a QAPP for monitoring to EPA for approval.

Title: Aucoot Cove Partnership to Reduce Nitrogen from Septic Systems

Town of Marion

Funding Amount: \$200,000

Contact: Paul Dawson, pdawson@marionma.gov

Status: To be completed June 30, 2017 (Buzzards Bay NEP)

Project Description: The Town of Marion and its partners, the Town of Mattapoisett and the Buzzards Bay Coalition, Inc., will design an expanded sewage collection system from the Town of Marion's Wastewater Treatment Facility (WWTF) into the existing densely-developed neighborhoods of Indian Cove (Marion) and Harbor Beach (Mattapoisett) on Aucoot Cove. Aucoot Cove fails to meet water quality standards due to excessive nitrogen pollution. The Inner Cove is listed as a Category 5 by MA DEP as nutrient impaired. Expanding sewer to these neighborhoods will reduce nitrogen from all existing on-site septic systems on Aucoot's western shore. A sewer connection feasibility study will be completed for the 151 homes located in the Indian Cove and Harbor Beach neighborhoods. The study will include evaluation of the Marion WWTF for capacity, a preliminary design report for sewerage of the two areas including alternatives (50% design for the Marion section and 30% designs for the Mattapoisett section), construction cost estimates, and recommendations for inter-municipal sewer service agreements and project financing. The goal of the project is to fully position the town for approvals and construction.

Progress to Date: A kick-off meeting with all project partners was held May 26, 2016 and survey work is currently underway.

Title: West Falmouth Harbor Oyster Reef Development Project

Town of Falmouth

Funding Amount: \$53,950

Contact: Chuck Martinsen, FALDNR@hotmail.com, Sia Karplus, sia@sciencewares.com

Status: To be completed June 30, 2017 (Buzzards Bay NEP)

Project Description: The Town of Falmouth will work to reduce nitrogen loads to West Falmouth Harbor by expanding an oyster reef development project in the Snug Harbor sub-embayment, at the location of Mashapaquit Creek's contribution to the harbor. The town plans to expand the existing .25-acre reef to 1-acre by planting an additional 1,500 bags of oyster spat-on-shell, as a means to provide a biological filter for water entering West Falmouth Harbor from Mashapaquit Creek, which is a significant source of nutrients. The monitoring results of this project will inform the extent to which oyster reefs can effectively improve water quality, and can contribute to watershed management plans for West Falmouth Harbor and other similar estuaries. West Falmouth Harbor fails to meet water quality standards due to nitrogen pollution and is listed as a nitrogen impaired Category 4a by MA DEP.

Progress to Date: The grantee ordered 1,500 remote set oyster bags and hired a technician. Recycled clutch was donated by the town and spread on the existing reef. The benefits of oyster beds on estuarine water quality can only be characterized after the shellfish reach a size, quantity and density that have a measurable impact. This typically takes several growing seasons. This project created an oyster bed during the 2016 season that should show measurable results once the oysters have reached at least 3 inches. Monitoring during the 2016 season established baseline conditions and preliminary information on the impact of oyster beds on ocean acidification.

Title: Scotcut Neck Stormwater Design for Pathogen and Nutrient Management

Town of Fairhaven

Funding Amount: \$58,350

Contact: Vincent Furtado, vfurtado@fairhaven-ma.gov

Status: To be completed June 30, 2017 (Buzzards Bay NEP)

Project Description: The Town of Fairhaven will prepare designs and permit applications for green infrastructure stormwater best management practices at outfalls on Scotcut Neck, to reduce pathogen and nutrient loading as well as stormwater pollutants to Little Bay and Nasketucket Bay, which includes approximately 3.7 square miles of Class SA shellfishing estuary subject to wet-weather impairment. The town will design and permit structural retrofits for four stormwater outfalls, identified as high priorities in the *Atlas of Stormwater Discharges in the Buzzards Bay Watershed*. In addition, it will conduct an inspection of the approximately 40 septic systems remaining on Scotcut Neck. Owners of failed septic systems will be required to tie into the existing sewer line pursuant to the town's sewer bylaw. The town will also conduct a technology transfer workshop with the neighboring towns of Marion, Mattapoisett, and Acushnet to initiate a regional partnership for collaboration on stormwater-related issues.

Progress to Date: The Town received complimentary funding from a CZM Coastal Pollution Remediation grant, therefore the proposed tasks were divided up between the two grant programs. Phase I of this project (CZM CPR grant funded) closed June 30th. No work on the SNEP portion (Phase II) has begun yet.

Title: Rogers Street Stormwater Wetland Demonstration Project

Town of Dartmouth

Funding Amount: \$106,260

Contact: Michael O'Reilly, moreilly@town.dartmouth.ma.us

Status: To be completed June 30, 2017 (Buzzards Bay NEP)

Project Description: The Town of Dartmouth, and its partner, the City of New Bedford, will implement a series of Best Management Practices, including an underground detention system and several proprietary treatment units manufactured by StormTreat, to treat runoff resulting from two stormwater outfalls located at the end of Rodgers Street in Dartmouth. These outfalls discharge untreated stormwater runoff, which is generated from roadways in both Dartmouth and New Bedford, into Clark's Cove. Monitoring has indicated that the bacteria levels in the stormwater runoff from these two outfalls exceeds the state water quality standards for swimming and shellfishing. Clarks Cove is included in the Final Pathogen TMDL for the Buzzards Bay Watershed (2009).

Progress to Date: The Town is working with a contractor to get an estimate to combine this project with an adjacent boat ramp project, with the expectation that it will reduce the overall cost of both projects. An existing permit will be amended to include the boat ramp before going out to bid. Design plans were provided to the Buzzards Bay NEP for review.

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NARRAGANSETT BAY GRANTS

Title: Nutrient Reduction through Innovative Land Use Techniques

Mass Audubon

Funding Amount: \$49,000

Contact: Heidi Ricci, hricci@massaudubon.org, Tim Calabrese, tcabrese@massaudubon.org

Completed: June 30, 2016 (Narragansett Bay NEP)

Project Description: Mass Audubon developed the *Shaping the Future of Your Community Outreach & Assistance Program* to provide smart growth workshops and technical assistance to address the fastest growing municipalities in the Blackstone River watershed in Massachusetts. The goal was to enhance municipal capacity in the adoption of innovative techniques, such as Low Impact Development (LID) techniques, to reduce and remediate nutrient pollution from stormwater.

Progress to Date: Five communities were selected (Auburn, Grafton Mendon, Millbury, and Worcester) to receive technical assistance for local Low Impact Development (LID) and land use planning projects to improve water quality and stormwater management. This technical assistance is provided with Audubon's partners Central Massachusetts Regional Planning Commission, Horsley Witten Group and the Blackstone River Coalition.

Title: Source Water Phosphorus Reduction Feasibility Plan

City of Newport

Funding Amount: \$111,585

Contact: Julia Forgue, jforgue@cityofnewport.com

Completed: June 30, 2016 (Narragansett Bay NEP)

Project Description: The Newport Source Water Phosphorus Reduction Feasibility Study was designed to identify and quantify sources of phosphorus to two of the nine waterbodies in the City of Newport Water Division (NWD) water supply system and to assess, recommend, and prioritize management actions to reduce contribution or "loading" of nutrients to St. Mary's Pond and Watson Reservoir. The study was motivated by the recognition that elevated nutrient inputs to these two waterbodies have impacted water quality, including creating conditions that support cyanobacteria blooms. The study consisted of three phases – documentation of existing conditions in the waterbodies and watersheds, identification of management strategies to control phosphorus loading, and development of a plan to implement the recommended management strategies. Recently, an 18-month study was completed that involved water and sediment sampling in St. Mary's Pond and Watson Reservoir and tributary streams, pollutant load modeling based on land use in the watersheds, identification and prioritization of management practices to reduce nutrients entering the waterbodies and development of estimates of both phosphorus reduction and cost to implement the identified management practices.

Progress to Date: The resulting implementation plan developed identifies a roadmap for feasible and cost-effective prioritization of efforts to reduce phosphorus loads to Watson Reservoir and St. Mary's Pond over the next several years. It is expected that these management measures will also support the achievement of goals for nutrient load reductions identified in the forthcoming TMDLs for those waterbodies. In addition to identifying nutrient reduction strategies for these two watersheds, the

management measures presented in the Plan are widely applicable to addressing nutrient reduction in other watersheds within the NWD system and throughout the Narragansett Bay Estuary watershed.

Title: Ribbed Mussel Nutrient Bio-Extraction Pilot Project

Save the Bay

Funding Amount: \$48,179

Contact: Tom Kutcher, tkutcher@savebay.org

Completed: June 30, 2016 (Narragansett Bay NEP)

Project Description: The waters in the upper portions of Narragansett Bay have high levels of anthropogenic nitrogen. Excess nitrogen can lead to overproduction of algae, which reduces light infiltration, can directly smother benthic organisms, and can reduce local oxygen levels in the water when it decomposes. Filter feeding bivalves can indirectly reduce water-column nitrogen by consuming plankton, but edible bivalves can pose a human health threat in polluted waters, making their restoration controversial. Ribbed mussels are not commonly eaten and thus could be useful for bioextraction in polluted systems. Ribbed mussels can effectively consume nutrient-rich seston from the water column while in their natural intertidal settings or while continually submerged. This study compared growth rates of 100 adult ribbed mussels in each of three settings: (1) a fringing salt marsh, (2) hanging continually submerged in shallow water from a floating raft, and (3) in a shellfish aquaculture upweller that continually forced water past the animals to theoretically increase feeding rate.

Progress to Date: Mean seasonal growth in length of typical-size adult mussels (mean initial length = 6.23 cm) ranged from 0.15 cm to 0.28 cm among the settings during the growth season, whereas smaller animals grew more rapidly (0.27 to 1.2 cm over a similar period). An average net nitrogen bioextraction rate of 7 to 13 mg per animal over the period was estimated using growth data. While no significant differences in growth rate among treatments were detected, continually submerged and intertidal animals appeared to grow similarly; whereas animals subjected to increased seston delivery by an aquaculture-style upweller appeared to grow slowest, indicating that factors associated with increased seston delivery, including equipment problems we encountered during this project, may have suppressed growth. In comparison, we estimated a nitrogen bioextraction rate of 0.03 to 0.09 mg per hour per g of dry weight using the biodeposition method. Findings suggest that ribbed mussels were able to successfully acclimate to constant submersion and that the field site had sufficient quantity and quality of food to support good growth. Bioextraction estimates may be useful to inform projects aimed at nitrogen mitigation of eutrophic estuarine waters using ribbed mussels.

Title: Optimizing Performance of Existing Onsite Wastewater Treatment

University of Rhode Island

Funding Amount: \$238,097

Contact: Jose Amador, jamador@uri.edu

Completed: December 30, 2016 (Narragansett Bay NEP)

Project Description: The University of Rhode Island's Laboratory of Soil Ecology and Microbiology is conducting research on optimizing performance of existing onsite wastewater treatment systems (OWTS). Nitrogen in effluent from conventional OWTS (a.k.a. septic systems) enters coastal waters

where it causes algal blooms that lead to poor water quality, oxygen depletion, and sometimes fish kills. URI's project goal is to optimize the performance of existing OWTS within the greater Narragansett Bay watershed to reduce nitrogen inputs. To find out how these systems are performing, URI monitored total N from advanced N-removal OWTS, identified underperforming systems so they could be adjusted, and evaluated changes in their performance. URI also evaluated methods to measure N in the field to help service providers evaluate system performance during routine visits.

Progress to Date: Many field methods used to test effluent can be inaccurate. URI identified field tests that provide accurate results when used to test wastewater. Results show that median total N levels in effluent are below 19 mg/L for all technologies. However, there is room for improvement. Adjusting underperforming systems can improve N removal, but not always. Adjusted systems may need longer to improve. More training of service providers may also help improve performance. The compliance rate in RI is lower than in Barnstable County, MA, where systems are monitored for total N and results are reported to a centralized database. A similar approach may improve performance in RI, keeping more N out of the Bay. URI is developing statistical models to predict total N from other parameters to help service providers. URI is also measuring the abundance of genes for enzymes that remove N to help us understand how microbes remove N in these systems.

Title: Moswansicut Reservoir Phosphorus Project

Northern RI Conservation District

Funding Amount: \$48,179

Contact: Gina DeMarco, gdemarco.nricd@gmail.com

Completed: June 30, 2016 (Narragansett Bay NEP)

Project Description: The Northern Rhode Island Conservation District is leading the Moswansicut Reservoir Phosphorus Project to educate the public of the importance of protecting the Moswansicut Reservoir – a small tributary reservoir of the Scituate Reservoir, Rhode Island's largest supply of drinking water. The reservoir, once a natural lake, is at risk of eutrophication and increased incidence of harmful algal blooms due to phosphorus loading from its watershed. This project sought to reduce phosphorus loading to Moswansicut Reservoir by utilizing techniques including educational mailings, workshops, community nights, and volunteer opportunities. Additionally, NRICD and partners from both Providence Water and the University of Rhode Island implemented Canada Goose management techniques at Moswansicut Reservoir and monitored phosphorus loading to the Moswansicut with a volunteer water quality monitoring program.

Progress to Date: The Moswansicut Reservoir Phosphorus Outreach and Monitoring Project yielded the following deliverables:

- Six educational events with a total of 158 attendees. Topics included low-input lawn care, septic system maintenance, safe composting, private well testing, and low impact development, as well as a watershed field tour on Providence Water land
- Recruitment of a team of seven volunteers who collected monthly water quality samples at 10 tributary sites around the Moswansicut Reservoir watershed
- Planting of tall native grasses at Moswansicut Dam to discourage congregation of native Canada geese
- Educational visits to three elementary schools to teach 3rd and 4th graders about stormwater and phosphorus pollution concepts

- The production of two educational mailings which were each received by approximately 600 homes.

Future educational efforts will continue to be funded in this area by Providence Water and NRICD. Recommendations include increased outreach on the topics of septic maintenance and lawn care, as well as providing funding for future years of water quality monitoring to build a 5-year dataset of tributary nutrient loading data. A toolkit of techniques used was developed to share with partner organizations.

Title: Stormwater Utility Implementation and Hardig Brook Restoration

West Warwick

Funding Amount: \$237,000

Contact: Fred Presley, fpresley@westwarwickri.org

Completed: June 30, 2017 (Narragansett Bay NEP)

Project Description: Greenwich Bay and Hardig Brook are listed as impaired for bacteria and both were the subject of a total maximum daily load study developed by the Department of Environmental Management (RIDEM) in 2005. Nutrient impacts are also apparent in these waters as evidenced by fish kills (e.g., August 20, 2003), and recurrent low dissolved oxygen levels in summer months. To address these issues, the Town proposed development of a stormwater utility and implementation of a capital infrastructure improvement plan. The project also includes a significant public involvement process.

Progress to Date: This project is ongoing and infrastructure construction is pending. The Town plans to propose a \$55/year/Equivalent Residential Unit fee, which will be used to fund \$4 million in capital projects and generate an operations budget \$570 thousand per year.

Title: Examine Stormwater Pollution to Trout Brook

The Town of Avon, Massachusetts

Funding Amount: \$24,000

Contact: William Fitzgerald, wfitzgerald@avonmass.org

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: Four square miles in size, Avon has over 23% impervious cover and ranks in the top 15% of Massachusetts communities in terms of impervious surface. Stormwater from these impervious surfaces flows to Trout Brook, a 604(b) listed stream in the upper reaches of Narragansett Bay. This stormwater also recharges the Town's drinking water groundwater sources. To protect its high-risk groundwater supply, address the impairment, and proactively meet NPDES permit requirements, the Town has undertaken comprehensive master planning. This project proposed to prioritize subwatershed locations for field sampling locations and to identify sites suitable in priority areas for BMPs/green infrastructure. The approach included mapping land uses, impervious surfaces, and drainage structure, and developing more detailed topography. Structures would also be inspected for condition and initial IDDE screening.

Progress to Date: Avon implemented replicable, cost effective methods to enhance available GIS data for source prioritization and green infrastructure retrofit planning:

- More detailed topography can be created through available LiDAR data sets and GIS analysis, allowing smaller catchment areas to be developed to divide flow for treatment in more locations

- Newer GPS units are affordable and can achieve sub-centimeter scale - an accuracy sufficient for most drainage/green infrastructure planning. Vertical accuracy allows hydraulic conveyance capacities to be evaluated.
- Not having local orthophotos/plainimetrics, pavement coverage was improved by a volunteer using heads up digitizing with open source GIS. A higher resolution aerial photo as a base would be helpful for improved impervious surface mapping, and future planning and evaluation. Regional efforts such as working with the 2017 UASI flyover is a possibility.
- Field data inspection can be streamlined, simplified, organized and reported with cloud-based technology

Title: Examining Limited Sewer Extensions to Serve Developed Town Center

The Town of East Bridgewater, Massachusetts

Funding Amount: \$30,000

Contact: Rich Philbrick, rphilbrick@ebmass.com

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: The Town of East Bridgewater is examining creative solutions to provide limited sewer extensions to serve the densely developed town center. East Bridgewater High School's existing wastewater treatment facility has the opportunity to serve additional downtown properties. This project would reduce nitrogen and phosphorus contributions to nearby surface waters, including Meadow Brook, Salisbury Plain River, and Matfield River. The Board of Health will review the capacity of the High School Treatment Facility, assess the flows from other town buildings, project available system capacity for serving town center properties, and develop a Capital Improvements Plan for limited sewer service areas.

Progress to Date:

Title: Stormwater Outfall Assessment for the East and West Monponsett Pond

The Town of Halifax, Massachusetts

Funding Amount: \$57,338

Contact: Russ Kleeklamp, Russell.Kleekamp@ghd.com, Cathy Drinan, cdrinan@town.halifax.ma.us

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: At the intersection of three watershed headwaters (North River, Jones River and the Taunton River) lie the Monponsett Ponds. The ponds serve several public interests including drinking water supply, fisheries and wildlife habitat (for three state-listed protected species), flood control, and recreation. The ponds also have experienced a long history of man-made manipulations and interventions. Over the last several years, an alarming decline in water quality has become a critical issue for residents, Town officials, and other. Recent algal blooms have been recorded at over 27x the closure limit of 70,000 cells/mL (DPH's safety threshold). Additionally, there are repeated fish kills and reports of foul and noxious odors as a result of the algal blooms. There are several known reasons for the decline in water quality, including the damming of Stump Brook that drains West Monponsett Pond toward the Taunton River, creating stagnant water conditions. Other causes of decline include nutrient intake from pond-side septic systems, and untreated storm-water runoff. The goal of this project is to identify the sources of untreated storm-water runoff that may be a source of storm-water pollution contributing pathogens and excess nutrients (nitrogen and phosphorus) to the ponds.

Progress to Date: Work has begun to identify and map the existing storm-water outfalls to the Monponsett Ponds in order to prioritize and develop engineered solutions to mitigate the impacts of storm-water pollution. Permit ready designs for the three top priority catch-basins will be submitted. Subsurface leaching, constructed wetlands, and low-impact-development technologies such as porous asphalt will all be considered for implementation to help reduce storm-water pollution to the ponds.

Title: Data Collection and Green Infrastructure Projects in Brickyard Pond

The Town of Barrington, Rhode Island

Funding Amount: \$19,260

Contact: Joseph Piccerelli, jpicerelli@barrington.ri.gov

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: The Town of Barrington is collecting water quality and sediment data and designing green infrastructure projects in and around Brickyard Pond to address water quality impairments. Connected to Narragansett Bay through Mussachuck Creek, Brickyard Pond hosts an annual run of anadromous river herring. The Town will complete a conceptual design study for green infrastructure/stormwater best management practices for five Town-owned priority outfalls. The Town's goal is to significantly reduce phosphorus loadings to support a healthy ecology in Brickyard Pond.

Progress to Date:

Title: Stormwater pathogens—Find it and Fix it, to Identify Pathogens at Easton's Beach

Clean Ocean Access, Newport & Middletown, Rhode Island

Funding Amount: \$45,900

Contact: Dave McLaughlin, dave.mclaughlin@cleanoceanaccess.org

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: The *Newport Source Water Phosphorus Reduction Feasibility Study* was designed to identify and quantify sources of the nutrient, phosphorus (P), to two of the nine waterbodies in the City of Newport Water Division (NWD) water supply system and to assess, recommend, and prioritize management actions to reduce contribution or "loading" of nutrients to St. Mary's Pond and Watson Reservoir. The study was motivated by the recognition that elevated nutrient inputs to these two waterbodies have impacted water quality, including creating conditions that support cyanobacteria blooms. The study consisted of three phases – documentation of existing conditions in the waterbodies and watersheds, identification of management strategies to control phosphorus loading, and development of a plan to implement the recommended management strategies.

Progress to Date: NWD's consultant, Fuss & O'Neill, Inc., recently completed the 18-month study that involved water and sediment sampling in St. Mary's Pond and Watson Reservoir and tributary streams, pollutant load modeling to estimate phosphorus loading based on land use in the watersheds, identification and prioritization of management practices to reduce the amount of nutrients entering the waterbodies and development of estimates of both phosphorus reduction and cost to implement the identified management practices. The resulting implementation plan developed identifies a roadmap for feasible and cost-effective prioritization of efforts to reduce phosphorus loads to Watson Reservoir and St. Mary's Pond over the next several years. It is expected that these management

measures will also support the achievement of goals for nutrient load reductions identified in the forthcoming TMDLs for St. Mary's Pond and Watson Reservoir. In addition to identifying nutrient reduction strategies for these two watersheds, the management measures presented in the Plan are widely applicable to addressing nutrient reduction in other watersheds within the NWD system and throughout the Narragansett Bay Estuary watershed.

Title: Stormwater Infiltration Projects in the Stillhouse Cove

The City of Cranston, Rhode Island

Funding Amount: \$99,100

Contact: Ed Tally, etally@cranstonri.org

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: Stillhouse Cove is located on Narragansett Bay and receives runoff from Narragansett Ave and a built-out residential neighborhood. The Cove is listed on the Rhode Island 303(d) list as impaired for low DO, nutrients and pathogens. Stormwater is the primary source of these impairments. Substantial financial resources have been dedicated to restoring salt marsh habitat in Stillhouse Cove in the past from state and federal government. The goal of this project is to develop two green infrastructure controls to reduce stormwater pollutant loadings to the Cove. Conceptually, it is anticipated that these will consist of installing bioretention systems within the City-owned right-of-way. The major elements of this project will include conceptual planning study to develop overall green infrastructure plan, final design and permitting, and construction of 1 to 2 BMPs

Progress to Date: QAPP has recently been approved and project is starting in September 2016.

Title: Stormwater Mitigation Project at Sabin Point Park

The City of East Providence, Rhode Island

Funding Amount: \$100,000

Contact: Jeanine Boyle, JBoyle@cityofeastprov.com

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: The City of East Providence is building a stormwater mitigation project at Sabin Point Park on the Providence River to help address elevated bacterial levels. Sabin Point Park is a popular urban park yet swimming has not been allowed in decades. The City received funding through the Rhode Island Department of Environmental Management to complete the design for the stormwater project. The City will partner with Brown University and the Rhode Island Department of Health staff to monitor nutrient and bacteria levels to assess the effectiveness of the project. In addition, Save The Bay will provide outreach to the surrounding communities regarding controls to stormwater runoff.

Progress to Date:

Title: Innovative Stormwater System for Sheffield Cove

The Town of Jamestown, Rhode Island

Funding Amount: \$118,200

Contact: Michael Gray, mgray@jamestownri.net, Jean Lambert, jlambert@jamestownri.net

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: Sheffield Cove was closed to shellfishing by RIDEM in 2009 as a result of bacterial exceedances found during the 2008 and 2009 routine sampling. Sheffield Cove is part of the West Passage Growing Area in Narragansett Bay. In 2015, the *Stormwater Runoff & Water Quality Study of Sheffield Cove & Surrounding Watershed* was completed and included 6 sampling events. The results of the sampling showed that 99% of the wet weather bacterial loads (and significant dry weather loads) originated from 2 catchments in close proximity to one another. Proposed management of the two primary sources must address both wet weather (stormwater) and dry weather (wildlife/wetlands/pet waste) sources and will include structural and non-structural approaches.

Progress to Date: The design and permitting of the bioretention areas and subsurface sand filtration system are underway. A pet waste education plan will focus on public awareness with a brochure suitable for mailing and posting by the Town.

Title: Stormwater Mapping and Green Infrastructure Design for Stormwater Outfalls

The City of Pawtucket, Rhode Island

Funding Amount: \$83,510

Contact: Andrew Silvia, asilvia@pawtucketri.com

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: The goal of this project is to develop a city-wide plan to holistically improve stormwater quality. This project will provide a comprehensive plan that will guide the City's actions in addressing these water quality issues for years. Major project elements include:

- Convert existing storm drainage mapping into GIS database
- Prioritize subcatchments based on water quality risks
- Field survey drainage systems in ten highest priority subcatchments
- Develop conceptual BMP designs for the ten highest priority subcatchments
- Model conceptual BMPs and develop prioritized list.
- Public engagement program

Progress to Date: Project QAPP has been approved and base mapping has been completed. Currently, prioritizing drainage areas. Field survey of drainage infrastructure to start in October.

Title: Install a Series of Bioretention Basins and Vegetated Swales near Oakland Beach and City Park Beach

The City of Warwick, Rhode Island

Funding Amount: \$180,000

Contact: Eric Earls, eric.j.earls@warwickri.com

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: Stormwater from the municipal stormwater system discharges to Brushneck Cove and Warwick Cove. Oakland Beach, Warwick's largest public beach, is located at the southern tip of the peninsula. Oakland Beach suffers from frequent beach closings associated with elevated bacteria levels. This project will increase the capacity of the stormwater drainage system, increase infiltration, reduce

flooding, and improve water quality within the medians of Suburban Parkway in the in the Oakland Beach section of Warwick. This stormwater management project consists of the installation of a series of bioretention basins and vegetated swales within the medians of Suburban Parkway and Strand Avenue. The total project will be approximately 2,000 feet long. This project will utilize the area within the existing median as a bioretention area, while utilizing the existing closed drainage system as an overflow/storage system. This project can be used as a model for implementing other water improvement construction projects. Also, by planting aesthetically pleasing vegetation, it will also be used to encourage private entities to create bioretention facilities or rain gardens on privately owned properties. The City anticipates that this project will minimize the frequency of those beach closures.

Progress to Date: The City hired a design group to design the project using Community Development Block Grant funding.

Title: Implement Water Quality Improvements in Little Narragansett Bay and Lower Pawcatuck River

The Town of Westerly, Rhode Island

Funding Amount: \$57,884

Contact: Nancy Letendre, nletendre@westerlyri.org

Status: To be completed June 30, 2017 (Narragansett Bay NEP)

Project Description: The Town of Westerly is identifying, prioritizing, and implementing water quality improvements in Little Narragansett Bay and the lower portion of the Pawcatuck River. Presently, these waters have high nutrient loads, elevated bacteria levels, lower water clarity, and low dissolved oxygen concentrations. This grant will support the Town's work with Save The Bay to identify pollutant sources and develop an implementation plan to address the Phase 1 study area, which includes downtown Westerly. This plan will include recommendations for both structural and non-structural water quality improvements and an interactive map showing the results.

Progress to Date:

HEALTHY COMMUNITIES GRANTS

Title: Building Large-Scale Capacity for the Rapid Detection of Bacterial Contamination in Coastal Waters

Rhode Island Department of Health: Beaches Environmental Assessment and Coastal Health (BEACH) Program

Funding Amount: \$200,000

Contact: Kerry Patterson, kerry.patterson@health.ri.gov

Status: To be completed June 30, 2017

Project Description: Bacteria testing for beaches and public recreation sites, while effective, has been slow to react to high bacteria levels due to the time it takes to process water samples. Testing takes 24 hours to complete, and can mean beach closures for fecal coliform contamination take place after a threat has been present for a prolonged period of time exposing beach-goers, after a threat has passed, or keep a beach closed when the threat is no longer present. Under this funding opportunity, the BEACH program would compare the results of its traditional testing method (IDEXX Enterolert) to the EPA's method 1609 (Rapid qPCR), which allows for same-day notifications of bacterial exceedances and could potentially lower the number of closures per year. Staff would be trained in the method and the RI lab would become to the first New England-certified laboratory to use the rapid methods for water testing and notification

Progress to Date:

Title: Strengthening Regional Partnerships to Advance An Integrated System of Environmental Indicators for Narragansett Bay and Its Bi-State Watershed

Rhode Island Department of Environmental Management, Office of Water Resources

Funding Amount: \$200,000

Contact: Sue Kiernan, Sue.Kiernan@dem.ri.gov

Status: To be completed June 30, 2017

Project Description: This bi-state effort will focus on building upon and strengthening collaborative efforts to synthesize and disseminate key environmental indicators. Several large data sets exist, but their size and a lack of capacity has prevented optimizing their use, and this project is designed to synthesize the data sets to examine potential relationships between pH, temperature, streamflow, and hypoxia. Objectives include informing historical baselines for warming waters, assessing acidification, relating streamflow to hypoxia, and other variables to examine potential climate change impacts. Once data has been synthesized, a workshop will take place to review indicators, assess linkages, identify any data and monitoring gaps, and identify opportunities to align monitoring and assessment strategies.

Progress to Date:

Title: Popponasset Bay Coastal Resilience and Habitat Restoration Project

Mashpee Wampanoag Tribe Natural Resources Department

Funding Amount: \$198,174

Contact: Casey Thornbrugh, casey.thornbrugh@mwtribe.com

Status: To be completed June 30, 2017

Project Description: The goal of the project would be to construct shell reef structures within Popponasset Bay and seed with oyster stock to introduce a large number of filter feeders to the bay (stated goal of 10 million over time) as a measure of water quality improvement. The proposed reef would cover approximately 4 acres of shoreline, and would also assist in protecting the shoreline from weather events causing further loss of beach. MWT and Mr. York will continue to measure water quality in the bar, a project already underway, using both deployed sondes and a summer water quality sampling program through the Mashpee Water Quality Collaborative.

Progress to Date:

Title: Annual Harvest of the Invasive Reed, Phragmites Australis: A Potential Nitrogen Mitigation Strategy with Widespread Application

Martha's Vineyard Shellfish Group

Funding Amount: \$135,693

Contact: Emma Green-Beach, emma.greenbeach@gmail.com

Status: To be completed June 30, 2017

Project Description: Research and calculate Nitrogen uptake by Phragmites australis, a common invasive reed, and investigate annual cutting and harvesting of Phragmites as a potential Nitrogen uptake and mitigation strategy. Monitor water quality in one affected study area, and observe effects of removal on surrounding habitat, the reeds, and native vegetation. Look into value of Phragmites as a useable product in agriculture as feed stock, bedding, and compost and soil amendment. Look into value of Phragmites as biofuel source as extruded pellet fuel material, and provide training to local community on manufacturing process.

Progress to Date:

Title: Buzzards Bay Stormwater Collaborative: A Coordinate Intermunicipal Pilot Program to Map Stormwater Networks and Monitors Discharges in Impaired Surface Waters in the Buzzards Bay Watershed

Buzzards Bay Action Committee

Funding Amount: \$200,000

Contact: Betsy White, bwhite@buzzardsbayaction.org

Status: To be completed June 30, 2017

Project Description: This initiative will help map stormwater infrastructure, identify pollution sources, and gather the kinds of information necessary to prioritize action to reduce stormwater pollution and ultimately re-open shellfish beds. The results of this project will eventually lead to stormwater treatment design for priority sites. The project will seek to update the GIS database of the Buzzards Bay stormwater atlas to include connections between catch basins within catchment areas newly defined through LiDAR analysis, and pipe details and conditions not currently documented. Stormwater teams will monitor the outfalls identified, and further track and monitor those that exceed discharge limits. SmartPhone applications will assist the documentation of monitoring, and will assist in the identification and removal of illicit discharges. Water quality results will be compiled into a database meeting EPA standards, and will be publically available. It is the hope that this method will then be standardized and expanded in the future to allow for the inclusion of other municipalities to grow the baseline

understanding of discharges. Finally, a cross-municipal public education program will be implemented in participating towns.

Progress to Date: Outcomes to date include:

- The mapping of stormwater networks throughout each town, focusing on those connected to priority discharge pipes
- Lack of rain facilitated the identification of illicit connections, of which there were few.
- A good general correlation was found between fecal coliform and enterococcus, eventually limiting testing to one indicator.
- BBAC tested, changed, and adopted protocols which allowed the streamlining of data collection.
- BBAC used local municipal knowledge to more efficiently and accurately map and sample sites.
- Established working relationships with towns, laboratories, and the public which will be assets for future stormwater initiatives and funding.
- Creating a “blueprint” which other towns can use to develop their own stormwater monitoring program.
- By employing student interns, this project helped train and give experience to the next generation of environmental advocates.

Title: 208 Plan Watershed Planning and Technology Transfer

The Nature Conservancy – Massachusetts Chapter

Funding Amount: \$199,664

Contact: John Torgan, jtorgan@tnc.org

Status: To be completed June 30, 2017

Project Description: Project seeks to transfer the technologies and planning approaches developed as part of the Cape 208 Plan. The project will focus on building collaboration and partnerships throughout the region through integrating representatives, NGO’s and other stakeholders. To do so, the project will create two sample nutrient management plans using the Cape 208 methods in the Taunton River Watershed. To follow, a series of 4 public workshops will be planned and held within the study areas. A technology review panel of local experts will convene to review and propose a plan from the methods learned in the earlier steps. Members will include the Cape Cod Monitoring Committee, The Nature Conservancy, and other local experts who have expertise in relevant areas. A Water Quality Summit will be organized and held to bring together and discuss the most up-to-date information about technology, pilot projects, and monitoring results. Finally, as a result of the Summit, an updated Technology Matrix will be produced with clear descriptions of various technologies, constraints and opportunities.

Progress to Date:

Title: Regional Planning and Training on Municipal Tools for a Resilient Taunton Watershed

Southeastern Regional Planning and Economic Development District (SRPEDD)

Funding Amount: \$170,000

Contact: Bill Napolitano, bnap@srpedd.org

Status: To be completed June 30, 2017

Project Description: The project will seek to develop a green infrastructure map of the Taunton River Water shed, building on existing maps to form a group of data layers that can be combined to produce

an overview of natural features that serve to protect water quality, groundwater recharge, flood control, and biodiversity. Ten case studies will then be produced and disseminated to highlight to municipalities the benefits of using a green infrastructure-based approach, including support of ecosystem services and the associated cost benefits of them. Finally, a pilot training program will be developed. A curriculum will be developed and delivered to three Taunton municipalities and consist of a series of modules to inform users on the benefits and approach of GI. Modules include: Climate Science 101 and regional vulnerability; regional green infrastructure overview, linkage of regional and local resiliency; use of green infrastructure/LID to address flooding, storm water management and water quality; and Cost/Benefit comparison of green and gray infrastructure approaches to resiliency. Training will be designed and provided by Mass Audubon's Shaping the Future of Your Community program.

Progress to Date:

Title: Sustaining the Baywatchers Monitoring Program to Provide Critical Nitrogen Management Information in Buzzards Bay

Buzzards Bay Coalition

Funding Amount: \$100,000

Contact: Rachel Jakuba, Jakuba@savebuzzardsbay.org

Status: To be completed June 30, 2017

Project Description: Buzzards Bay's watershed stretches west from Little Compton, RI to Woods Hole, MA and the Elizabeth Islands in the east. It covers parts of 17 towns where ~300,000 people live. Nitrogen pollution is a top concern for the Bay's ecological health with 37 water segments classified as impaired due to nutrient pollution. This project, which began in October 2015, supports Baywatchers water quality monitoring activities for 1 year, including the expansion of Baywatchers into the winter and early spring months. Baywatchers tracks nutrient-related Bay health and documents the impact of nitrogen pollution with the use of citizen scientists. For 25 years, Baywatchers has collected basic water quality, nutrient, and algal pigment information around Buzzards Bay during the summer months and educated the public on their local water quality. Baywatchers long-term monitoring has proven to be an essential tool in all regulatory aspects of coastal restoration—identifying impaired waters, evaluating discharge permits, developing TMDLs, and tracking progress towards goals.

Progress to Date: The results of this project include:

- 140 citizen scientists trained, equipped, and coordinated by the Buzzards Bay Coalition,
- Water quality data on 200 sites around Buzzards Bay and Vineyard Sound,
- 3,000 measurements of basic water quality (dissolved oxygen, temperature, salinity, and water clarity since May 2016),
- 1,000 samples collected since January 2016 and delivered to the Marine Biological Laboratory for more detailed nutrient analysis (ammonium, nitrate+nitrite, total dissolved nitrogen, particulate organic nitrogen, particulate organic carbon, phosphate, chlorophyll a, phaeophytin, salinity), and
- 70 nutrient samples analyzed from sites around Buzzards Bay in January and March.

Preliminary results suggest that in January, more nitrogen occurs as highly-available inorganic forms than in March, July and August. The data collected by this project builds on the long-term monitoring, which has proven an essential tool for effective management of the Bay's resources and for educating and empowering citizens.

Title: Stormwater Treatment Systems: Are They Effective in Reducing Nutrients to Coastal Waters?

Cape Cod Cooperative Extension Marine Program

Funding Amount: \$66,468

Contact: Diane Murphy, dmurphy@barnstablecounty.org

Status: To be completed June 30, 2017

Project Description: The project will seek to directly compare the effectiveness of nitrogen removal in rain gardens and conventional stormwater systems on 3 Cape Cod parcels (1 each in Bourne, Dennis and Mashpee) that each contain both systems allowing for a direct comparison. Efficiency of the two systems will then be compared in terms of cost vs. performance for nitrogen removal. The results from 12 samples will be compiled into a report and shared with stormwater managers and other coastal resource decision makers in neighboring towns.

Progress to Date:

DRAFT