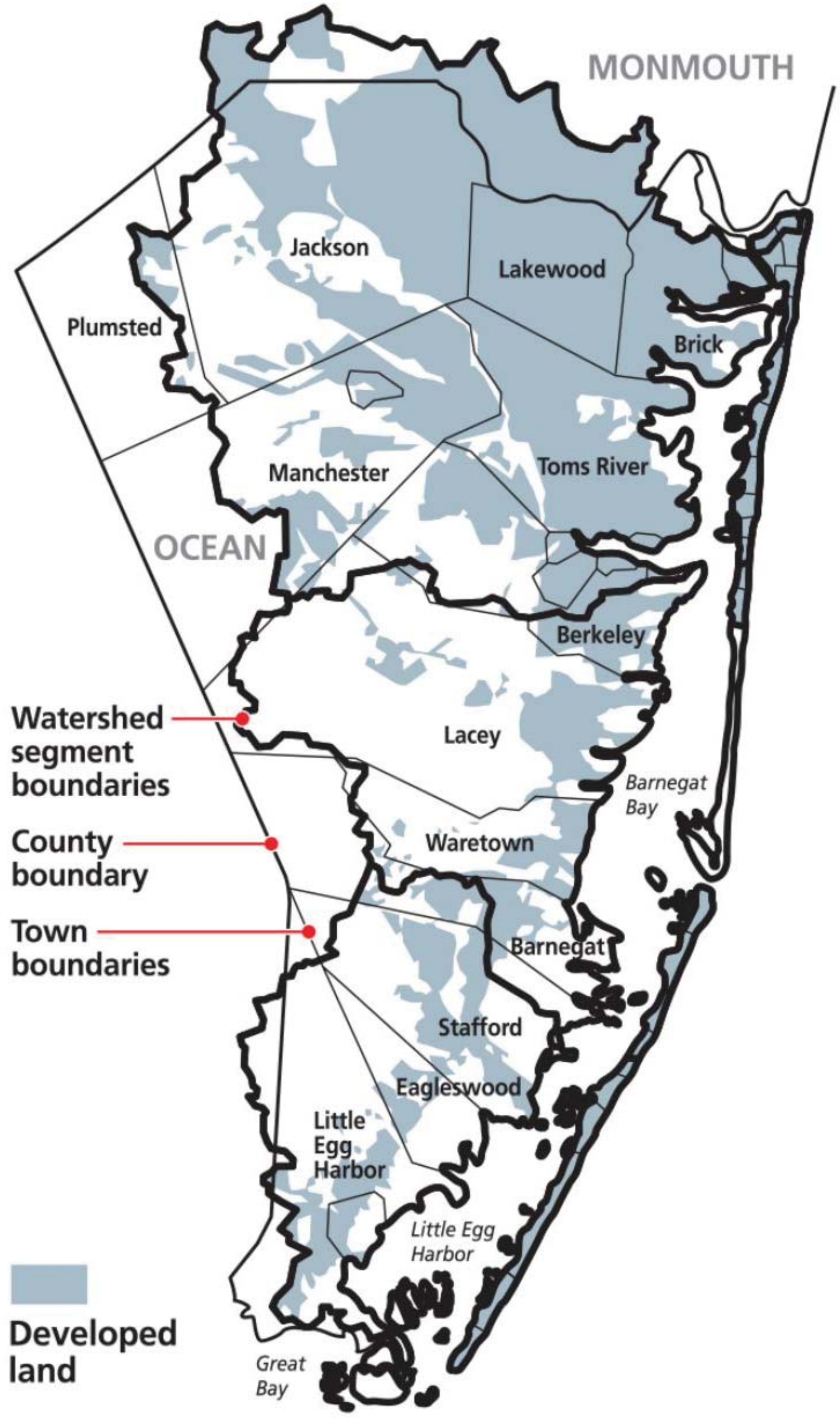
Clean Water, Beautiful Bay

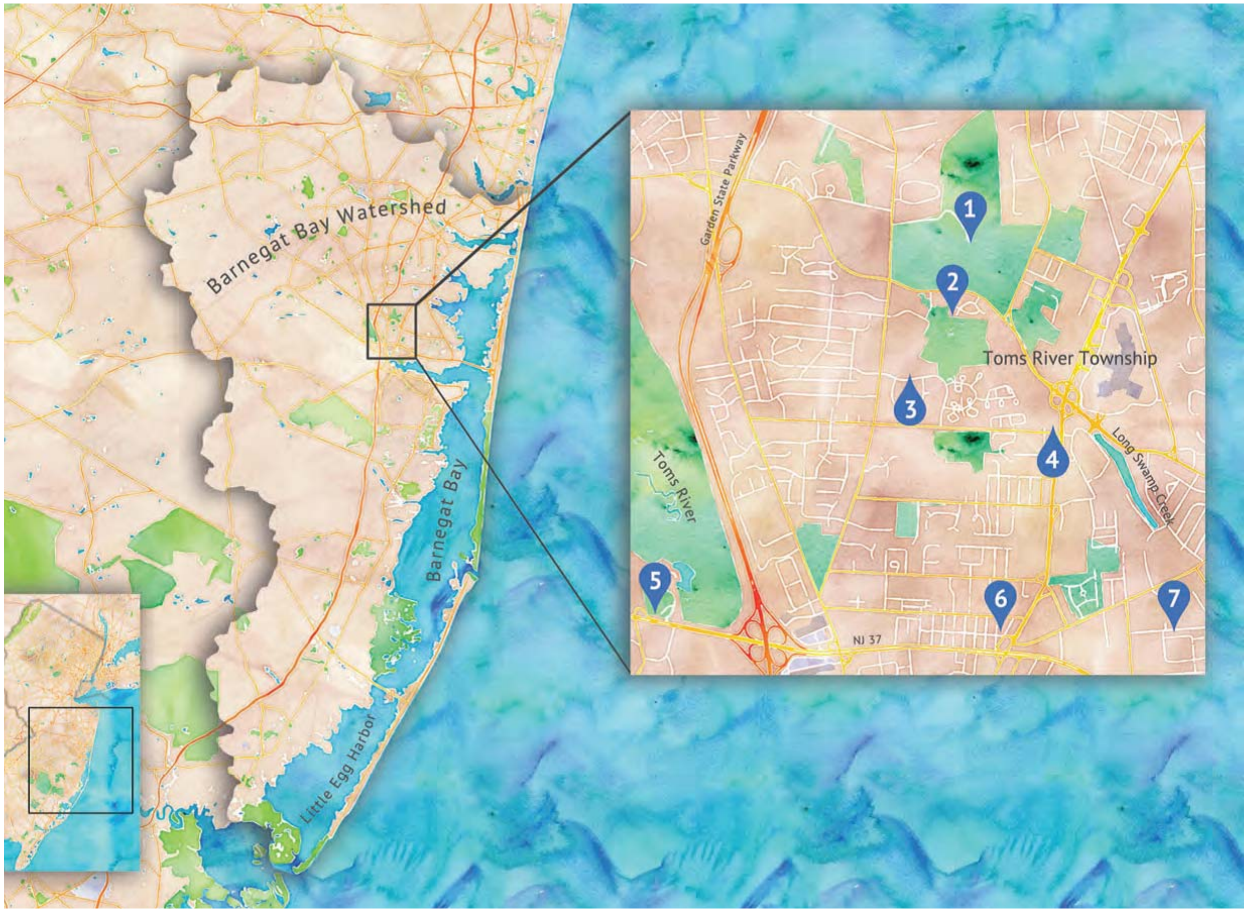
Barnegat Bay Stormwater Projects in Action : Stories of Success

American Littoral Society
Coastal Conservation



Barnegat Bay is nationally recognized as a unique estuarine ecosystem with a variety of different habitats that many species depend on for survival. Due to numerous factors, but especially the development of its watershed and resulting high levels of nitrogen loading from stormwater runoff, the Bay has suffered serious ecological decline.

In an effort to save the Bay, the American Littoral Society developed a multi-faceted Clean Water Project plan, which focuses heavily on one of the Bay's key issues: eutrophication due to excessive nitrogen loading. In partnership with Princeton Hydro, the Ocean County Soil Conservation District and others, the American Littoral Society began work to decrease the volume of stormwater runoff and associated pollutants flowing into and damaging the Bay.



Our Demonstration Projects:

1. Bey Lea Golf Course: Land management program- Barnegat Bay - friendly certification
2. Toms River High School North: Rain Garden, "Bayscape for Barnegat Bay" native plant garden, tree boxes and manufactured treatment device.
3. Laurel Commons Homeowners Association: Bio-retention basin retrofit
4. Toms river Board of Education: "Bayscape for Barnegat Bay" native plant rain garden, porous pavement, and manufactured treatment device
5. Community Medical Center: Bio-retention, rain garden basin/inlet retrofit
6. Ocean County Basin: Soil amendments, invasive plant removal
7. Toms River Township: Low flow Channel Basin Improvement.

The specific work products of Barnegat Bay Stormwater Project are a result of the development of a stormwater prioritization matrix. The matrix, created by Princeton Hydro, provides a non-biased, quantitative means of identifying and ranking stormwater management projects having the greatest potential to decrease pollutant loading to the Bay.

With a prioritization methodology in place, the American Littoral Society then began its work to retrofit antiquated, inefficient stormwater basins within the Barnegat Bay watershed. The American Littoral Society and Princeton Hydro implemented a variety of green infrastructure projects to treat stormwater at its source while delivering environmental, social and economic benefits to Barnegat Bay.

Each of the targeted basins or other stormwater improvement projects presented in this booklet were initially installed to function as dry detention basins; therefore, many of them have a history of failure in providing infiltration and also lack the ability to effectively attenuate nutrients. All of the basins manage the runoff from large impervious surfaces, residential lawns, highly developed areas, or municipal facilities. The infiltration and pollutant removal abilities of some of these basins have been further compromised due to improper or inadequate maintenance

Post naturalization, the targeted basins and projects will have far greater phosphorus, nitrogen, pathogen, and sediment trapping, attenuation, and removal capabilities, and will be able to more fully and affectively infiltrate stormwater, thereby decreasing, not only the amount of pollutants discharged, but also the volume of stormwater released from the basins to the receiving bodies of water. In addition, these improvements are a critical component of flood control.

This project is fully in keeping with the NJDEP's published restoration strategy for Barnegat Bay, which emphasizes the need to retrofit the stormwater infrastructure that currently discharges to the Bay. The basin improvements directly address sources of pollution to the Bay that have been tracked and quantified through the previous combined efforts of the NJDEP and the project partners. The work that has been completed through this project is fully consistent with, and furthers the recommendations of, the Barnegat Bay Comprehensive Conservation and Management Plan (CCMP) and the Long Swamp Creek Watershed Protection Plan (WPP), both of which are NJDEP approved watershed management plans.

Bayscape for Barnegat Bay
Native Plant Rain Garden

Bayscape for Barnegat Bay engages citizens throughout the Barnegat Bay watershed to become better stewards of the coast and Bay by becoming better stewards of the land. Barnegat Bay has been in serious ecological decline due to many detrimental human activities that take place on the watershed lands which drain to the Bay

You can help by:

- Using native plantings to improve the health of the entire ecosystem along the coast
- Reducing your lawn area bordering your existing lawn with plant buffers
- Creating habitat for pollinators and other species
- Practicing appropriate use of pesticides and fertilizers
- Limiting water use

This Native Plant Rain Garden showcases some of the plants that are appropriate for our eco-region. For more information, visit http://www.littoralsociety.org/.

Funding for this project was provided through a Watershed Restoration 319(h) Grant from the New Jersey Department of Environmental Protection (Grant #RP11-038)

Native Plant Material Used


PENSTEMON DIGITALIS


HELIOPSIS HELIANTHOIDES


ASCLEPIAS SYRIACA


POLYGONUM PENSYLVANICUM


LIATRIS SPICATA


ASCLEPIAS TUBEROSA


RUDBECKIA FULGIDA


LOLIUM MULTIFLORUM


CHELONE GLABRA


SCHIZACHYRIUM SCOPARIUM


MONARDA DIDYMA


ELYMUS VIRGINICUS


SENNA HEBECARPA

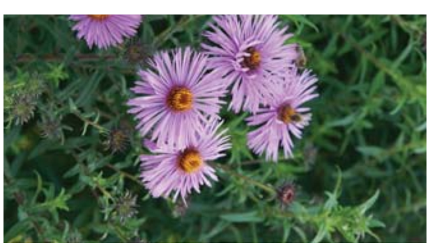

MONARDA PUNCTATA


EUPATORIUM PERFOLIATUM


SOLIDAGO RUGOSA


PANICUM DICHOTOMIFLORUM


EUTROCHIUM FISTULOSUM

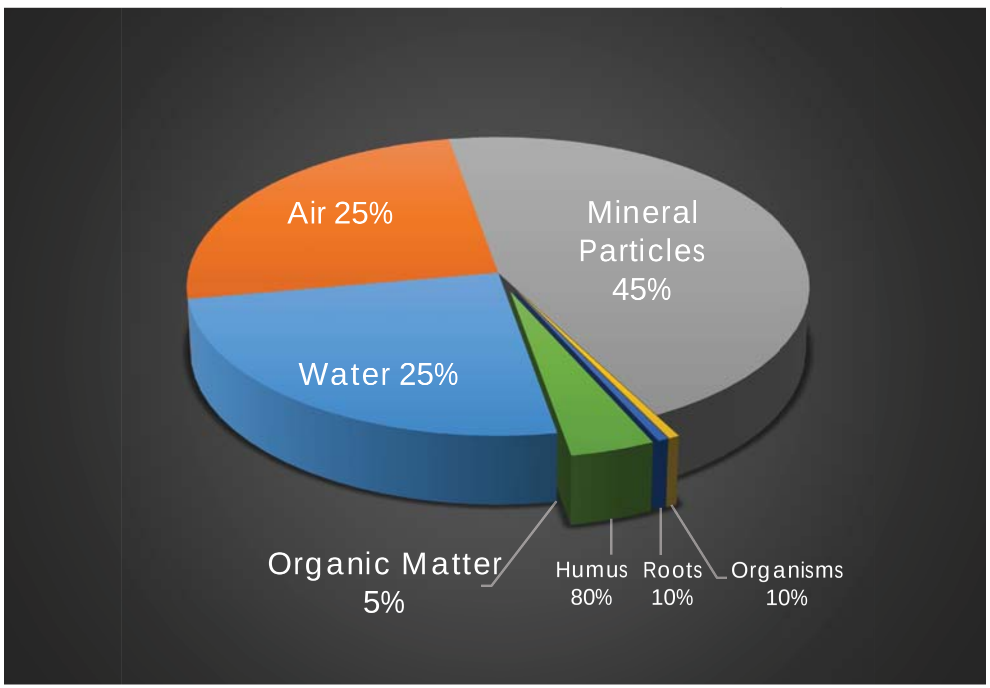

SYMPHYOTRICHUM NOVAE-ANGLIAE

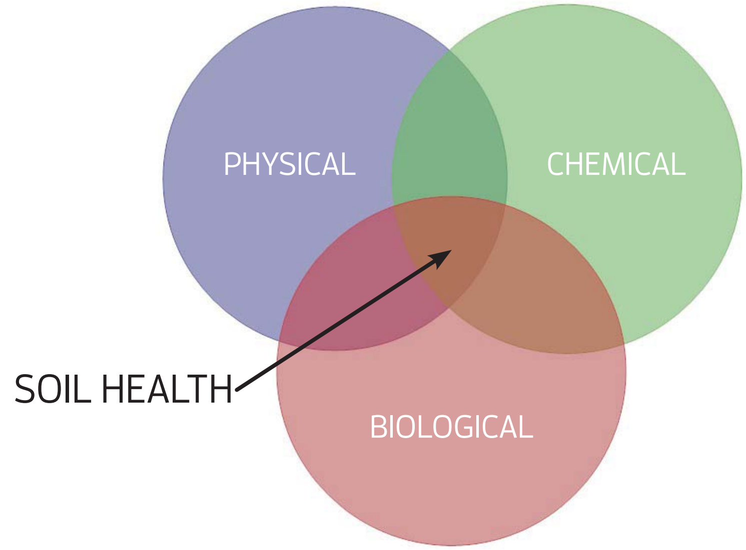

PANICUM VIRGATUM


HELENIUM AUTUMNALE

Soil is a living, dynamic resource that supports life. Soil is healthy if it breathes, transforms nutrients, interacts with the environment, and purifies toxic substances. Healthy Soil is imperative for the successful implementation of "low impact development" and "green infrastructure" improvement projects within the Barnegat Bay watershed and elsewhere. We depend upon soil to perform vital environmental functions that result in clean air, clean water, diverse wildlife habitat and beautiful landscapes. Soil acts as a filter as it regulates the flow and storage of nutrients, pesticides and other compounds that are dissolved in water.

Soil types vary from place to place and each type has both inherent and dynamic properties that set them apart. Inherent properties reflect the natural ability of soil to function based on what it was "born with" through soil formation such as; parent material, climate, texture, drainage class or depth to bedrock. These properties are not easily changed or altered by use and management. In contrast, dynamic soil properties reflect human induced changes and are related to how the soil is managed.





Healthy Soil is comprised of about 45% mineral particles (sand, silt, & clay), 25% water, 25% air, and 5% organic matter. Organic matter, although least in overall percentage, is necessary for all soil function and is the most important indicator of Soil Health. It is comprised of living and dead organisms, fresh plant residue, decomposing organic matter and stabilized humus. Organic matter holds 18-20 times its weight in water and recycles nutrients for plants to use. It is estimated that a soil containing just 1% organic matter can hold 27,000 gallons of water within the top six inches of soil per acre! Soil that can store water reduces the need for supplemental irrigation and allows for the recharge of groundwater supplies while abating salt water intrusion.

Soil has biological, chemical and physical properties that are always changing and it is the synergy of these properties that allow soil to function to the greatest environmental potential. Soils that support all three properties are more resilient in times of natural disasters such as flooding and extreme weather events.

Soil should be tested by a reputable soil testing lab to better understand the physical, biological and chemical soil limitations and opportunities prior to soil restoration.


Shallow Root Development

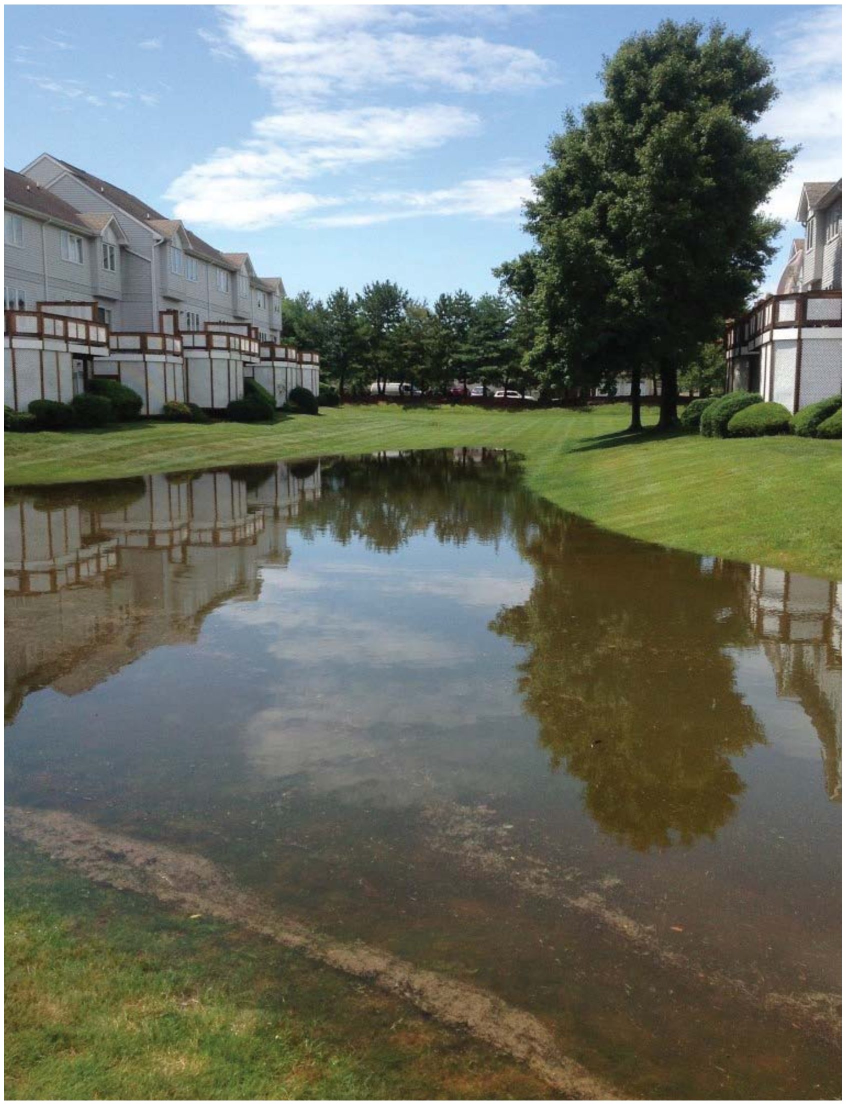
Soil compaction is a physical soil property that affects soil function, plant growth, organic matter content, aeration, water storage, resistance to erosion, root proliferation, plant diversity, surface sealing and organism movement. Compaction is a common problem in developing watersheds and can occur during construction activities or while working the soil when it is too wet. Compaction eliminates essential pore spaces within the soil profile and reduces the soils natural ability to exchange gasses, support plant life, uptake nutrients, drain and infiltrate water. Saturated soils are more prone to compaction as the soil pore spaces are filled with water and are not able to resist the downward forces of pressure exerted upon them by heavy machinery or foot traffic.

It is sometimes necessary to mechanically break up compacted soil with tillage machinery, when the soil is dry, in order eliminate the compaction and improve soil function. However, tilling or inverting the soil regularly is detrimental in that it negatively impacts soil structure and should be done judiciously. Organic matter in the form of compost can be mixed into the soil to provide habitat for a diversity of soil microbes that have a positive effect on the soil structure and nutrient utilization. Increased utilization of soil nutrients prevent leaching that could potentially contaminate groundwater supplies or cause eutrophication of surface waters. Restored ground surfaces should be left in "rough" or uneven condition after land grading to encourage infiltration into the loosened soil. Planting diverse, native plants eliminate the need for supplemental fertilizer and pesticides as these plants have evolved to grow in natural conditions. Native plants also provide crucial habitat. Once roots grow deep into the soil, the biological, chemical and physical properties of the soil begin to positively change, thus creating essential pore spaces for nutrients, air and water to flow freely.


Deep Root Development

Demonstration Project: Laurel Commons Homeowner Association

Improvement: Conversion of standard, grassed detention basin to naturalized bio-rentention basin
Cost: Low
Water Quality Benefit: High
Flooding Benefit: High
Habitat Benefit: High
Maintenance Requirement: Moderate



Laurel Commons is a privately owned and maintained facility located in a very flat grassed area situated between three clusters of townhomes. This area receives stormwater from the surrounding areas before it reaches a stormwater management basin to the northeast of the site. The drainage area to this grassed area is approximately 5 acres, encompassing both A and B type soils. The existing soil conditions include a grassy sod on top of a hardpan layer, underlain with a very sandy soil. Subsequently, stormwater in this area does not drain well due to this hardpan layer, which prior to renovation, resulted in standing water and saturated conditions.

The proposed conditions included retrofitting this basin area to provide better infiltration and overall water quality while improving aesthetics. These improvements included amending the soil, implementing weirs, providing native plantings, and "no-mow" zones while keeping gardening to a minimum. The soil amendments will provide conditions more conducive to infiltrating stormwater. The weirs will provide an increase in water quality by facilitating infiltration of the stormwater into the amended soils. The native plantings and designated "no-mow" zones provide for water quality, aesthetics and habitat creation. The project's total area of disturbance is less than 30,000 square feet. Overall, this basin retrofit project has resulted in increased overall water quality and aesthetics of this area and decreased flooding events

Soil amendments included the placement of two (2) to three (3) inches of leaf compost spread evenly over the soil amendment area. The leaf compost was comprised of exclusively fallen deciduous leaves with less than 5% dry weight of woody or green yard debris materials. The compost was also specified to be matured (i.e., composted for a period of at least one [1] year) and was required to exhibit no further decomposition and be free of weed seed stock. Visual appearance of leaf matter in the compost was not acceptable. The soil amendment area was then plowed with a bottom plow to a minimum depth of twelve (12) inches. Following this step, the soil amendment area was then rototilled to a minimum depth of six (6) inches.

A 90% decrease in TSS is anticipated in this basin. Nutrient loads are also expected to decrease, with a 60% decrease is expected in phosphorous levels along with a 30% reduction in nitrogen concentrations. Prior to the retrofit of this area, percolation rates were less than half an inch per hour. Post retrofit, percolation rates have increased to greater than ten (10) inches per hour.

Demonstration Project: Community Medical Center

Improvement: Improvement of standard stormwater outlet with bio-swale. Creation of native plant garden with installation of eco-pavers
Cost: Low
Water Quality Benefit: High
Flooding Benefit: High
Habitat Benefit: High
Maintenance Requirement: Moderate

This project is located in the premises of the Community Medical Center in the Township of Toms River, Ocean County, New Jersey. The project site is located in a very flat grassed area, situated between a parking garage, and a large traditional parking lot. This area receives stormwater from the surrounding area and used to drain into a type "E" inlet surrounded by gravel, and a type "A" inlet that drained to an existing stormwater conveyance system.

The proposed conditions included retrofitting the existing stormwater system to become a bioretention basin aimed at improving overall water quality while improving aesthetics. These improvements included removing the impervious patio area and gazebo, replaced with eco-pavers with benches and creating a garden bed, removing an old inlet and providing native plantings in a low lying area to encourage infiltration, while keeping grading to a minimum. The native plantings also provide processes for water quality and aesthetics. The project's total area of disturbance was approximately 8,500 square feet (0.20 acres). Overall, this basin retrofit project was designed to increase pollutant removal efficiency, enhance its aesthetics and reduce total maintenance needs

A 90% decrease in TSS is anticipated in this basin. Nutrient loads are also expected to decrease, with a 60% decrease is expected in phosphorous levels along with a 30% reduction in nitrogen concentrations.

Demonstration Project: Toms River High School North

Improvement: Installation of multiple MTD's, (underground vault, Filterra units, stormwater planters) creation of Rain Garden and native plant garden.
Cost: High
Water Quality Benefit: High
Flooding Benefit: Low
Habitat Benefit: Moderate
Maintenance Requirement: Moderate

This project at Toms River High School North in the township of Toms River, NJ included the installation of five stormwater management structures, and was part of a larger series of projects aimed at improving stormwater management practices in the Long Swamp Creek watershed. With the implementation of these structures at Toms River High School North, potential sources of eutrophication will be removed before entering the ecosystem. These structures include the following.

Manufactured Treatment Device:

In order to increase pollutant removal efficiency, a Manufactured Treatment Device was implemented in the southeastern portion of the site, located between multiple parking lots. The MTD chosen for this element was the Vortechs 16000 which is a hydrodynamic separator that combines swirl concentration and flow controls that traps and retains trash, debris, sediment, and hydrocarbons from stormwater runoff. The installation of this MTD allows for excess sediment to settle within its compartments, which results in a reduction of total suspended solids, and is anticipated to remove 50% of the TSS entering the system.

Planter Boxes:

Two 350 square foot Filterra stormwater planter boxes were installed at the central portion of the site between the school building and the parking lot, connected to the existing storm sewer, then planted with native perennials to increase nutrient uptake and infiltration.

Filterra Unit:

A 91 square foot Filterra tree box was installed in the southern portion of the site between a parking lot and the tree line, connected to the existing catch basin, and planted with two trees. The installation of this MTD allows for excess sediment in the water to settle, and is anticipated to remove 80% of the TSS entering the system.

Rain Garden:

A 2,200 square foot rain garden was installed in the northwestern portion of the site location, adjacent to the northernmost parking lot. A basin was created by adding amendments to the soil to the appropriate elevations, removing existing vegetation, and installing layers of new material, including gravel, sand and soil to increase infiltration rates. The site was then replanted with new native vegetation, providing habitat for pollinators and birds.

Demonstration Garden:

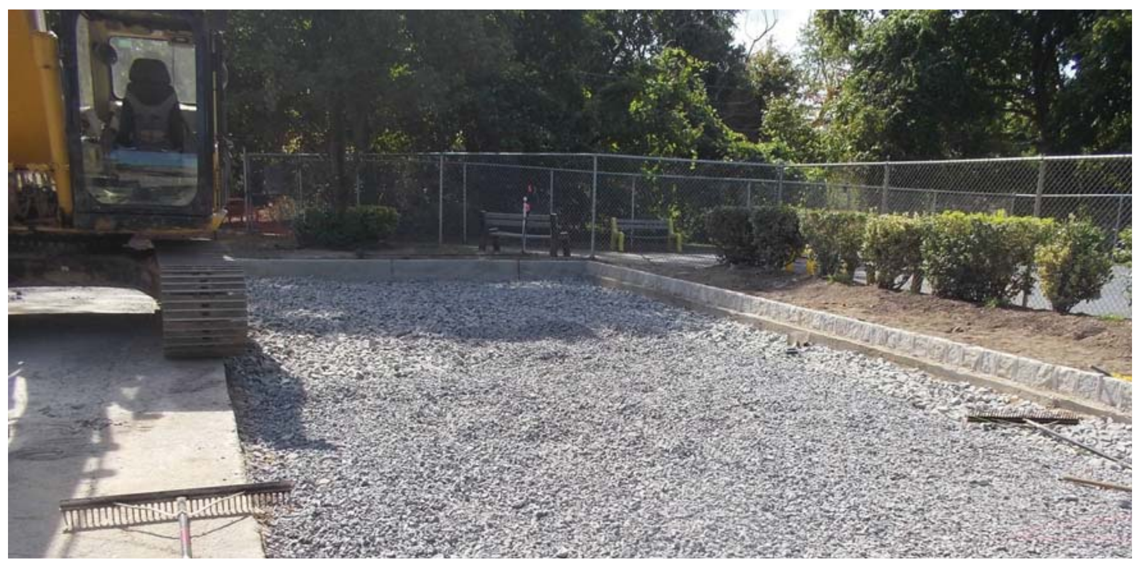
A Bayscape demonstration garden was implemented in the western portion of the project location. This garden is located next to a parking lot, directly behind home plate of the baseball field. This native plant demonstration garden acts as a rain garden would, collecting the adjacent runoff from the parking lots and fields to increase water quality while creating habitat for pollinators and birds.

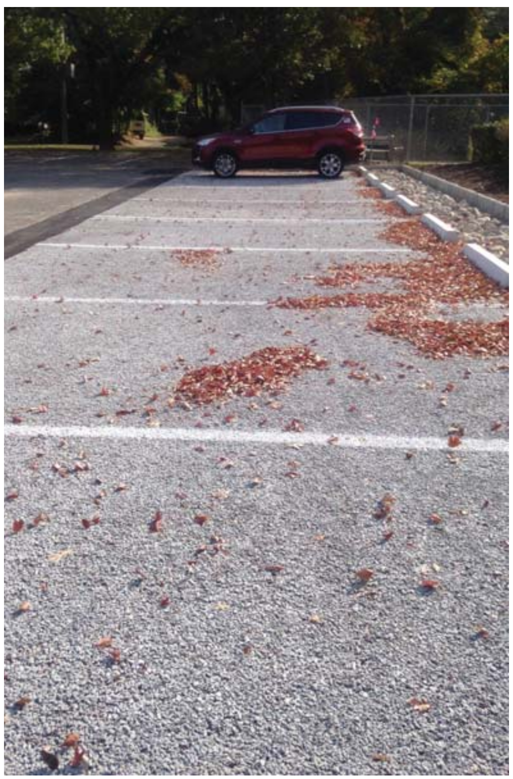
Demonstration Project: Toms River Board of Education (1144 Hooper Ave)

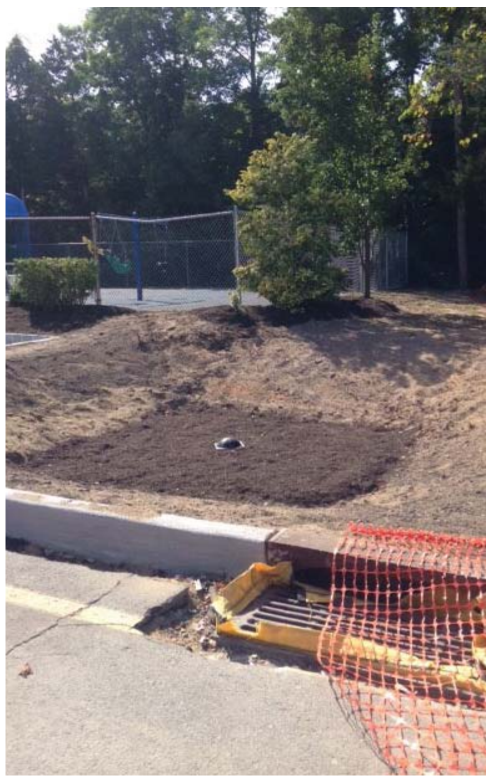
Improvement: Installation of MTD's, porous pavement and naturalized bio retention basin
Cost: Moderate
Water Quality Benefit: High
Flooding Benefit: Moderate
Habitat Benefit: Moderate
Maintenance Requirement: Low

This project at Toms River Board of Education in the township of Toms River, NJ included the installation of three stormwater management structures to accommodate stormwater inputs from building and parking impervious surfaces at the site. By implementing these structures at Toms River Board of Education, potential sources of eutrophication will be removed before entering the ecosystem.

Manufactured Treatment Device:
In order to increase pollutant removal efficiency, a Manufactured Treatment Device was implemented in the southeastern portion of the site, located between multiple parking lots. The MTD chosen for this element was the Vortechs 9000, which is a hydrodynamic separator that combines swirl concentration and flow controls that traps and retains trash, debris, sediment, and hydrocarbons from stormwater runoff. The installation of this MTD allows for excess sediment to settle within its compartments, which results in a reduction of total suspended solids, and is anticipated to remove 50% of the TSS entering the system. As this MTD is in the lower elevations of this location, it acts as a last resort of stormwater treatment before entering the nearest waterbody, Long Swamp Creek.







Porous Pavement:

In order to increase infiltration of stormwater into the ground, porous pavement was implemented in the southwestern portion of the site, adjacent to the playground. The porous pavement consisted of Portland cement, open-graded aggregate and water, which allows for water to infiltrate in parking lots and reduces the increased flow rates and pollutants associated with paved areas. The aggregate material below the paved area allows for further infiltration.

An 80% decrease in TSS is anticipated in this basin along with a volume reduction that distributes more runoff to the groundwater instead of directly into the waterbodies. Nutrient loads are also expected to decrease. A 60% decrease is expected in phosphorous levels, along with a 50% reduction in nitrogen concentrations.

Rain Garden:

A rain garden was installed in the western portion of the site location, and was designed to intercept stormwater that was not captured by the porous pavement. A basin was created by excavation and grading, and layers of new material were installed, including gravel, sand and soil to increase infiltration rates. The site was then mulched and replanted with new native vegetation to create habitat for pollinators and birds.

Demonstration Project: Bey Lea Golf Course

Improvement: Reduction of non-point source pollution through Bay-Friendly land and turf management methods
Cost: Low
Water Quality Benefit: High
Flooding Benefit: Low
Habitat Benefit: Moderate
Maintenance Requirement: Moderate

Located on 130 acres in Toms River Township, Bey Lea Golf Course is a former farm that was developed into a golf course in 1969 through a grant from the New Jersey Green Acres Program. The Township of Toms River, which owns and operates the course, is dedicated to providing its residents with a great golfing experience for reasonable rates while being good stewards of the Barnegat Bay.

The first step in managing a golf course is to understand the surrounding area – its population, local economy, and environmental considerations. The second step is to develop a turf management program that will work within the specific local environmental and financial constraints and provide golfers with a high quality golfing experience.

- 25 Acres "No Mow" Naturalized Areas
- Native Plant Buffers around Water Features
- Fertilizer Applications and Turf Maintenance based on Turf Demands

The following goals shape the turf management program at Bey Lea:

1. Establish only drought-tolerant perennial grasses that require less fertilizer.
2. Develop a fertilizer program based on plant needs, physical properties of the soil, and the site-specific location, keeping in mind that excess fertilizer can be carried by stormwater into our local waterway, the Long Swamp Creek, and then into the Barnegat Bay.
3. Reduce fertilizer, pesticide, and mechanical inputs (i.e., mowing) whenever possible.
4. Never allow soil to reach field (water-holding) capacity when irrigating turf areas. Not only are playing conditions better when the turf is run drier, but it also improves infiltration of rainfall into the soil and reduces stormwater runoff. Better water management (i.e., drier turf) also reduces turf disease, which in turn means reduced pesticide usage.

Bey Lea is recognized as the "Gold Standard" level certification for maintaining its turf for their needs while reducing the amount of nitrogen fertilizer they apply to the turf. They also protect water features with native plant buffers throughout the site which further reduces the amount of non-point source pollution entering the Long Swamp Creek.

Thank you for reviewing our Clean Water Beautiful Bay Technical Publication. We hope the information and projects provide useful information and motivate you to implement steps to achieve cleaner water in your community. The improvements showcased in this publication were made possible by funding provided through a Watershed Restoration 319(h) Grant from the New Jersey Department of Environmental Protection for Implementation of Stormwater Management Strategies to Long Swamp Creek, Lower Toms River and Barnegat Bay to reduce non-point source pollution entering these waterbodies. To find out more information about how green infrastructure stormwater management can succeed in your community or to ensure MS4 permit compliance in your municipality you can visit the following NJDEP web resource pages:

New Jersey Division of Water Quality – Bureau of Nonpoint Pollution Control: http://www.nj.gov/dep/dwq/msrp_home.htm

NJDEP's stormwater index: http://www.nj.gov/dep/dwq/fd.htm

Green Infrastructure in New Jersey – What is Green Infrastructure?: http://www.nj.gov/dep/gi/

Created by the American Littoral Society and Princeton Hydro LLC.

Funding for this project provided through a Watershed Restoration 319(h) Grant from the New Jersey Department of Environmental Protection (Grant # RP11-038)