

Lake Plan Development and Implementation

1. Update and Quantify the Internal Phosphorus Load and Implement Four Projects to Reduce Phosphorus in Lake Hopatcong

Grantee: Lake Hopatcong Commission

Funding amount: \$206,000

In the summer of 2019, Lake Hopatcong experienced severe, long-lasting HABs that negatively affected the lake's ecology, recreational uses, and surrounding local economies. In contrast to some large, deep lakes in the State where HABs lasted only a few weeks, in Lake Hopatcong they persisted well into October. While external nutrient loading from stormwater runoff is an important contributing factor to HABs, the durability of the 2019 Lake Hopatcong HABs suggests that internal nutrient loading, particularly of phosphorous, may play a significant role in HAB onset and duration. Lake Hopatcong's internal total phosphorous loading was last quantified in 1983.

To better understand the role of internal nutrient loading in HAB events, the Lake Hopatcong Commission will conduct a refined quantification of Lake Hopatcong's internal phosphorus load using a combination of existing water quality data, additional water quality sampling, and modeling. The results of this assessment will be used to determine if steps should be taken to reduce the internal phosphorous load through in-lake management efforts, and if such efforts would be cost effective.

Lake Hopatcong Commission will also implement nonpoint source pollution reduction projects in the Lake Hopatcong watershed, including the installation of floating wetland islands, shoreline stabilization with native plants, the replanting of stormwater basins, and maintenance of existing Filterra boxes to optimize stormwater filtration.

2. HAB Prevention: Green Infrastructure Improvements and Stormwater Control at the Lee's Marina County Park

Grantee: Morris County Park Commission

Funding amount: \$495,000

In the summer of 2019, Lake Hopatcong experienced a severe, long-lasting HAB which was likely facilitated by elevated concentrations of total phosphorous, the primary limiting nutrient for freshwater cyanobacteria. The prevention of future HABs depends on the reduction of total phosphorous inputs to Lake Hopatcong.

To this end, Morris County Park Commission (MCPC) will install several major green infrastructure features at Lee's County Park Marina on the shores of Lake Hopatcong in Mount Arlington Township. In the marina's current condition, stormwater from surrounding roadways drains across the marina and enters Lake Hopatcong untreated. MCPC will install curb cuts and grading improvements to direct stormwater runoff to five bioretention basins, where phosphorous as well as nitrogen, total suspended solids, and other pollutants can be filtered.

Additionally, eight stormwater inlets to Lake Hopatcong will be retrofitted with manufactured treatment devices for removal of nutrients and sediments.

These green infrastructure installations will improve existing surface water quality impairments, decrease the volume of runoff discharged from the marina and surrounding roadways to Lake Hopatcong, and reduce the associated pollutant loads of phosphorus, total suspended solids, and nitrogen. Additionally, given the public accessibility of Lee's Marina, this project will be a valuable opportunity for public education on the uses of green infrastructure for stormwater management.

3. Watershed Restoration and Protection Plan for Budd Lake

Grantee: Raritan Headwaters Association

Funding amount: \$49,000

Budd Lake is a 374-acre glacial lake located in Mount Olive Township, Morris County. Situated in the headwaters of the South Branch Raritan River, Budd Lake is widely used by the public for fishing, swimming, and boating. Roughly half of the land surrounding the lake is undeveloped and protected, while the other half is categorized as urban land use.

The goal of this project is to develop a Watershed Restoration and Protection Plan for Budd Lake and its watershed that addresses nutrient inputs that contribute to HABs and pathogen loading. A 2007 TMDL for Budd Lake requires a 98.94% reduction in pathogen loading from internal and external sources; additionally, nutrients carried by stormwater runoff likely contributed to a harmful algae bloom (HAB) event in the summer of 2019. A Watershed Restoration and Protection Plan will be a blueprint for achieving pathogen reductions and reducing the impacts of stormwater runoff.

The plan will contain the US Environmental Protection Agency's (EPA) nine components of a watershed restoration and protection plan. There will also be a strong educational and outreach component to engage the community to assist with plan development and encourage municipal support and participation in plan implementation. Raritan Headwaters Association will work closely with the Rutgers Cooperative Extension Water Resources Program and Mount Olive Township to complete the plan and engage local stakeholders.

4. Creation of a Lake Protection and Watershed Management Plan for Lake Topanemus *Grantee:*

Lake Topanemus Park Commission

Funding amount: \$96,000

Lake Topanemus is a 21-acre man-made lake in Freehold Township, Monmouth County, where it is a popular destination for fishermen, joggers, and nature enthusiasts. The surrounding area, designated Lake Topanemus Park, is maintained by the Lake Topanemus Park Commission.

Water quality issues including eutrophication, elevated nitrogen and phosphorous levels, sediment accumulation, and dense aquatic macrophyte growth have been documented in Lake Topanemus as early as a 1983 DEP lake management study and confirmed as recently as a 2010 US Army Corps of Engineers assessment and 2018 DEP Watershed Ambassador study. Additionally, the lake and its watershed both possess a TMDL for total phosphorus and fecal coliform, respectively. This project aims to update the existing characterization study from 1983, as well as identify the steps necessary for future restoration and management. The result of this project will be a Lake Protection and Watershed Management Plan based on USEPA's nine minimum components of watershed planning, which will guide lake management activities undertaken by the Lake Topanemus Park Commission.

5. Watershed Restoration and Protection Plan for the Spruce Run Watershed

Grantee: New Jersey Water Supply Authority

Funding amount: \$80,000

The Raritan Basin Water Supply Complex is comprised of Spruce Run Reservoir, Round Valley Reservoir and the Delaware and Raritan Canal, and provides the basic source of water supply to public and private water utilities for more than 1,500,000 people in central New Jersey. Spruce Run Reservoir, the third largest reservoir in the state, stores 11 billion gallons, and is fed by Mulhockaway Creek and Spruce Run Creek.

Spruce Run Reservoir and several of its tributaries have experienced severe HABs in recent years, most notably in the summer of 2019 and the fall of 2018. Although the Spruce Run Reservoir and its tributaries are attaining total phosphorous criteria, the length and scope of the Reservoir's blooms indicate that internal and external nutrient loading are contributing to HAB severity.

To address reduce nutrient loads contributing to HAB events in Spruce Run, as well as existing bacterial impairments, the New Jersey Water Supply Authority (NJWSA) will develop a watershed restoration and protection plan for three HUC14 subwatersheds that drain to Spruce Run Reservoir—Spruce Run Creek, Willoughby Brook and Rocky Run—and the reservoir itself. These watersheds drain the northern portion of the Spruce Run Reservoir watershed in Hunterdon and Morris Counties and encompass approximately 15.5 square miles of land and 21.2 miles of streams.

Under this grant, NJWSA, their consultant and stakeholders will characterize environmental conditions and the regulatory framework, characterize nonpoint source loading and needed reductions, perform limited field reconnaissance, and identify watershed restoration strategies. The internal total phosphorous load for the Reservoir will be calculated. This information will be compiled into a nine minimum element watershed restoration and protection plan to protect source water quality and reduce the occurrences of HABs in the Reservoir.

6. Development of a Lake Protection and Watershed Management Plan for Twilight Lake, Ocean County, NJ

Grantee: Borough of Bay Head

Funding amount: \$85,000

Twilight Lake is a saline, tidally influenced waterbody located in the Borough of Bay Head, Ocean County. Twilight Lake is a tributary of Bay Head Harbor and ultimately, Barnegat Bay. The lake is enjoyed by locals as a spot for kayaking, paddle boarding, and fishing for crabs, catfish, and white perch. In recent years, Twilight Lake has experienced excessive aquatic plant and algae growth, pockets of accumulated sediment, and significant shoreline erosion. Additionally, the tributary connecting Twilight Lake to Bay Head Harbor is subject to a fecal coliform TMDL to address non-attainment of the shellfish harvesting designated use.

The outcome of this project will be a Twilight Lake Protection and Watershed Management Plan, based on the nine minimum elements of EPA-approved watershed management plans. This plan will enable the Borough of Bay Head to properly identify, design, and implement future restoration activities in Twilight Lake, which will address existing impairments and emerging threats to water quality.

7. Swartswood Lakes Nonpoint Source Watershed Management Plan

Grantee: Swartswood Lakes and Watershed Association

Funding amount: \$40,000

Swartswood Lakes and Watershed Association (SLWA) is a 501(c)(3) organization that was created to protect and restore Swartswood Lake and Little Swartswood Lake, and works in cooperation with Swartswood State Park, NJDEP and other stakeholders to protect the resources of the Swartswood Lakes and their watershed. The Swartswood Lakes themselves are a regionally important summer tourism location.

Substantial water quality restoration work was performed in Swartswood Lake between the 1980's and 2007 to address nuisance plant growth and algae blooms, reduced dissolved oxygen, loss of water clarity, and fishery deterioration; these deteriorations in lake water quality were a major detriment to the public, as the Swartswood Lakes are the central component of the popular Swartswood State Park system. Since 2017, recurrent HABs have presented a new threat to the water quality of the Swartswood Lakes and spurred SLWA to consider additional planning and lake management measures.

This project will use available information and data, as well as new water quality sampling, to develop a watershed restoration and protection plan for the Swartswood Lakes that includes the nine minimum components required by the EPA. The plan will identify pollutant sources and provide recommendations to reduce pollutant loading from sources both external and internal, and serve as the blueprint for future restoration activities in the Swartswood Lake

watershed. Development of this plan will be carried out in conjunction with a second DEP Water Quality Restoration grant, which will examine maintenance or replacement of Swartswood Lake's aeration system.

SLWA had also proposed to undertake hydro raking and aquatic weed removal as part of this grant at a substantially higher cost. Taking into account the second grant awarded to SLWA for aeration system replacement and funding priorities in other watersheds, the Division opted to fund only the planning component of this proposal.

8. Swartswood Lake Aeration System Investigation and Upgrade

Grantee: Swartswood Lakes and Watershed Association

Funding amount: \$270,000

Swartswood Lakes and Watershed Association (SLWA) is a 501(c)(3) organization that was created to protect and restore Swartswood Lake and Little Swartswood Lake, and works in cooperation with Swartswood State Park, NJDEP and other stakeholders to protect the resources of the Swartswood Lakes and their watershed. The Swartswood Lakes themselves are a regionally important summer tourism location that experienced two short-lived HABs in the summer of 2019.

A key component of SLWA's lake management strategy is the maintenance of an aeration system. This system helps to maintain proper dissolved oxygen levels during the summer months, prevents water from stagnating, discourages nuisance algae growth, and helps to maintain proper water chemistry for the breakdown and consumption of nutrients by microorganisms. Aeration is also shown to discourage conditions conducive to HAB formation.

The aeration system currently in place in Swartswood Lake is 27 years old. This grant will fund the inspection of Swartswood Lake's existing aeration system, supplemental water sampling to assess the performance of the current system, and the execution of necessary repairs to or replacement of the existing system. This grant will be implemented in conjunction with a second SLWA grant for the development of a lake protection and watershed management plan for Swartswood Lake.

Watershed Based Plan Development

9. Update and Expansion of the Musconetcong River Watershed Protection and Restoration Plan

Grantee: Musconetcong Watershed Association

Funding amount: \$126,000

The Musconetcong River Watershed is one of the five sub-watershed basins in the Upper Delaware water region and is a major tributary to the Delaware River, comprising 156 square

miles and portions of 26 municipalities. The primary objective of this project is to update and expand the “2012 Musconetcong River Restoration and Protection Plan – Hampton to Bloomsbury,” to include four additional HUC14 sub-watersheds.

The 2012 plan recognized twelve areas of implementation projects. Since the approval of the plan, half of these projects have been implemented, including cover crops, green infrastructure, addressing illicit connections, agricultural vegetative buffers, and cattle stream crossings on dairy farms. The 2012 plan has already produced real results, including the case of a targeted tributary in which bacteria levels were reduced by 95% as a result of partnership work with agricultural landowners.

Due to extensive implementation of the 2012 plan, the Musconetcong Watershed Association will update and expand the existing plan to four upstream HUC14's, which encompass the areas of greatest urbanization and opportunity for additional best management practice (BMP) implementation in the watershed. This plan extension will conform with the criteria for USEPA nine element watershed management plans. When implemented, this plan expansion will guide efforts to reduce fecal coliform loading pursuant to the Musconetcong River watershed's fecal coliform TMDL, improve benthic macroinvertebrate communities, and address pH impairments. The scope of work includes targeted sampling and technical studies to determine pollutant sources, modeling to determine overall reductions from proposed BMPs, and an education and outreach program targeting key stakeholders.

10. Watershed Restoration and Protection Plans for Miry Run Watershed and Doctors Creek Watershed

Grantee: Rutgers, The State University of New Jersey

Funding amount: \$170,000

The Miry Run and Doctors Creek watersheds are located in the Upper Delaware water region, spanning portions of six municipalities in Mercer and Monmouth Counties. These watersheds are both dominated by agricultural and urban land uses, and both possess a total phosphorous TMDL. While the TMDL documents do not identify specific phosphorous sources, nonpoint sources are the likely primary contributors to phosphorous impairments in the three HUC14s comprising these watersheds. The purpose of this project is to develop Watershed Restoration and Protection Plans for the Miry Run and Doctors Creek watersheds, which will facilitate attainment of the required reductions in total phosphorus loading. One of the main goals of these plans will be to identify specific pollutant sources and recommend stormwater management practices to reduce pollutant loading.

Both Watershed Restoration and Protection Plans will satisfy the nine minimum elements required by EPA's watershed planning process. The plans will address nonpoint source pollution throughout the entire watersheds, with special attention towards leveraging an existing partnership between the Rutgers Cooperative Extension's Water Resources Program and Hamilton Township in Mercer County, which has already produced a floodplain management

plan, a municipal stormwater management plan, a database of stormwater infrastructure, and an impervious cover assessment.

Watershed Based Plan Implementation

11. Upper Paulins Kill Headwaters Lakes Initiative

Grantee: Sussex County Municipal Utilities Authority

Funding amount: \$190,000

In 2012, the Sussex County Municipal Utilities Authority (SCMUA) finalized the development of a DEP-approved Watershed Restoration and Protection Plan for the Upper Paulins Kill Watershed. Over the course of the past eight years, SCMUA has worked to successfully leverage DEP 319(h) funding to implement components of this plan, including the establishment of the SCMUA's stormwater management program and the installation of high-visibility green infrastructure projects throughout Newton and Hampton Townships. The success of these projects led to an infusion of funding from the William Penn Foundation and National Fish and Wildlife Foundation as part of the Delaware River Watershed Initiative (DRWI) that helped the SCMUA establish its "Paulins Kill Lakes Initiative" focus area and obtain funding to construct additional green infrastructure demonstration projects at Culver, Kemah, and Crandon Lakes.

SCMUA will use this grant to build upon the momentum of these past projects. This grant is composed of three work areas: the Upper Paulins Kill Lakes Community Rain Garden Assistance Program; a floating wetland islands pilot program; and an emerald ash borer tree canopy replacement and resiliency program.

The rain garden assistance program will incentivize green infrastructure adoption in Paulins Kill watershed lake communities, which will combat nonpoint source pollutant loading and aid in HAB prevention. This program will be carried out in partnership with the Rutgers Cooperative Extension, which has years of experience in residential rain garden installation.

Floating wetland islands will also be installed in Kemah Lake, Culvers Lake, and Lake Owassa in the Paulins Kill River watershed; these floating vegetation communities will filter and assimilate nonpoint source pollutants from the waters of these three lakes.

Finally, the emerald ash borer tree canopy replacement program will work with interested Paulins Kill watershed residents to replace ash trees killed by the invasive emerald ash borer. This program will increase native tree diversity within the lakeshed canopy while replacing, in part, the water filtration services provided by ash trees lost in this watershed.

12. Data to Action: Tracking Sources of Bacteria in the Musconetcong Watershed to Guide Water Quality Restoration and Protection Actions

Grantee: Montclair University

Funding amount: \$353,000

Located in northwest New Jersey, the Musconetcong River watershed is 156 square miles in size, mostly comprised of agricultural, forest, wetland and water land cover, and is located in the Upper Delaware water region. While the Musconetcong River possesses exceptional ecological and cultural value—for example, 24 miles belong to the National Park Service’s National Wild and Scenic River System—the Musconetcong River is subject to a TMDL for fecal coliform, which requires a 93% reduction in nonpoint source fecal coliform loads.

In 2018, Montclair University partnered with the Musconetcong Watershed Association and North Jersey Resource Conservation & Development Council to assess reductions of fecal coliform levels in the lower portion of the TMDL area following ten years of BMP implementation. The results of this study indicated a significant reduction of fecal coliform in the lower TMDL area compared to 2007 levels. This study also used microbial source tracking to identify specific sources of the remaining fecal contamination, revealing the majority of remaining contamination to be of human origin, with secondary contributions from cows and wildlife. The results of that study are now informing source reduction and BMP implementation in the affected subwatersheds.

The 2018 study only focused on the lower portion of the TMDL area. This project will implement a similar study in the upper portion of the Musconetcong River’s TMDL area to assess source reduction progress, identify remaining contaminant sources, and tailor future BMP implementations to those sources. Montclair University will use existing relationships with practitioners in the Musconetcong River watershed to disseminate project results and develop water quality restoration and protection actions. The ultimate goal of this project is to pursue de-listing this section of the Musconetcong River from the 303(d) list.

13. Crops, Dairy and Livestock: On-Farm Strategies to Protect Water Quality

Grantee: North Jersey Resource Conservation & Development Council, Inc.

Funding amount: \$740,000

Recognizing that agricultural BMPs provide immense water quality benefits but may be cost-prohibitive for individual farmers to implement, North Jersey Resource Conservation & Development Council (NJRCDC) will use DEP Water Quality Restoration Grant funding to implement agricultural BMPs on farms across Hunterdon, Sussex, and Warren Counties. DEP funds will be leveraged with funding from USDA cost share programs, which provide additional financial support to participating agricultural landowners for BMP implementation.

NJRCD has identified four cattle and dairy operations where the implementation of livestock management practices will substantially reduce impacts to water quality. Farmer commitment letters and enrollment in a USDA cost share program have already been confirmed for all four projects, and all four sites are located in watersheds with an EPA-approved watershed management plan. Each project includes multiple BMPs, including manure management and storage improvements, livestock stream crossings and exclusions, riparian buffer restorations, and various barnyard runoff controls.

Additionally, NJRCD will subsidize landowner participation in no-till agriculture and cover cropping, continuing a successful program initiated under previous Water Quality Restoration grants. NJRCD has identified “priority watersheds” within the Upper Delaware water region where the highest water quality benefits can be obtained with the available funds. Within these priority watersheds, NJRCD estimates that proposed educational programs and BMP implementation incentives will stimulate long-term agricultural management improvement and annually reduce total suspended solids and phosphorous loading by at least 500 tons and 10,000 pounds, respectively.

Climate Change Resiliency

14. Lighthouse Center Enhancement & Rejuvenation Program: Shoreline Stabilization and Rejuvenation

Grantee: Natural Resource Education Foundation of New Jersey

Funding amount: \$300,000

The Lighthouse Center for Natural Resource Education (LHC) is an environmental education and research center located in Ocean Township, Ocean County, and is situated on one of the last undeveloped bayfront tracts in Barnegat Bay. Through a lease agreement with the DEP’s Division of Fish and Wildlife, the LHC is operated by the Natural Resource Education Foundation of New Jersey (NREFNJ), a non-profit 501(c)(3) corporation.

The LHC encompasses 194 acres of diverse coastal habitats, which have suffered extensive degradation over the past 50 years, predominantly due to historic mosquito control practices, sea level rise, significant climatic events such as Hurricane Sandy, and chronic boat wake action. Along portions of the shoreline, the rate of shoreline loss since 1995 has averaged approximately 3-4 feet per year. Shoreline degradation has also increased the LHC’s vulnerability to severe storm events.

This grant will fund execution of a living shoreline project on the LHC property, design for which has already been completed by NREFNJ and received partial grant funding from The Nature Conservancy. This living shoreline project will restore salt marsh habitats along the LHC waterfront, which will in turn help to protect a sensitive brackish impoundment from coastal storms and storm surge; enhance water quality by promoting ecosystem services furnished by

filter feeding bivalves and stands of bayfront vegetation; protect habitats of migratory birds, fish and near-shore marine species; and provide opportunities for public involvement and student training in the employment of natural infrastructure for the protection of Barnegat Bay.

Green Infrastructure in Environmental Justice Communities

15. Green Infrastructure Improvements in CSO Areas: Stormwater Retention Planter Boxes

Grantee: North Hudson Sewerage Authority

Funding amount: \$300,000

The North Hudson Sewerage Authority (NHSA) provides wastewater treatment services to four communities in Hudson County: Hoboken, Union City, Weehawken, and West New York. Each of these communities contains combined sewer overflow (CSO) discharges into the Hudson River operated by NHSA. Additionally, West New York has been identified by the DEP as an environmental justice community.

To advance its goals of improving water quality in the North Hudson watershed by reducing CSO overflow outfalls, restoring natural hydrology, and educating the public through demonstration programs and volunteerism, NHSA will install three 900 square-foot stormwater planter boxes for trees and other cover plants in the towns of West New York and Weehawken. Each planter box will provide a minimum of .058 million gallons of annual recharge, remove ten or more pounds of total suspended solids per year, and divert approximately 4,300 gallons of precipitation per storm event.

Together, these projects will reduce the volume of stormwater entering the combined sewer systems of Weehawken and West New York and serve as green infrastructure demonstration projects through their placement at schools and areas of public access.