NONPOINT SOURCE PROGRAM ANNUAL REPORT

Delaware

2013

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

Nonpoint Source Program

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The Delaware Nonpoint Source Program administers a competitive grant made possible through Section 319 of the Clean Water Act. The grant provides funding for projects designed to reduce nonpoint source (NPS) pollution in Delaware. NPS pollution may be defined as any pollution that originates from a diffuse source (such as an open field or a road) and is transported to surface or ground waters through leaching or runoff. Reduction of NPS pollution may often be achieved through incorporation of specific best management practices (BMPs) into project workplans. Projects may target any source of NPS pollution, but most frequently involve agriculture, silviculture, construction, marinas, septic systems, and hydromodification activities.

In addition to funding projects that achieve reductions in NPS pollution, the Delaware NPS Program is committed to addressing the issue through educational programs, publications, and partnerships with other organizations working to reduce NPS pollution in Delaware.

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Table of Contents

	Preface	**4**
I.	**The Delaware NPS Program**	**5**
II.	**NPS Program Funding**	**5**
III.	**Delaware NPS Issues**	**6**
IV.	**Vision and Mission**	**6**
V.	**Executive Summary**	**7**
VI.	**Watersheds**	**10**
	a. Chesapeake Bay	**10**
	b. St. Jones River	**14**
	c. Inland Bays	**18**
	d. Broadkill River	**21**
	e. Appoquinimink River	**24**
	f. Christina Basin	**27**
VII.	**Load Reductions**	**30**
VIII.	**Future Changes and Challenges**	**30**
IX.	**List of Partner Organizations/Committee Members**	**33**

Preface

The 2013 Delaware NPS Report is developed by the Delaware Department of Natural Resources and Environmental Control (DNREC) to meet a grant condition that appears in each annual 319(h) Grant award to the State of Delaware from the US Environmental Protection Agency. This programmatic condition in the award states:

The report shall contain the following:

- A brief summary of progress in meeting the schedule of milestones in the approved Management Program, and,
- Reductions in nonpoint source pollutant loading and improvements in water quality that has resulted from implementation of the Management Program.
- Descriptions of priority Watershed Based Plan accomplishments. Accomplishments should be based on the implementation milestone goals/objectives as identified in each priority plan. The goal information can be displayed in the form of a watershed goal/accomplishment chart showing percent achieved, supplemented by a short narrative that should give the reader a clear understanding of the actions being taken and the outputs and outcomes which are occurring from the actions. If monitoring was completed, a summary of that information should also be included. For example, if 1000 feet of streambank stabilization was completed, then how does that compare to the needs identified in the watershed based plan i.e. what percent of streambank stabilization was completed compared to the overall needs as identified by the plan. Similar comparisons should also be provided for each significant pollutant load reduction

What is Nonpoint Source Pollution?

Nonpoint source (NPS) pollution is defined as polluted stormwater runoff associated with rainfall, snowmelt or irrigation water moving over and through the ground. As this water moves, it picks up and carries pollutants with it, such as sediments, nutrients, toxics, and pathogens. These pollutants eventually reach lakes, rivers, wetlands, coastal waters and ground waters of Delaware

NPS pollution is associated with a variety of activities on the land including farming, logging, urban/construction runoff, onsite sewage systems, streambank degradation, shore erosion and others. For example, stormwater flowing off the land carries the nutrients nitrogen and phosphorus into local streams, rivers and ponds. Under natural conditions, this is beneficial up to a point. However, if excessive nutrients enter these water bodies they cause nuisance algae blooms, then these nutrients are deemed pollutants.

The pollution contributed by nonpoint sources is the main reason why many of Delaware's waters are considered "impaired." Impaired waters are those waters that do not meet Water Quality Standards for designated uses (e.g., fishing, swimming, drinking water, shellfish harvesting, etc.). Progress in managing NPS pollution in Delaware is represented in this report. It was produced by the Department of Natural Resources and Environmental Control (DNREC) – NPS Program to

meet Clean Water Act, Section 319(h) Grant conditions and to demonstrate consistency with three essential elements:

1. EPA Strategic Plan Goal 2 – Protecting America's Waters
2. EPA Strategic Objective 2.2 – Protect and Restore Watersheds and Aquatic Ecosystems
3. Work plan commitments plus time frame (overall progress is reported in this document)

I. The Delaware NPS Program

As part of the Delaware Department of Natural Resources and Environmental Control, the Delaware NPS Program is committed to addressing the issue of nonpoint sources pollution as it affects Delaware's numerous waterbodies. Efforts will include grant funding, education, outreach, and partnerships with other organizations working together to reduce nonpoint source pollution in Delaware.

II. NPS Program Funding

Nonpoint Source (NPS) pollution constitutes the nation's largest source of water quality problems. Approximately 40 percent of the United States rivers, lakes, and estuaries surveyed to date are not clean enough to meet basic uses such as fishing or swimming due to NPS pollution.

To counter the ever expanding NPS problem, Congress established the NPS Pollution Management Program under Section 319 of the Clean Water Act (CWA) in 1987. This program provides states with grants to implement NPS pollution controls to achieve goals that are described in NPS pollution management program plans.

On August 4, 1988, Delaware's original (NPS) Program was approved by the Environmental Protection Agency (EPA) making it one of the first programs in the nation to comply with Section 319 of the CWA. Using CWA Section 319 funding, Delaware's NPS Program administers a competitive grant program. The grant provides funding for projects designed to reduce NPS pollution in Delaware's impaired waterbodies. Reduction of NPS pollution is most often achieved through incorporation of specific best management practices (BMPs) into project workplans. Whenever possible, funds are focused in sub-watersheds where NPS control activities are likely to have the greatest positive impact. Funded restoration activities are implemented using the most effective measures and practices available in order to achieve water quality improvements. Eligible types of management program implementation activities include the following:

- Non-regulatory NPS reduction programs
- Technical assistance
- Financial assistance
- Education
- Training
- Technology transfer
- Demonstration projects

Proposals are requested annually, reviewed, evaluated and prioritized, and those which are determined to meet specified requirements are eligible for funding. At least 40 percent of the overall project cost must be represented by non-federal matching funds.

III. Delaware NPS Issues

More than 90 percent of Delaware's waterways are considered impaired. The state's list of impaired waters, filed with the EPA, includes 377 bodies of water that suffer from 11 different impairments, the most common of which are NPS related pollutants including pathogens and nutrients (nitrogen and phosphorus). Most impairments come from nonpoint sources, which are harder to control. As Delaware is a groundwater driven state, removing NPS pollutants become an even harder problem to solve. Due to the rate of groundwater travel through the system, many NPS pollutants entering the systems up to 30 years ago are just now entering surface water bodies today. As such, the effectiveness of current agricultural BMPs will not be realized until much further in the future.

"Impaired waters" are polluted waters. More technically, they are waters that do not meet water-quality standards for their designated uses, such as recreation, fishing, or drinking. Impaired waters could be suffering from excess nutrients, low dissolved oxygen, toxins, bacteria, heat, or any combination of these problems.

Reduction of nonpoint sources of pollution is achieved through the incorporation or installation of specific best management practices (BMPs) addressing agriculture, silviculture, construction, septic systems, and hydromodification activities. To encourage and support the BMP installation, the NPS Program administers a competitive grant program currently made possible through Section 319 of the Clean Water Act. While this federal financial support has proven successful in complementing Delaware's NPS efforts, the NPS Program is currently seeking additional finances to expand our activities to more systematically address Delaware's NPS concerns.

Additional roles and responsibilities of the NPS Program include geospatial BMP tracking and reporting, management of the agricultural State Revolving Fund Program, support for developing Pollution Control Strategies, and watershed plan development and/or coordination.

IV. Vision and Mission

The Department of Natural Resources and Environmental Control envisions a Delaware that offers a healthy environment where people include a commitment to the protection, enhancement and enjoyment of the environment in their daily lives; where Delawareans' stewardship of natural resources ensures the sustainability of these resources for the appreciation and enjoyment of future generations; and where people recognize that a healthy environment and a strong economy support one another.

It's the mission of the Delaware Department of Natural Resources and Environmental Control to protect and manage the state's vital natural resources, protect public health and safety, provide quality outdoor recreation and to serve and educate the citizens of the First State about the wise use, conservation and enhancement of Delaware's Environment.

The Nonpoint Source Management Program is a dynamic and open-ended program intended to facilitate and promote statewide efforts to manage nonpoint source pollution. The following priorities will guide this program:

1. The NPS Program will support the identification and quantification of those problems that are caused specifically by nonpoint source pollution through assessment updates.
2. The NPS Program will be implemented and updated to realistically reduce nonpoint source pollution in a cost-effective manner.
3. The NPS Program will address nonpoint source pollution through a program that balances education, research, technical assistance, financial incentives, and regulation.
4. The NPS Program will follow a non-degradation policy in areas where surface and ground waters meet state water quality standards and a policy to realistically improve water quality in areas that do not meet these standards.
5. The NPS Program will continue to use the coordinated approach for implementation and maintain an open ended framework to incorporate new initiatives and support interactive approaches based on the effectiveness of existing policies and implementation mechanisms.
6. The NPS Program will support the development and implementation of Watershed Restoration Action Strategies (WRAS)/Pollution Control Strategies (PCS) for watersheds of identified impaired or threatened waters in accordance with the Unified Watershed Assessment List.

In Delaware, the lead agency for the development and implementation of the Nonpoint Source (NPS) 319 Program is the Department of Natural Resources and Environmental Control (DNREC), Division of Watershed Stewardship.

V. Executive Summary

This report documents the activities and highlights of the State of Delaware, Nonpoint Source (NPS) Program during the 2013 calendar year. The NPS Program administers a competitive grant made possible through Section 319 of the Clean Water Act. The grant provides funding for projects designed to reduce nonpoint source NPS pollution in Delaware. Reduction of NPS pollution is most often achieved through incorporation of specific best management practices (BMPs) into project workplans. Proposals are reviewed and evaluated, and those which are determined to meet specified requirements are eligible for funding. At least 40 percent of the overall project cost of all projects must be represented by non-federal matching funds.

In calendar year 2013, there have been notable successes and accomplishments:

- Projects funded by 319(h) Grant that were completed during calendar year reported implementing best management practices resulting in pollutant load reductions: nitrogen 957,425 pounds/year and phosphorus 22,295 pounds/year.

- One watershed plan in Delaware, the *Upper Chesapeake Bay Watershed Management Plan,* was drafted in 2013 and was conditionally accepted by EPA. Three additional watershed plans, all within the Chesapeake Bay Watershed, are in the development process currently and are anticipated to be complete by the end of 2014. The development of the *Broadkill River Watershed Management Plan* is being postponed until 2015.

Project Highlights:

Projects highlighted in the 2013 NPS Annual Report include the following:

☑ Sussex County Conservation District – Conservation Planners

Sussex County Conservation District Planners work with area farmers to encourage the installation of agriculture best management practices and partner with the USDA's Natural Resources Conservation Service in developing conservation plans, nutrient management plans and Environmental Quality Incentive Program (EQIP) contracts. Efforts are focused in priority watersheds that have approved Watershed Plans. In 2013, the SCD expended over $900,000 in conservation cost-share funds. These included payments for 23,871 acres of cover crops, 2,078 acres of pre-side dress stalk nitrogen tests, 3,037 acres of nutrient management planning, 221 heavy use area protection pads, 14 animal mortality structures, and various CREP practices. The efforts of the SCD Planners are represented on a watershed scale in Section VII below.

☑ Kent County Conservation District – Conservation Planners

Kent County Conservation District Planners work with Kent County Farmers to provide nutrient management planning, conservation planning and encourage the installation and/or adoption of agricultural best management practices. In 2013, the State of Delaware General Assembly provided $400,000 in cost share funds, which were utilized by different cooperating landowners. Projects implemented emphasized water quality, water management, and erosion/sediment control. These included payments for 4,941 acres of cover crops, 2,027 acres of nutrient management planning, 5 acres of certified nutrient management planning, 2 animal storage systems, 27 heavy use area protection pads, and various CREP practices. The efforts of the KCD Planners are represented on a watershed scale in Section VII below.

☑ Nutrient Relocation Program

Statewide, the Nutrient Relocation Program accounted for the transportation of over 56,000 tons of poultry manure out of Delaware's priority watersheds in 2013. If that tonnage had been applied to the source farm rather than relocated**,** significant nitrogen and phosphorus could have potentially entered Delaware's surface waters. On a watershed scale, the tons of manure for each priority watershed are represented in Section VII below.

☑ **Wetland and Stream Restoration Projects**

In 2013, Wetland and Stream Restoration projects initiated and/or completed include the following:

- Horsepen Arm (Prong 10) – channel restoration with water control structures
- Horsepen Arm (Prong 4) – channel restoration with water control structures
- Blackarm Tax Ditch - channel restoration with water control structures

☑ **Stream & Corridor Enhancement Program**

In 2013, Stream and Riparian Corridor Enhancement Program projects included the following:

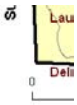
Established Upper Cristina stream restoration project goals for the project slated for implementation in 2014. These include:

- Stabilization of the stream banks to reduce erosion;
- Creation of habitat – putting in sequences of riffles and pools in the stream channel, random boulder placement in the channel, and planting the banks with a trees and shrubs;
- Improvements to water quality;
- Reduce landowner's loss of property and threat to dwellings;
- Reconnecting the stream channel with the floodplain; and
- Maintaining the natural look of the stream.

VI. Watersheds

a. Chesapeake Bay

Location: The Chesapeake Bay Watershed includes land area within Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia. The portion of the Chesapeake Drainage within Delaware makes up about 1% of the land area within the entire Chesapeake Bay Watershed. The watersheds that make up the Chesapeake Drainage in Delaware encompass a 451,268 acre area of land in all three of Delaware's counties. The Chesapeake makes up approximately 10% of New Castle County, 33% of Kent County, and 50% of Sussex County.



The headwater streams and rivers that originate in Delaware all ultimately drain to the Eastern Shore of the Chesapeake. These streams include, from north to south: Elk Creek, Perch Creek, the C&D Canal, Bohemia Creek, Sassafras River, Chester River, Choptank River, Marshyhope Creek, Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, Broad Creek, Wicomico River, and Pocomoke River.

Goal: Current goals call for the increased implementation of numerous nonpoint source best management practices, especially in the agriculture sector (see below for a highlight of key

numeric targets). The milestones allow jurisdictions the opportunity to adapt implementation strategies s as necessary to meet the goals and achieve the Total Maximum Daily Load (TMDL) standard. Delaware's milestone commitments are to reduce nitrogen by 48,149 pounds, phosphorus by 42,702 pounds, and sediment by 18,731,484 pounds by the end of 2013, compared to the 2009 baseline.

Impairment: TMDLs were developed by DNREC in response to data collected from water quality monitoring. The data indicated that numerous streams within the Chesapeake Bay Watershed were impaired; they do not meet Delaware's Water Quality Standards for dissolved oxygen, or meet target concentrations for nitrogen or phosphorus.

Implementation: The information presented within this section is drawn from Milestone reporting made available to the Chesapeake Bay Program for 2013. Where data is available, Section 319 specific information is provided as well (refer to Table 1). The Milestone data is necessary to demonstrate efforts and actions towards progress with the Phase II Chesapeake Bay Watershed Implementation Plan (WIP). As the WIP reporting criteria is more detailed and up to date, it's inclusion within this document is warranted.

In future versions of the Delaware NPS Program Annual report, more detailed sub-watershed information will be provided. Currently, Delaware has contracted with KCI Technologies, Inc. to develop approved Watershed Plans for the four sub-watersheds of Delaware's drainage to the Chesapeake Bay (the Upper Chesapeake, Chester/Choptank, Nanticoke, and the lower Chesapeake).

Table 1. Section 319 Activity within the Chesapeake Bay Watershed

319 Projects	Grant Year	Status	319 Funds
Ecological Restoration	FY09 & 10	Complete	$15,785
Nutrient Management Planning	FY10	Complete	$152,289
Nutrient Relocation	FY10	Complete	$124,072
CREP Acres (Salary for Coordinator)	FY2011	Complete	$60,000 (statewide)

Table 2. 2013 Milestone Data

Pollutant Controls, Practices, and Actions	2013
Commodity Cover Crops	6,772 acres
Cover Crops	41,289 acres
Wetland Restoration	588 acres
Nutrient Relocation	35,972 tons
Nutrient Management	42,735 acres
Bioretention	1.38 acres
Wet Ponds and Wetlands	5,750 acres
Septic Pumpouts	410 systems
Septic Connections	1 systems

Table 3. Chesapeake Bay Load Reductions based upon direct funding or leveraged funding associated with the NPS Program.

Practice	Load Reductions N	Load Reductions P
Cover Crops	453,037 lbs/year	942 lbs/year
Nutrient Relocation	148,528 lbs/year	7,050 lbs/year
Nutrient Management	88,623 lbs/year	4,598 lbs/year
Wetland Restoration	13,650 lbs/year	470 lbs/year
Bioretention	4.14 lbs/year	0.61 lbs/year
Wet Ponds/Wetlands	37,950 lbs/year	1,759 lbs/year
Total	***741,792 lbs/yr***	***14,820 lbs/yr***

Progress Highlights: As referenced above, this section is taken from the Chesapeake Bay WIP Highlight report for 2013.

In 2013, Delaware saw continued decreases in the modeled nitrogen, phosphorus, and sediment loads due to increased implementation, improved data tracking and reporting efforts, and improved communication and coordination with partner agencies through the Watershed Plan development process.

Several of the specific implementation goals originally set in 2009 were achieved and surpassed. The total acres of cover crops planted increased more than anticipated, likely due to modified cost share programs and focused funding; data tracking and reporting (species planted, planting date and method, standard/commodity) for this practice also improved. Wetland restoration and tree planting goals were surpassed due to supporting funds from both the Chesapeake Bay

Implementation Grant and a National Fish and Wildlife Foundation grant and better coordination and reporting of partner efforts due to the creation of a WIP Restoration Subcommittee. The acres of agriculture nutrient management planning were also maintained.

Several regulatory revisions also got underway. The Concentrated Animal Feeding Operation regulations were re-vised to be consistent with federal standards and became effective in November 2011. Revisions to both the Sediment and Stormwater Regulations and the Regulations Governing the Design, Installation, and Operation of On-Site Wastewater Treatment and Disposal Systems also went through the regulatory revision process. Both sets of regulations were finalized at the end of 2013.

Important improvements have been made to data tracking and reporting systems through the conversion to the National Environmental Information Exchange Network (NEIEN) platform too. As a result, more data on practices that have routinely been implemented but previous not reported are now captured and missing and unpopulated fields have been filled. In addition, several studies or literature reviews to examine the effectiveness of BMPs currently not modeled were initiated and include an assessment of the impacts of irrigation management and heavy use area pads. Delaware's non-farm fertilizer sales data was also examined and significant decreases in phosphorus are apparent, likely as a result of residential fertilizer P-bans in neighboring states. DNREC and DDA are working with Chesapeake Bay Program committees to determine appropriate credit for these practices.

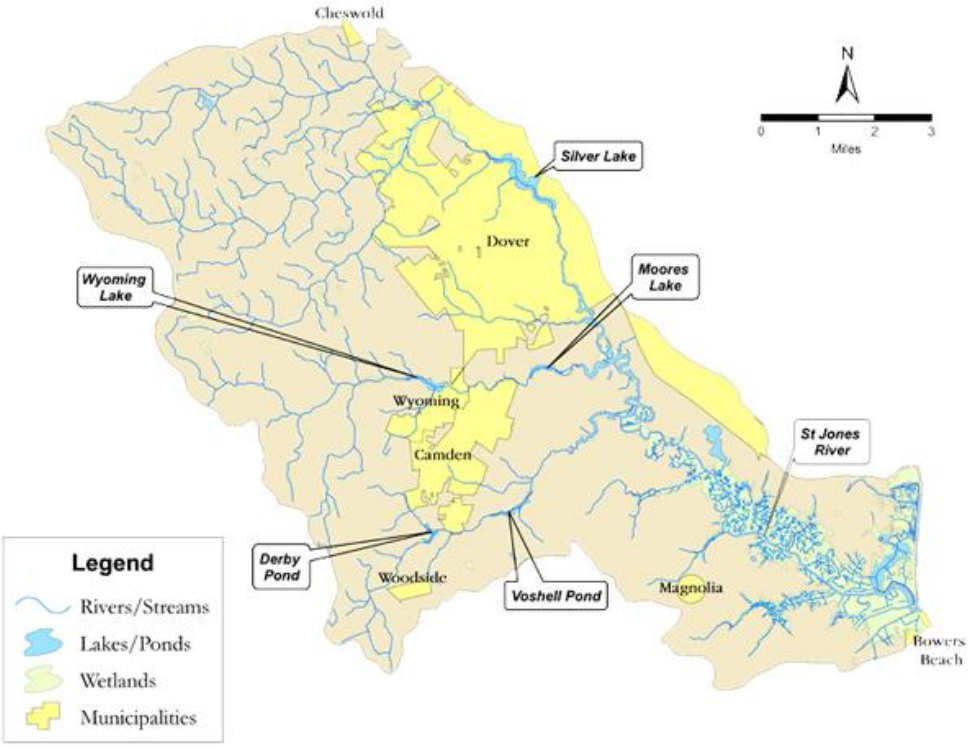
Shortfalls: While we have met or exceeded our overall load reduction goals, we did not achieve a few specific implementation goals. The exact goals for early/standard/late cover crops were not achieved, but cost share programs have been modified to emphasize early plantings and this acreage is expected to increase in the future. Forest buffer acreage did not increase and members of the agriculture community have indicated that current market prices of crops do not support land conversion for buffers at this time. A collaborative group plans to examine how much of an additional cost share incentive is needed to encourage additional enrollment in buffer programs. The tons of poultry litter transported has decreased in recent years; Delaware believes in general that the total volume of litter has decreased as has the nutrient content of the litter and staff are working with the CBP Ag Workgroup to assess the data and make necessary model modifications. Finally, the onsite pump out goal was not achieved, but regulations have been proposed requiring a pump-out and inspection at the time of property sale or transfer and will also require reporting when inspections occur; both requirements are expected to increase the number of pump-outs reported each year.

b. St. Jones River

Location: The St. Jones River Watershed is approximately 25.9 square mile (16,576 acres) and is

located in the central portion of Kent County. It is bounded on the south by the Murderkill River watershed, on the east by the Delaware Bay, on the north and northeast by the Leipsic River and Little Creek watersheds, and on the west by the Choptank River watersheds. It drains 90 square miles of land. The major watercourse in the watershed is the St. Jones River which has its headwaters in the western part of the county, about 22 miles upstream from the Delaware Bay. Significant ponds in the watershed are Silver Lake, Moores Lake, and Wyoming Lake. Flat wetlands, usually forested, exist mostly in the upper portion of the watershed and eventually drain into creeks and streams. Nontidal riverine wetlands and tidal wetlands line the banks of the river, sometimes up to 1/2 mile wide toward the mouth of the river. Wetlands comprise 9,669 acres of the watershed and provide critical services such as nutrient removal, erosion control, habitat for plants and wildlife, flood reduction, and storm water storage to the citizens of Delaware. The extent to which wetlands can perform these functions and thrive in the future depends on their health.

The St. Jones Watershed has the largest percentage of protected lands 5,236 acres with the River Reserve totaling approximately 3,750 acres of the protected lands. The Watershed land use is dominated by agriculture (33%), followed by wetlands (25.5%), and residential lands (17.4%). The impervious cover in the Watershed is approximately 9.8% with a possible future impervious cover of 23%. Between 2002 and 2007 agricultural lands decreased by 4% and residential lands increased by 2.1%. Wetland slightly decreased by 0.7% as did forested land by 0.1%.



Goal: Limit pollutants to levels at or below the Total Maximum Daily Load (TMDL) values specified in the regulation, i.e., an overall reduction of nitrogen and phosphorus in the waterways by 40%, or 869.5 lbs per day for nitrogen and 63.4 pounds per day for phosphorus. Nonpoint sources, must reduce total nitrogen from 838.5 lbs per day and total phosphorus from 52.9 lbs per

day (refer to Table 3). The TMDL also calls for 21.8 lbs per day reduction of nitrogen and 3.4 lbs per day from its stormwater (MS4) discharges. The designated uses for the St. Jones River include primary recreation, secondary recreation, fish, aquatic life and wildlife, industrial water supply, and agricultural water supply in freshwater segments.

Impairment: Delaware studies reviewed indicate the current condition of the Watershed is of degraded quality. Water quality samples have shown that the impairments (parameters) affect approximately 35.6 miles of streams and 208 acres of ponds. These impairments are primarily caused by nonpoint sources. Silver Lake and Moores Lake, both within the watershed, have been impaired by planktonic algae. To date, data has not been provided for Wyoming Pond. Most, if not all of the St. Jones River segments were listed as impaired by pollutants on Delaware's 303(d) list. Impairments include dissolved oxygen (DO), nutrients, and bacteria. Land use impairments for the St. Jones River are found below:

Source	TN (lbs/acre/year)	TP (lbs/acre/year)	TN (lbs/yr)	TP (lbs/yr)	Area
Urban	10.24	1.25	196,596.15	23,998.55	19,198.4
Agriculture	13.19	1.25	284,740.78	26,984.53	21,587.63
Forest	6.51	0.05	31,611.88	242.79	4,855.89
Wetland	0.00	0.00	0.00	0.00	8,685.97
Water	0.00	0.00	0.00	0.00	1,550.99
Range	7.50	0.45	2,403.58	144.21	320.48
Other	7.50	0.45	10,642.90	638.57	1,419.05

Implementation: Projects that are implementing watershed plan goals are summarized below. Most of the projects using 319 Grant funds in 2013 have been in Silver Lake and Wyoming Pond portion of the St. Jones River watershed.

Table 1. Section 319 Activity within the St. Jones Watershed

319 Projects	Grant Year	Status	319 Funds
Nutrient Management Planning	FY12	Complete	$7,102

Table 2. 2013 Milestone Data

Pollutant Controls, Practices, and Actions	2013

Cover Crops	2,394 acres
Nutrient Management Planning	1,504 acres
CD Nutrient Management Planning	421 acres

Table 3. St. Jones Load Reductions

Practice	Load Reductions N	Load Reductions P
Cover Crops	7,341 lbs/year	8 lbs/year
Nutrient Management Planning	5,681 lbs/year	659 lbs/year
CD Nutrient Management Planning	284 lbs/year	8 lbs/year
Total	***13,306 lbs/yr***	***675 lbs/yr***

Progress Highlights: The following are specific examples of NPS Program funded projects that occurred or finalized in 2013:

1. *Wyoming Pond Buffer planting* - On May 4, 2013 the 319 NPS Program and The Town of Wyoming continued with the multiphase water quality project, adding to the riparian buffer along the banks of Wyoming Lake in Isaac Branch, a tributary of the St. Jones River. Volunteers planted approximately 50 shrubs to expand the riparian buffer by approximately 75 feet along the lake that will not only beautify Wyoming Park, but will also help reduce stormwater run-off, erosion, sediment and excess nutrients from entering the river. The buffer will also act as a deterrent for geese that reside in the Park, which should reduce bacteria levels in the St. Jones. The St. Jones River TMDL calls for a 90% reduction in bacteria levels. Additional volunteer days are planned for maintenance of the buffer and expansion where appropriate.

2. *Mirror Lake* - This project involves dewatering Mirror Lake, mixing activated carbon into the sediments to bind contaminants, and constructing fringing wetlands to cap the contaminants. The project reach is approximately 1500 linear feet and lies within the park-like setting that borders the St. Jones River. The restoration project will focus on the creation of a stable conveyance and improved ecological diversity within Mirror Lake and along the banks of the St. Jones.

   In addition to the endorsement of Dover City Council, DNREC also held a workshop in August 2012 to introduce the project to the public and seek initial feedback, which was generally positive. The public will have additional opportunities to provide input on the project during the permitting stage. This Mirror Lake project is being funded using State

HSCA dollars and general funds from the office of the Secretary. Biohabitats is developing and preparing design and construction drawings, specifications and a cost estimate for the restoration of Mirror Lake and a portion of the St. Jones River from Mirror Lake downstream to the weir just below Court Street in Dover, DE. Biohabitats will also be incorporating sediment remediation plans and specifications that are being created by Upal Ghosh at the University of Maryland, Baltimore County (UMBC) which will utilize activated carbon to remediate the contaminant level of the sediments within Mirror Lake

In December 2013, the construction phase of the Mirror Lake Remediation & Restoration Project, Watershed Remediation Hazardous Substance Release Site in Dover, ended December 5, ahead of schedule and under budget. In all, 79 tons of SediMite (activated carbon pellets) were applied to five (5) acres of lake and channel sediments in 10 days. Nine hundred sixty-seven (967) cubic yards (1325 tons) of sand were placed in Mirror Lake to create the intertidal wetland; 62 tons of stone were placed in Mirror Lake to create two (2) rock vane hydraulic control structures; and 760 linear feet of 16-inch diameter coir log, double stacked, were place on the west bank of the lake to prevent erosion. Sixty-seven (67) volunteers helped on the project. The Boot Camp Program, AmeriCorps, and the Homeless Shelter contributed 770 hours of volunteer labor; and DNREC staff contributed 511 hours of labor. Sincere thanks go out to all volunteers, especially the Shoreline and Waterways crew, for help with heavy equipment and bulk material transfer. The temporary construction entrances have been removed and lay down areas have been seeded, matted, and stabilized for the winter. The remainder of the plantings, paid for by DE NPS program, on the new intertidal wetland and along the bank in front of Frazier's is scheduled for the spring 2014. Load reductions will follow after the spring planting.

Additional NPS Activity in the St. Jones Watershed:

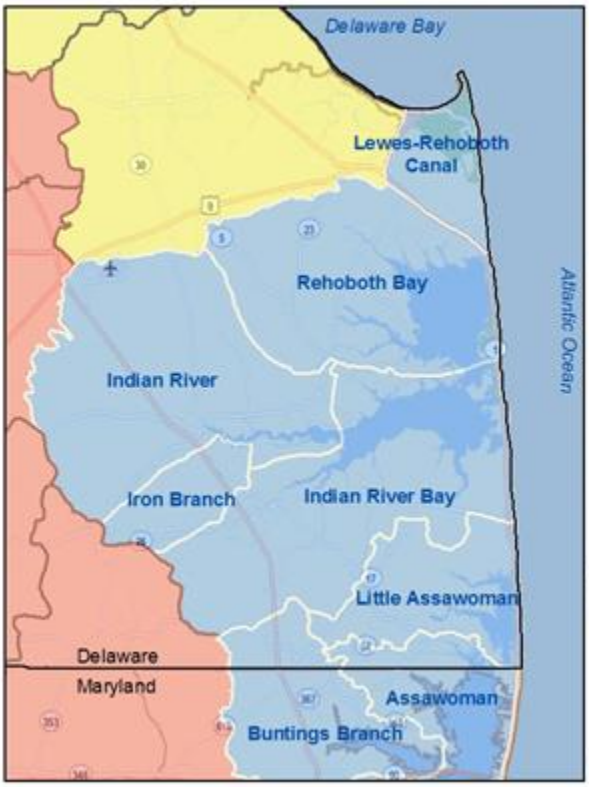
Project Name	CWQIG Award	319 Funds Leveraged	Watershed
DNREC- Stormwater wetland to treat parking lot runoff at DNREC's R&R bldg	$50,000	TBD	St. Jones

Community Water Quality Improvement Grant - The purpose of the Community Water Quality Improvement Grant Program (CWQIG) is to provide financial assistance to eligible entities to facilitate projects that will support water quality improvement in impaired Delaware watersheds. The CWQIG is administered by DNREC, Nonpoint Source Program. The goals of the program are to support projects that focus on the developed landscape that will help improve water quality.

Funding for the following projects is available as a result of the interest earned from the State Revolving Fund Loan Program.

c. *Inland Bays*

Location: The Inland Bays/Atlantic Ocean Basin comprises approximately 313 square miles of eastern Sussex County, Delaware. Starting at Lewes and Cape Henlopen State Park at the southern edge of the entrance to Delaware Bay, the area extends southward approximately 24 miles along the Atlantic shoreline to the Maryland State Line. It includes the coastal towns of Rehoboth Beach, Dewey Beach, Bethany Beach, South Bethany Beach, and Fenwick Island. State Route 1 (SR 1) extends parallel to the shoreline and connects the towns.



The three inland bays are located just landward of the Atlantic Ocean shoreline. From north to south, these are Rehoboth Bay, Indian River Bay, and Little Assawoman Bay. Rehoboth Bay contains the Lewes-Rehoboth Canal and Rehoboth Bay Watershed; the Indian River Bay contains the Indian River, Iron Branch, and Indian River Bay Watersheds; and the Little Assawoman Bay contains the Little Assawoman, Assawoman, and Buntings Branch Watersheds.

Goal: Current goals call for the increased implementation of numerous nonpoint source best management practices, especially in the agriculture sector (see below for a highlight of key numeric targets). The goals are those that were presented by Inland Bays Pollution Control

Strategies (PCS) and an approved EPA watershed plan. The PCS involves many strategies to reduce nitrogen and phosphorous to meet the TMDL, but what is presented here are initiatives of the 319 program.

Table1. Progress toward goals within the Inland Bays Watershed

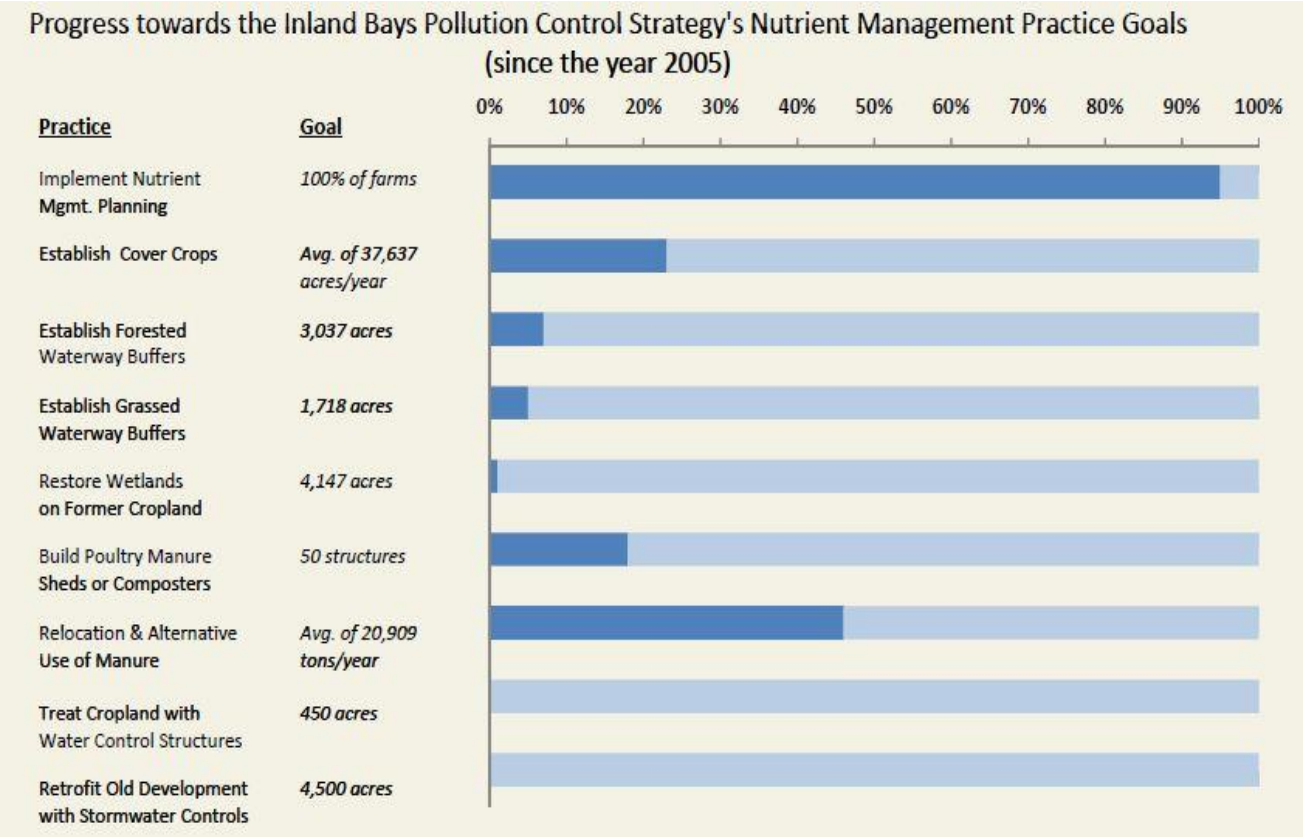


Table 2. Section 319 Activity within the Inland Bays Watershed

319 Projects	Grant Year	Status	319 Funds
Cover Crop	FY2012	Complete	$270,000
Nutrient Management Planning	FY2010	Complete	$36,812
Nutrient Relocation	FY2010	Complete	$52,555
CREP Acres (salary for coordinator)	FY2011	Complete	$60,000 Statewide
Stream Fencing	FY2010	Complete	$8,000

Table 3. 2013 Milestone Data

Pollutant Controls, Practices, and Actions	2013
Cover Crops	6,000 acres
Manure Composter and Sheds	4 systems

Tree Planting	0 acres
Heavy Use Area Protection	43 pads
Nutrient Relocation	11,595 tons
Nutrient Management	953 acres
Wet Ponds and Wetlands	2 acres
PSNT	733 acres
Stream Fencing	850 feet

Table 3. Inland Bays Load Reductions

Practice	Load Reductions N	Load Reductions P
Cover Crops	76,700 lbs/year	236 lbs/year
Nutrient Relocation	64,926 lbs/year	4,562 lbs/year
Nutrient Management	2,680 lbs/year	206 lbs/year
Stream Fencing	314 lbs/year	15 lbs/year
Wet Ponds/Wetlands (CREP)	18 lbs/year	0.11 lbs/year
Totals	***144,638 lbs/yr***	***5,019 lbs/yr***

Progress Highlights: The following are specific examples of NPS Program funded projects that occurred or finalized in 2013:

Hopkins Dairy Farm - The project is located on the Hopkins Farm, the largest dairy farm in Delaware and site of their popular dairy-made ice cream store on Route 9, just west of Lewes.

The project focused on an area along the stream that is used to keep heifers; cows too young to join the regular milk-producing herd. To protect the stream banks and keep the cows and their manure out of the water, fencing and gates were installed. In addition, three stone crossings were constructed so that the cattle can access shade and grazing areas, and be moved to the loading corral, and watering areas without damaging stream banks or entering the water.

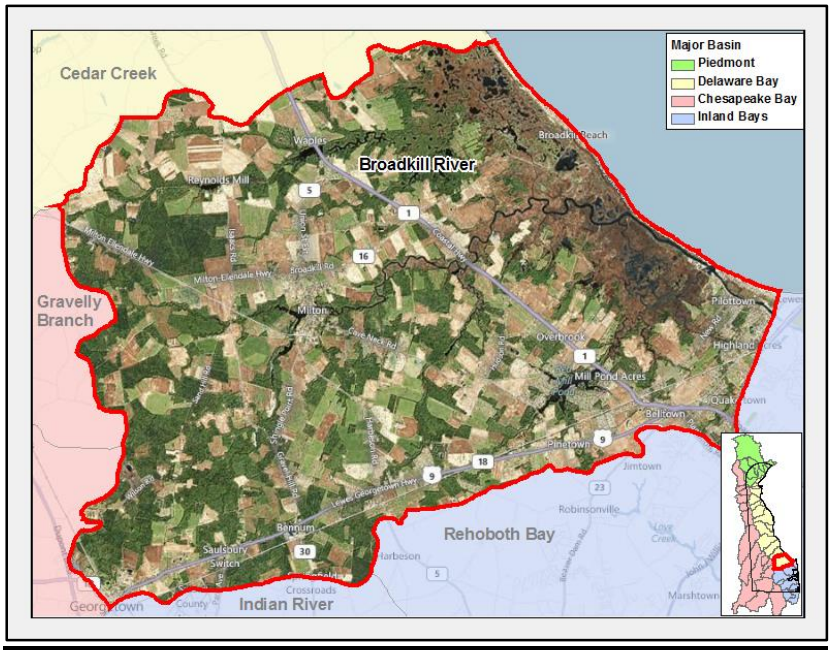
In all, 850 feet of fencing was placed at least 35 feet from each side of the stream creating a buffer that protects more than two acres along the stream and will reduce the amount of sediment and nutrients running off the land and into the water. With the exception of the three stone crossings, which were installed by the Sussex Conservation District, all work was completed by the landowner.

It is estimated that these enhancements will prevent 314 pounds of nitrogen and 15 pounds of phosphorus from entering Love Creek and Rehoboth Bay each year. The nutrients nitrogen and phosphorus are the principal source of pollution in the Inland Bays.

Funding for the project was provided by the Delaware Center for the Inland Bays, Delaware Department of Natural Resources and Environmental Control Nonpoint Source Pollution Program, and Ducks Unlimited. Design and technical expertise was provided by the USDA Natural Resources Conservation Service.

d. Broadkill River

Location: The Broadkill River watershed is located in the east central portion of Sussex County. It is bounded on the north by the Cedar Creek watershed, on the west by the Gravelly Branch and Deep Creek watersheds, on the south by the Lewes-Rehoboth Canal, Rehoboth Bay, and Indian River watersheds, and on the east by the Delaware Bay. The mainstem of the Broadkill River is approximately 25 miles long. The major watercourse in this segment is the Broadkill River which originates at the Town of Milton and discharges into the Roosevelt Inlet near Lewes. Major impoundments in the area are Waggamons Pond and Diamond Pond located near Milton. The Broadkill River flows generally eastward until it approaches the coast where it turns abruptly and flows south to discharge into the Roosevelt Inlet. The flow of this stream is sluggish and the water is turbid. The watershed drains an area of 107 square miles.



Goal: The established TMDL requires in terms of daily nonpoint nutrient loads, a 40% reduction in nitrogen (baseline 1,675 lbs/day) would require a reduction of 670 lbs/day to reach the target load. A 40% reduction in phosphorus (baseline 69.3 lbs/day) would require a 27.7 lbs/day reduction to reach the target load. These target goals can be achieved by the

Impairment: Water quality monitoring performed by the Department of Natural Resources and Environmental Control (DNREC) has shown that waters of Broadkill River and several of its tributaries and ponds are impaired by high levels of bacteria and elevated levels of nitrogen and phosphorous, and that the designated uses are not fully supported due to levels of these pollutants in these waterways. Total Maximum Daily Loads (TMDLs) were established for the Broadkill River Watershed in December 2006.

Implementation: Where data is available, Section 319 specific information is provided (refer to Table 1). The Milestone data is necessary to demonstrate efforts and actions towards progress within the Broadkill River Watershed.

In future versions of the Delaware NPS Program Annual report, more detailed watershed information will be provided. Currently, Delaware has contracted with KCI Technologies, Inc. to develop an approved Watershed Plan for the Broadkill River Watershed. This activity is being delayed until the watershed plans for the Chesapeake Bay are complete.

Table 1. Section 319 Activity within the Broadkill River Watershed

319 Projects	Grant Year	Status	319 Funds
Nutrient Management Planning	FY12	Complete	$745
Nutrient Relocation	FY 12	Complete	$1,845
Cover Crop	FY 08	Complete	$75,000

Table 2. 2012 Milestone Data

Pollutant Controls, Practices, and Actions	2012
Cover Crops	2,943 acres
Pre-Sidedress Nitrogen Test (PSNT)	106 acres
Heavy Use Area Protection	1 unit
Nutrient Relocation	341 tons
Nutrient Management	2034 acres
Conservation District Nutrient Management	524 acres

Table 3. Broadkill River Load Reductions based upon direct funding or leveraged funding associated with the NPS Program.

Practice	Load Reductions N	Load Reductions P
Cover Crops	37,360 lbs./yr.	174 lb./yr.
Nutrient Relocation	1,910 lbs/yr.	191 lbs/yr
Nutrient Management	5,681 lbs./yr.	659 lbs./yr.
CD Nutrient Management	1,463 lbs./yr.	170 lbs./yr.
Rain Garden	0.38 lbs./yr.	0.59 lbs./yr.
Totals	***46,414 lbs/yr***	***1,195 lbs/yr***

Additional NPS Activity in the Broadkill Watershed:

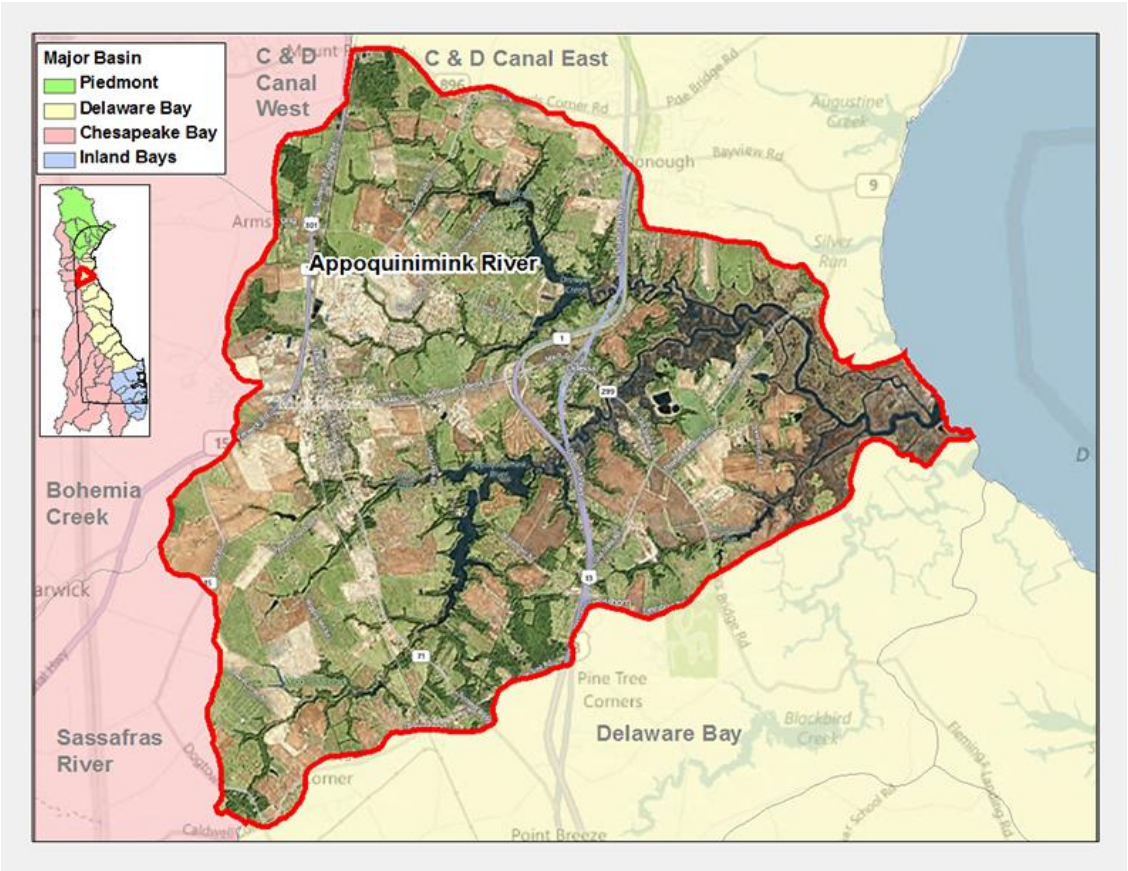
Community Water Quality Improvement Grant - The purpose of the Community Water Quality Improvement Grant Program (CWQIG) is to provide financial assistance to eligible entities to facilitate projects that will support water quality improvement in impaired Delaware watersheds.

The CWQIG is administered by DNREC, Nonpoint Source Program. The goals of the program are to support projects that focus on the developed landscape that will help improve water quality. Funding for the following projects is available as a result of the interest earned from the State Revolving Fund Loan Program.

Project Name	CWQIG Award	319 Funds Leveraged	Quantity	Watershed
Town of Milton Rain Garden Installation	$50,000	NA	3	Broadkill
Bioretention Facility		$ 7,500	1	Broadkill

e. Appoquinimink River

Location: The 16-mile Appoquinimink River meanders through farmlands and wetlands in southern New Castle County, draining 47 square miles. The headwater drains mostly agricultural lands, and feeds four major ponds. The tidal freshwater segment of the Appoquinimink is bound by the head of tide at Noxontown Pond and Silver Lake, and by Drawyers Creek's confluence with the Appoquinimink. The remainder of the watershed consists of a tidal marsh extending to the Delaware River. The Appoquinimink River system consists of five main tributaries, the Appoquinimink River main stem, Deep Creek, Dove Nest, Hangman's Run, and Drawyer Creek. There are several shallow, man-made small lakes and ponds in the watershed: Wiggins Mill Pond, Noxontown Pond, Silver Lake, and Shallcross Lake. The Appoquinimink River is tidal from the confluence with Delaware Bay to the dam at Noxontown Lake on the main stem, the dam at Silver Lake on Deep Creek, and the confluence with Drawyer Creek. Salinity intrusion from Delaware Bay typically reaches upstream past the Drawyer Creek confluence at river kilometer (Rkm) 8.5.



Goal: Total Maximum Daily Loads (TMDLs) were established for the entire Appoquinimink River in December, 2003. These TMDLs called for a 60% reduction in nonpoint nitrogen and phosphorus loading. An implementation plan, or a Pollution Control Strategy, was to be developed by a Tributary Action Team, a diverse group of citizens and government agency personnel presented to the Department for promulgation to reach the prescribed TMDLs. Load reductions will be achieved through the implementation of BMP's in agriculture, development, wastewater, and private stewardship. The Strategy is designed to reduce nutrient loadings from current and future land practices. This combination of actions will lead to the achievement of the TMDL.

Impairment: The Appoquinimink River watershed has historic water quality problems with respect to nutrient and low dissolved oxygen concentrations. A Total Maximum Daily Load for nutrients and bacteria has been established requiring a 60% reduction in nitrogen and phosphorus loads and a bacteria reduction of between 11-15% in freshwater areas and 72-73% in marine areas.

Implementation: Where data is available, Section 319 specific information is provided (refer to Table 1). The Milestone data is necessary to demonstrate efforts and actions towards progress within the Appoquinimink River Watershed.

Table 1. Section 319 Activity within the Appoquinimink River Watershed

319 Projects	Grant Year	Status	319 Funds
Nutrient Management Planning	2013	Complete	$19,000
CREP Acres (salary for Coordinator)	2013	Complete	$ 60,000 (statewide)

Table 2. 2013 Milestone Data

Pollutant Controls, Practices, and Actions	2013
Nutrient Management	5,436 acres

Table 3. Appoquinimink River Load Reductions

Practice	Load Reductions N	Load Reductions P
Nutrient Management	11,273 lbs/yr	584 lbs/yr
Totals	***11,273 lbs/yr***	***584 lbs/yr***

MOT Rain Garden Maintenance Workshop: Local Lowes volunteers led by Red Tail Restoration staff had a hands-on workshop at the Jean Birch MOT Senior Center in Middletown to learn about the proper maintenance of rain gardens. Volunteers cleared inflows, removed vines and dead vegetation and trimmed existing trees and shrubs in the existing rain garden. Season maintenance tasks were also discussed.

Progress Highlights: All sectors have taken steps to improve water quality through the implementation of laws, regulations, and voluntary BMPs. Analysis using a basic land use loading rate model shows that, to date, nonpoint sources of TN and TP have been reduced by 109% and 111%, respectively, from the TMDL baseline levels. While land use modeling based on current practices predicts reductions exceeding that required by the TMDL, there is still a need for further reductions in areas that are currently lacking such as wastewater and stormwater.

f. Christina Basin

Location: The Christina Basin is a 565 square mile basin contained in the larger Delaware River Basin. The Christina Basin, located in New Castle County in northern Delaware, includes four sub-watersheds:

- Brandywine Creek 325 sq. mi.
- Red Clay Creek 54 sq. mi.
- White Clay Creek 107 sq. mi.
- Christina River 78 sq. mi.

Although a small portion can be found within Maryland, the Christina Basin falls principally within two states, Pennsylvania to the north and Delaware to the south. The Pennsylvania portion is characterized by more open space, including agricultural land and forests, while the more urban, southerly portion in Delaware tends to have more built-up land.

Goal: Delaware's goal is to reduce pollutant loadings from current and future land use practices with an effort to achieve the TMDL. The effort for the Delaware portion of the Christina Basin will be implemented through the work of numerous organizations and individuals and will be coordinated with the ongoing pollution reduction efforts in the Pennsylvania portion of the

Christina Basin. The level of pollution reductions necessary to achieve the designated uses in the streams of the Delaware portion of the Christina Basin vary significantly. For example, bacteria levels need to be reduced as much as 95 percent in some areas, nitrogen levels need to be reduced as much as 50 percent in some areas, and phosphorus levels need to be reduced as much as 89 percent in some areas. In contrast, other areas of the Christina Basin are relatively free of excess nitrogen, phosphorus, and bacteria and simply need to be protected in their current state. Figure 3.21 shows the subwatersheds that were used to determine the TMDLs for the Christina Basin. Figures 3.22–3.25 graphically represent the pollution reductions as mandated by the USEPA for the Brandywine Creek, Red Clay, and White Clay Creeks, and the Christina River.

Impairment: The streams of the Christina Basin in Delaware suffer from impaired water quality due to the following problems:

- *Nutrients*: One hundred and thirty stream miles have higher than desired nitrogen and phosphorus loads, which could cause low dissolved oxygen (DO) levels.
- *Bacteria* (pathogens): Concentrations along 134.2 miles of stream frequently exceed the primary recreation standards for swimming of 100 colonies per 100 milliliters.
- *Sediment*: The streams are degraded by high sediment loads that range between 311 and 975 pounds per acre annually, depending on the subwatershed.
- *Stream Habitat*: While biological diversity of the streams has been improving, 39 percent of the nontidal streams in the Piedmont have poor habitat due to the increased frequency and rate of runoff from urban/suburban development and rural activities (Shaver et al., 1995).
- *Contaminated Waste Sites:* Contaminated waste sites are situated throughout the watershed.
- *Fish Consumption Advisories*: Health warnings advising against the consumption of fish have been posted along 82.2 stream miles due to PCB contaminated sediment and high PCB levels in fish tissue.

Implementation: The Watershed Implementation Plan development for the Christina Watershed was approved by EPA in the spring of 2013.

Progress Highlights: The following are specific examples of NPS Program funded projects that occurred or finalized in 2013:

Grace Lutheran Church Rain Garden:

The Grace Lutheran rain garden (400 sq ft) was a stormwater retrofit of a portion of a dry pond draining 1 acre of surrounding area, parking lot and building. The rain garden was constructed by Brightfields Inc. Environmental Consulting including sod removal, a rock swale connection to an existing swale, seeded berms and mulch. The Church Planting Team planted over 320 native plants in the rain garden which included species such as a serviceberry, lowbush blueberries, switchgrass, New England aster, wild pink, wild bergamot, obedient plant, black eyed susan, rough goldenrod and wild blue indigo. The Rain Gardens for the Bays campaign provided $2,400 and United Water $800 for the construction of the rain garden, plants and mulch. Church members were very involved in every aspect of the rain garden construction and volunteered 175 hours toward this

project.

Limestone Presbyterian Church Rain Garden:

The Limestone Presbyterian Church rain garden (1600 sq ft) took parking lot islands and made them into rain gardens that drain 2.6 acres of parking lot and upland areas. . The rain garden was constructed by Brightfields Inc. Environmental Consulting including sod removal, a rock swale, soil amending and mulch. Church members and Boy Scouts helped to plant over 600 container sized native plants over 2 days. Plant species included golden alexanders, broomsedge, blazing star, wild pink, goldenrod, sneezeweed, blue flag iris and more. The Rain Gardens for the Bays campaign provided $5,500 and United Water $1,000 for the construction of the rain garden, plants and mulch. To find out more about the garden, its plants and how it works, check out its website www.limestonepresbyterian.org/RainGarden.html.

Swift Park:

Two grassed swales located in the highly trafficked Swift Park in New Castle County, DE (approximate area 2,500 sq. ft.) were re-graded and replanted with 93 flats of landscape plugs (approximately 4,600 native plants) with the help of New Castle County employees. The plants were densely planted to minimize weeding and once established should slow down runoff from small storm events and help trap sediment from reaching Mill Creek sub-basin of the White Clay Creek. Additionally, the swales were used as part of a hands-on BMP maintenance workshop for New Castle County conducted by the White Clay Creek Wild and Scenic Rivers Program and North Creek Nursery. They were also visited by a class of Del Tech students learning about stormwater best management practices. Funds for the landscape plugs came from DNREC NPS and totaled $4,995.50.

Table 1. Christina River Load Reductions

Practice	Load Reductions N	Load Reductions P
Grassed Swales	0.0329 lbs/yr	0.0035 lbs/yr
Rain Gardens	1.14 lbs/yr	1.77 lbs/yr
Totals	***1.15 lbs/yr***	***1.77 lbs/yr***

<u>Additional NPS Activity in the Christina Watershed:</u>

<u>Community Water Quality Improvement Grant</u> - The purpose of the Community Water Quality Improvement Grant Program (CWQIG) is to provide financial assistance to eligible entities to facilitate projects that will support water quality improvement in impaired Delaware watersheds. The CWQIG is administered by DNREC, Nonpoint Source Program. The goals of the program

are to support projects that focus on the developed landscape that will help improve water quality. Funding for the following projects is available as a result of the interest earned from the State Revolving Fund Loan Program.

Project Name	CWQIG Award	319 Funds Leveraged	Quantity	Watershed
Freshwater Mussel Restoration	$46,052	NA	1	Christina

VII. Load Reductions

In 2013, the Delaware NPS Program load reductions were calculated for many of the 319 funded projects implemented on a watershed scale. The load reductions are calculated using guidance established during the Pollution Control Strategy development process.

2013 Project Load Reductions/Year by Watershed

Project	Nitrogen (lbs)	Phosphorus (lbs)
Chesapeake Bay	741,792	14,820
St. Jones River	13,306	675
Inland Bays	144,638	5,019
Broadkill River	46,414	1,195
Appoquinimink River	11,273	584
Christina Basin	1.15	1.77
TOTAL	**957,725**	**22,295**

VIII. Future Changes and Challenges

Programmatic Changes

From 1989 to 1997, the NPS Program relied on the development and implementation of Best Management Practices, identification of key partners, establishing agreements for interagency cooperation and funding many successful education, protection and restoration projects. This early period of NPS management in Delaware served to foster a keen understanding of the value of collaboration, consensus and community involvement in water quality management.

From 1997 to the present, efforts were made to fund implementation programs or activities that address the priority NPS contaminant sources such as agriculture, forestry, urban runoff, hydro

modification, land disposal and various other miscellaneous sources. Examples of past activities include funding Kent and Sussex County Conservation District planner positions, stream restoration, and septic system pump-out, repair and/or replacement. These activities were prioritized based upon contaminate category and tended to establish BMP implementation on a geographic wide scale throughout Delaware. This broad approach served to successfully educate various sectors of the positive outcomes from BMP implementation and fostered a high rate of acceptance within each of the respective implementation groups.

While these and similar projects are expected to continue, a prioritized approach will be established to assure NPS activities are focused in stream reach drainages with the highest potential for contaminant delisting and/or re-establishing designated uses. In short, Delaware's NPS focus will target watersheds with accepted Watershed Plans meeting the a) through i) criteria.

Current activity will be summarized and accounted for during the *2014 Delaware NPS Management Plan* development process. A first draft was submitted to EPA in late 2013. Comments were received and will be addressed during the next revision. A final approved plan will be developed by September 2014 that identifies the NPS Program's long-term goals reflecting a strategically focused state NPS management program designed to achieve and maintain water quality standards and to maximize water quality benefits.

Annual milestones in the *2014 Delaware NPS Management Plan* will describe outcomes and key actions expected each year. The Plan will include objectives that address nonpoint sources of surface water and ground water pollution as appropriate (including sources of drinking water) in alignment with the goals of the Clean Water Act. The objectives include both implementation steps and how results will be tracked (e.g., water quality improvements or load reductions). The Plan will include long-term goals and shorter-term (e.g., three- to five-year) objectives that are well integrated with other key environmental and natural resource programs. The program goals and objectives will be periodically revised as necessary to reflect progress or problems encountered, strategies to make progress towards achieving the goals, and indicators to measure progress.

Shortfalls

While we have met or exceeded our overall load reduction expectations within the targeted watersheds, the NPS Program did not achieve a few specific implementation goals we have set for ourselves. The exact goals for early/standard/late cover crops were not achieved, but cost share programs have been modified to emphasize early plantings and this acreage is expected to increase in the future. Forest buffer acreage did not increase and members of the agriculture community have indicated that current market prices of crops do not support land conversion for buffers at this time. A collaborative group plans to examine how much of an additional cost share incentive is needed to encourage additional enrollment in buffer programs. The tons of poultry litter transported has decreased in recent years; Delaware believes in general that the total volume of litter has decreased as has the nutrient content of the litter and staff are working with the CBP Ag Workgroup to assess the data and make necessary model modifications. Finally, the onsite pump out goal was not achieved, but regulations have been proposed requiring a pump-out and inspection at the time of property sale or transfer and will also require reporting when inspections occur; both requirements are expected to increase the number of pump-outs reported each year.

Land Use Changes/Challenges

Ed Ratledge, Director of the Center for Applied Demography and Survey Research at the University of Delaware says the number of acres of farmland is decreasing. Delaware had approximately 900,000 acres of farmland in 1920. Currently, we have about 580,000 acres in the state. Farmland acres are projected to continue to decrease until we reach about 380,000 acres by 2030.

The NPS program must address land use changes and trends for the next five years and beyond. As water runs over the landscape it picks up pollutants. These pollutants are either discharged into surface waters through runoff or seep through the soils into groundwater. The polluted groundwater eventually gets into the surface waters. As the landscape changes, so too does the funding demands of the NPS Program. Because of this fact, looking at land use will give the NPS Program goals, objectives and funding needs in which to focus the various resources the NPS Program receives. Agriculture BMPs, historically, have given the NPS Program the biggest return of nutrient uptake per dollar spent.

The trend of land use from agriculture to urban in the future could also mean a trend for the NPS program to spend more money on technologies and initiatives to reduce non-point source pollution. When land is developed nutrient loadings come from multiple sources, such as yard maintenance, wastewater disposal, stormwater runoff, soil erosion, and increases in impervious cover. Delaware is the 9th fastest growing state according to the U.S. Census Bureau. The fast rate of growth in Delaware means an increase in urban/residential areas. An increase in urban/residential areas nutrient loads from these land uses must be dealt with without relinquishing our efforts in agriculture.

IX. List of Partner Organizations/Committee Members

The hard work and many hours of agency staff members, organization members and private individuals who have partnered with the NPS Program in 2013 to address, reduce, identify and/or measure NPS pollution in Delaware is greatly appreciated. This NPS pollution control and prevention program has been very active, well received and effective. It is a credit to our partners as they have cooperated in the face of many conflicts to make this program what it is today.

Al Rizzo	**U.S. Fish and Wildlife Service**
Ann Marie Townshend	**Kent County Planning Office**
Austin Short	**DE Department of Agriculture**
Bob Coleman	**Delaware Nutrient Management Program**
Brenda Zeiters	**DNREC/NPS Program**
Brian Bloch	**DNREC/ Watershed Stewardship**
Bryan Hall	**State of Delaware Planning Office**
Chuck Williams	**DNREC/Shoreline**
Brittany Sturgis	**DNREC/ Watershed Stewardship**
Chris Bason	**Center for the Inland Bays**
Dale Churchey	**Delaware CREP Program**
Debbie Absher	**Sussex Conservation District**
Dave Schepens	**DNREC/Groundwater Discharges**
E.J. Chalavala	**Center for the Inland Bays**
Ed Lewandoski	**University of Delaware**
Eric Beuhl	**Center for the Inland Bays**
Frank Piorko	**DNREC/Watershed Stewardship**
Fred Suffian	**US EPA**
Gordon Johnson	**University of Delaware**
Greg Moore	**DNREC/Fish&Wildlife**
Jamie Rutherford	**DNREC/Sediment & Stormwater**
Jen Walls	**DNREC/Watershed Stewardship**
Jen Gochenauer	**Delaware Nature Society**
Jenn Volk	**University of Delaware**
Jerry Kauffman	**Water Resources Agency**
Jessica Watson	**Sussex Conservation District**
Jim Cassidy	**DNREC/Groundwater Discharges**
Jim Chaconas	**DNREC/Wetlands & Subaqueous Lands**
Jim Short	**DNREC/Solid Waste**
Joe Farrell	**University of Delaware**
Jim Sullivan	**DNREC/Watershed Stewardship**

John Barndt	**DNREC/Water Resources**
John Schneider	**DNREC/Watershed Stewardship**
Kevin Donnelly	**New Castle Conservation District**
Kimberly Cole	**DNREC/Delaware Coastal Program**
Kip Foskey	**Sussex Conservation District**
Lyle Jones	**DNREC/Watershed Stewardship**
Lara Allison	**DNREC/NPS Program**
Larry Towle	**DE Department of Agriculture**
Lynn Mangus	**Farm Service Agency/State Office**
Marcia Fox	**DNREC/Watershed Stewardship**
Marianne Walch	**DE Department of Transportation**
Mark Biddle	**DNREC/Watershed Stewardship**
Mark Davis	**DE Department of Agriculture**
Mark Hogan	**DNREC/NPS Program**
Paul Petrichenko	**NRCS State Office**
Randy Cole	**DE Department of Transportation**
Robert Baldwin	**DNREC/Watershed Stewardship**
Robert Palmer	**DNREC/NPS Program**
Russel Morgan	**USDA/NRCS**
Sally Boswell	**Center for the Inland Bays**
Sally Kepfer	**NRCS State Office**
Sara Esposito	**DNREC/ Watershed Stewardship**
Sara Wosniak	**DNREC/ Watershed Stewardship**
Sharon Webb	**DNREC/ NPS Program**
Shelley Tovell	**DNREC/Fish&Wildlife**
Steve Williams	**DNREC/ Watershed Stewardship**
Sue McDowell	**US EPA**
Tiana Blount	**US EPA**
Tim Garrahan	**NRCS State Office**
Tim Riley	**Kent Conservation District**
Tom Barthelmeh	**DNREC/Watershed Stewardship**