Assessment of the Implementation of the Inland Bays Pollution Control Strategy

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Background

Nutrient pollution is a primary concern facing the Delaware Inland Bays and their tributaries. Years of persistent nutrient pollution from fertilizers, wastewater, and runoff have caused the Bays to shift from clear waters with plentiful bay grass meadows and oxygen levels that support diverse, plentiful fish populations to murky waters that are dominated by algae, have few bay grasses or oysters, and do not support healthy oxygen levels in many areas. Major pollution reductions are needed to restore water quality.

To address nutrient pollution, Delaware Department of Natural Resources and Environmental Control (DNREC) enacted Total Maximum Daily Load (TMDL) regulations for the Inland Bays in 1998 (DNREC 1998; DNREC 2005) and promulgated the Inland Bays Pollution Control Strategy (PCS) in 2008 (DNREC 2008). TMDLs are the maximum amount of a pollutant that a waterbody can assimilate and still achieve water quality standards, and the PCS is a plan of actions to meet the TMDLs. Implementation of the PCS is critical to meeting the TMDLs. Achievement of TMDL goals are tracked through water quality monitoring, but the implementation of the PCS is not formally tracked. Therefore this report is a comprehensive assessment of the implementation of the PCS with the purpose of informing the anticipated 2018 PCS revision.

The Assessment

In place of a formal tracking system or model, the assessment was based on implementation of voluntary best management practices as tracked through cost share or technical assistance programs, and compliance with regulatory programs. Data collection for each sector is unique, and as follows:

- Point source discharges are required by regulation, through the National Pollutant Discharge Elimination System, to be routinely monitored. The water quality monitoring program is administered by DNREC Division of Water.
- Agricultural best management practices (BMPs) are a combination of voluntary participation in cost share and technical assistance programs, and regulation of nutrient management. Agricultural conservation cost share programs are a partnership between DNREC Division of Watershed Assessment, United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS), Sussex Conservation District (SCD), Delaware Department of Agriculture (DDA), U.S. Environmental Protection Agency (EPA) and landowners. Nutrient management planning, as required by regulation, is administrated through DDA.
- Through regulation, new or replacement onsite wastewater treatment and disposal systems must achieve higher performance standards. All aspects of siting, design and installation of onsite systems are administrated by DNREC Division of Water. The conversion of systems to central sewer is a voluntary action that is coordinated by both DNREC Division of Water and Sussex County.
- Stormwater management for new construction is regulated through DNREC Division of Watershed Stewardship (Sediment and Stormwater Management Program) and Sussex Conservation District. Retrofitting outdated stormwater facilities is a voluntary practice.

Tracking of retrofits was through DNREC's Environmental Finance Community Water Quality Improvement grant program.

Implementation was evaluated by sectors - point source, nonpoint source (including agriculture, urban land use, onsite wastewater and disposal systems, and stormwater) and concurrence (including agreements to work together among and between agencies). Each action under these sections is categorized by progress of nutrient reductions compared to projected reductions under full implementation: (100%), in progress (between 1% and 99.9%), or no action (<1%). Nutrient reductions (BMP efficiencies) are those assigned to each best management practice in the original PCS. When nutrient reductions were not provided, assessment of the level of completion is based on professional judgement. Similarly, cost estimates to reach full implementation were based on figures provided in the PCS. Cost estimates in this report were adjusted for inflation to 2016 dollars. The assessment was conducted using data from 2008 until 2015. In some cases, 2015 data were not available. In this instance, the most recent data were provided and the date noted.

Summary

Achievement was assessed on net nutrient reductions, as well as achievement of reduction goals. Based on net nutrient reductions, the agricultural sector made the greatest strides in reducing nitrogen by 1,078 lb/day mainly through planting of cover crops, nutrient management planning, and manure relocation, and reducing phosphorus by 29 lb/day mainly through manure relocation and use of phytase (Table 1). Based on percentage goal achieved, the onsite treatment and disposal systems sector made the greatest progress by achieving 71% of its nitrogen goal, and 372% of the phosphorus goal.

Alternatively, little to no progress was made in the urban land use or stormwater management section. As a result of a 2011 Delaware Superior Court decision, the buffer portions were void and unenforceable. One acre of buffer in the critical areas, such as adjacent to wetlands, can reduce nutrients from two upland acres of urban land. Little progress was made to retrofit existing stormwater infrastructure because it is costly to engineer and construct infrastructure in urban settings without adequate cost share programs.

Since PCS promulgation, 36% of the nitrogen reduction and 75% of the phosphorus reduction goals have been achieved. Based on 2008 cost estimates adjusted for inflation, at a minimum, $27,439,631 per year is needed to achieve full implementation of the PCS. This excludes costs associated with the conversion of Rehoboth Beach Wastewater Treatment Plant to ocean outfall at an estimated cost of $25,500,000. In addition to funding, full implementation of the PCS is possible only if there is clear coordination, tracking and accountability from DNREC.

Table 1. Summary of Pollution Control Strategy nutrient reductions by sector from 2008 until 2015

Sector	Nitrogen			Phosphorus		
	Reduction (lb.)	Goal (lb)	% complete	Reduction (lb.)	Goal (lb.)	% complete
Point sources	53	85	62	12	43	27
Agriculture	1,078	3,272	33	29	37	79
Onsite systems	267	377	71	29	8	372
Stormwater	3	130	2	<1	5	2
Total	*1,401*	*3,864*	*36*	*70*	*93*	*75*

POINT SOURCE

Within the Inland Bays all point source pollution originates from a single, easily identifiable source, such as a pipe discharging from a wastewater treatment plant. The Inland Bays Total Maximum Daily Loads and Pollution Control Strategies call for elimination of point source pollution. While progress has been made towards the goal of eliminating point source discharges by converting systems to land based application, a few point source discharges remain. It is important to note that elimination of point source discharges does not equate to complete elimination of nutrients. Although land application allows additional treatment of the effluent because the soil helps to remove remaining nutrients, the greatest nutrient reductions are a result of higher performance wastewater treatment plants. In the watershed, land application methods include spray irrigation and rapid infiltration basins.

Implementation of the actions in this section are a result of coordination between DNREC Division of Water and each wastewater treatment plant owner. Funding for implementation is available through grants and loans from DNREC Environmental Finance, which administers Delaware's Clean Water State Revolving Fund, a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects.

- *General Action*: Systematic elimination of all point sources of N and P to Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay
- *Summary of Achievement*: Elimination of point source discharges and improved wastewater treatment processes resulted in reducing pollution loads from point sources by 53 lbs. per day of nitrogen (62%) and 12 lbs. per day of phosphorus (27%).
- *Estimated Cost to Reach Full Implementation:* At a minimum, $52,500,000 is needed to reach full implementation.

COMPLETED ACTIONS

1. Lewes Wastewater Treatment Plant to acquire water quality credits in order to account for 2.5% of its discharge after implementation of more stringent nutrient removal technology.
   Status: Lewes Wastewater Treatment Plant maintains its discharge to the Lewes and Rehoboth Canal, and accounts for the nutrient pollution that reaches the Bays by funding manure relocation out of the watershed.
   Loads: On average from 2008 to 2015, Lewes contributed 0.43 lb/day of nitrogen and 0.11 lb/day of phosphorus to the Inland Bays.
   Reductions: In 2012, Lewes financed the relocation of 300 tons of manure out of the watershed. Based on the agricultural sector, this action resulted in reducing nutrients by an estimated 5 lb/day of nitrogen and 0.5 lb/day of phosphorus.

2. Systematic elimination of the Millsboro Wastewater Treatment Plant discharge.
   Status: The Millsboro Wastewater Treatment Plant converted to a Rapid Infiltration Basins System in August 2015.
   Loads: On average from 2008 to 2015, Millsboro contributed 37.0 lb/day of nitrogen and 1.98 lb/day of phosphorus.

Reductions: The estimated load reductions from the conversion are 26.1 lb/day of total nitrogen and 6.25 lb/day of total phosphorus.

ACTIONS IN PROGRESS

1. Water Quality Trading shall be considered as one of several options in reducing phosphorus and/or nitrogen in the Inland Bays, so long as any trading is tightly regulated to ensure true net reductions within the Inland Bays watershed.
   Status: Through this action, the City of Lewes offset their discharge through financing manure relocation out of the watershed. Also, through this action, the Allen Harim facility (formerly Pinnacle Foods) included nonpoint source load reductions through removal of corn production as a condition of the permit for this facility. As the last minor discharge, Allen Harim is in discussions with DNREC about how to address its point source.
   Loads: In 2012, the nonpoint source reductions ceased when land application of wastewater reverted to point source discharge. On average from 2012 to 2015, Allen Harim contributed 6.84 lb/day of total nitrogen and 0.66 lb/day of total phosphorus.

2. Systematic elimination of the Rehoboth Beach Wastewater Treatment Plant discharge.
   Status: Elimination of the discharge by conversion from point source discharge into the Lewes and Rehoboth Canal to an ocean outfall is scheduled for completion by June 2018.
   Loads: On average from 2008 to 2015, Rehoboth contributed 53.1 lb/day of nitrogen and 3.7 lb/day of phosphorus.
   Reductions: Pursuant to a consent decree, Rehoboth was given two years from the issuance of their discharge permit (10/1/05) to achieve a 25% reduction in nutrient loads, 22.3 lb/day of nitrogen and 4.8 lb/day of phosphorus. These reductions were achieved through upgrades to the treatment plant and resulted in significant nutrient reductions.
   Cost: The estimated cost for this action is $52,500,000. This includes $25,000,000 for conversion to ocean outfall, $15,000,000 for wastewater treatment plant improvements, and $12,500,000 for biosolids handling (Cooper, 2015).

NONPOINT SOURCE

Nonpoint source pollution originates from diffuse sources over a wide area, and enters the Bays through surface runoff or groundwater inputs. Nonpoint source pollution enters the Bays from activities on land including cropland and lawn fertilization, land applied wastewater disposal, and stormwater runoff from developed areas.

I. Agriculture

Although agricultural lands are decreasing over time as land is converted to development, it remains the largest land use in the watershed, accounting for 31% of the watershed area. Between 1992 and 2012, agricultural lands decreased by 18.2 square miles. Agriculture contributes significant amounts of nitrogen and phosphorus through field applications of manure and commercial fertilizers. Nutrients from agriculture are eventually transported to the Inland Bays, but loss can be minimized by following best management practices.

Implementation of the actions in this section are a result of coordination between DDA Nutrient Management Commission, SCD, DNREC, and farmers and producers. Funding for these actions is through a varity of cost share programs such as Nutrient Management Planning Program, Nutrient Management Relocation Program, Cover Crop Cost Share Program, Conservation Reserve Program/Conservation Reserve Enhancement Program, State Revolving Fund Agricultural Nonpoint Source Loan Program, and Environmental Quality Incentives Program.

- *General Action*: The agricultural sector should implement additional best management practices (BMPs) in order to achieve water quality standards.
- *Summary of Achievement*: Since 2008, the ongoing partnership between farmers, researchers, and government has resulted in substantial estimated reductions of 1,078 lbs. per day of nitrogen (33%) and 29 lbs. per day of phosphorus (79%).
- Estimated Cost to Reach Full Implementation: $4,030,170 per year

COMPLETED ACTIONS

1. Full compliance with the Nutrient Management Act; all agricultural acres should have a nutrient management plan.
   Status: As a result of the 1999 Nutrient Management Law, all animal feeding operations with greater than 8 animal units, or any properties over 10 acres upon which nutrients are applied, must have a nutrient management plan that specifies the level of nutrient applications that are needed to attain expected crop yields. As of 2016, 100% of farms (53,827 acres) are in compliance with nutrient management plans (Delaware Department of Agriculture, 2016).

Reductions: This action resulted in an estimated reduction of 635 lb/day of nitrogen.

2. Continue the use of feed amendments, such as phytase, and to minimize calcium di-phosphate in poultry feed in order to reduce nutrients in poultry manure.
   Status: Through regulation, all feed is amended with phytase to reduce nutrients in poultry manure.

   Reductions: This action resulted in an estimated reduction of 8.24 lb/day of phosphorus.

ACTIONS IN PROGRESS

1. Annual goal of 37,637 acres in cover crops.
   Status: From 2008 to 2015, an average of 7,086 acres of cover crops were planted. Establishment of cover crops is tracked through cost share programs, but not all farmers participate. In 2015, a crop transect survey was conducted by DNREC to better estimate cover crop establishment. The survey estimated an additional 7,808 acres that were not part of the subsidy program.
   Reductions: This action resulted in a reduction of 241 lb/day of nitrogen and 0.8 lb/day of phosphorus. The additional 7,808 acres resulted in an estimated reduction of 265 lb/day of nitrogen and 0.8 lb/day of phosphorus.
   Cost: To reach the established goal, an estimated $1,272,449 per year is needed. In 2015, requests for cover crop funding were more than two times the available funding (DNREC 2016).

2. Goal of 3,246 (209 of which already exist) acres of riparian forested buffer.
   Status: From 2008 to 2015, 12 acres of forested waterway buffers were established.
   Reductions: This action resulted in a reduction of 1 lb/day of nitrogen and <0.1 lb/day of phosphorus.
   Cost: To reach the established goal, an estimated $687,139 per year is needed.

3. Goal of restoring 4,175 (of which 29 already exist) acres of wetlands in areas that were previously converted to cropland.
   Status: From 2008 to 2015, a total of 38 acres of wetlands were restored.
   Reductions: This action resulted in a reduction of 4 lb/day of nitrogen and 0.1 lb/day of phosphorus.
   Cost: To reach the established goal, an estimated $1,406,105 per year is needed.

4. Goal of 1,772 acres (54.5 of which already exist) of grassed buffers.
   Status: From 2008 to 2015, 5 acres of grassed buffers were established.
   Reductions: This action resulted in a reduction of 0.3 lb/day of nitrogen and <0.1 lb/day of phosphorus.
   Cost: To reach the established goal, an additional $353,509 per year is needed.

5. Continue to use and support the construction of poultry manure storage sheds and composters, and build an additional 50 structures.

Status: From 2008 to 2015, 28 structures (15 sheds and 13 composters) were built.
Reductions: The PCS did not assign specific nutrient reductions to the manure sheds or poultry mortality composters.
Cost: To reach the established goal, an additional $137,809 per year is needed.

6. Annually relocate 20,909 tons of manure from the watershed or put into alternative use.
   Status: From 2008 to 2015, an average of 12,260 tons per year of manure were relocated. Relocation varies from year to year as a result of manure crust out or clean out schedules provided by the poultry integrator.
   Reductions: This action resulted in a reduction of 188 lb/day of nitrogen and 20 lb/day of phosphorus.
   Cost: To reach the established goal, an additional $133,916 per year is needed.

7. Implement additional Water Control Structures to treat 450 acres of cropland and maintain the 1,530 acres currently treated by these structures.
   Status: From 2008 to 2015, 2 water control structures have been implemented within the watershed. One structure treats 26 acres; therefore, 52 acres have been treated. The status of the existing structures to treat 1,530 acres is unknown.
   Reductions: This action resulted in an estimated reduction of 4 lb/day of nitrogen.
   Cost: To reach the established goal, an additional $24,418 per year is needed.

II. Urban Land Use

Urban land is increasing in the watershed as agricultural and forested areas are converted to development. From 1992 to 2012, developed land increased by 33.9 square miles. Urban land contributes nitrogen and phosphorus through numerous sources such as applications of fertilizer, erosion from construction activities, exhaust emissions, and runoff from impervious surfaces. Developed areas with higher percentages of impervious surface contribute significant pollution loads compared to forested areas. Studies have shown that noticeable degradation to the water quality of estuaries begins when their watershed exceeds 10% imperviousness. The Inland Bays watershed as a whole has reached 10.4% impervious cover. Rehoboth and Little Assawoman Bay watersheds are even higher—13.7% and 12.7%, respectively (Homsey, 2016).

- *General Action*: Decrease nutrient loading from urban nonpoint sources.
- *Summary of Achievement*: A February 25, 2011 Delaware Superior Court decision declared the buffer portions of the PCS void and unenforceable. There is no progress to report for the buffer portion of this sector. Little progress was made on the remaining actions due to a lack of dedicated funding source.

  Although urban best management practices are an important component for overall nutrient reductions, specific reductions were not assigned in 2008. As a result, assessment of implementation is based on professional judgement, and nutrient reductions are not reported for this sector.
- Estimated Cost to Reach Full Implementation: Unknown

COMPLETED ACTIONS

None

ACTIONS IN PROGRESS

1. Designation of the Inland Bays Watershed as a 'Critical Environmental Area.' The entire Inland Bays Watershed shall be managed for nutrient reductions consistent with TMDL load reductions, or reductions attributed to 'best available technologies' (BATs).
   Status: The Inland Bays Watershed is not designated a 'Critical Environmental Area;' however, regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds implemented the second portion of this action.
   Reductions: Dependent upon the type of practice implemented.

2. Encourage the planting of trees and other plants adjacent to all waters and wetlands.
   Status: From 2008 to 2015, the Center and partners have planted about 248 acres of trees or other plants adjacent to waters and wetlands. Outside of these Center projects, progress is not tracked by DNREC.
   Reductions: Reductions are variable depending on the type and location of planting. A best estimate was made using land use loading rates in Appendix E of the PCS. The conversion of agricultural to forested land results in an estimated average reduction 16 lb/day of nitrogen and 0.4 lb/day of phosphorus; therefore, this action resulted in an estimated 3,968 lb/day of nitrogen and 99 lb/day of phosphorus. These reductions were not included in the progress assessment, since nutrient reductions were not assigned in the PCS.

3. For new developments subject to State review under the Preliminary Land Use Service law, the Department will produce a nutrient budget. The nutrient budget will illustrate how the future land use will reduce or increase nutrient loading. Results will be available upon request.
   Status: The Delaware Urban Runoff Management Model (DURMM) is used to determine the difference in nutrient loading rates for the pervious land use and the developed land use with BMPs.
   Reductions: Reductions are variable depending on the BMP type.

ACTIONS WITHOUT PROGRESS

1. The Strategies for State Policies and Spending and other incentive/disincentive tools shall be specifically tied to natural resource protection goals in the Inland Bays Watershed.
   Status: The Strategies for State Policies and Spending are not specifically tied to natural resource protection goals in the Inland Bays.

2. When development-wide nutrient management plans are required, the homeowners association must retain the plan on file, maintain records of nutrient applications, and

submit a summary of nutrient application records to the Department of Agriculture, Nutrient Management Program on an annual basis.

Status: Residential developments are exempt from creating a nutrient management plan when individual, noncontiguous parcels upon which nutrients are applied do not exceed 10 acres or more.

3. Develop a grant program that addresses practices that may result in nutrient reductions on parcels of 10 acres or less where nutrients are applied. These shall include, but are not limited to: establishing nutrient budgets for homeowners, technical support for small landowners, and education.

   Status: Technical support and education for homeowners is available through Delaware Livable Lawns. No grant program was developed.

4. Land maintained as open space under County or municipal ordinances or codes should be managed to minimize nutrient loading. Land maintained as open space under County or municipal ordinances or codes should be managed to minimize nutrient loading.

   Status: Unknown.

III. Onsite Wastewater Treatment and Disposal Systems

Onsite wastewater treatment and disposal systems are a large source of nutrient pollution to the Inland Bays. A septic system is a common type of onsite wastewater treatment and disposal system. As of November 2014, approximately 8,292 septic systems permitted in the watershed. On average, these systems discharge as much as 240 lb/day of nitrogen and 16 lb/day of phosphorus to the groundwater. Conversion of septic and other onsite systems to central sewer and implementation of advanced technology on new and replacement systems is responsible for significant nutrient reductions.

- *General Action*: Improve operation and maintenance of onsite wastewater disposal systems such that nutrient loadings from them are reduced. This will require the use of innovative and alternative removal systems, as well as the conversion of some onsite systems to central sewer.
- *Summary of Achievement*: Since 2007, 8,527 equivalent dwelling units were converted from onsite systems to central sewer. This greatly surpassed the goal of converting 2,359 systems. Therefore this action is responsible for the majority of nutrient reductions in this sector, an estimated 245 lb/day of nitrogen and 20 lb/day of phosphorus. Reductions are anticipated to continue with additional sewer districts.
- *Estimated Cost to Reach Implementation*: Although the goal of converting onsite systems to central sewer has been achieved, a cost remains to maintain the regulatory programs and installation of new and replacement systems to higher performance standards. At a minimum the remaining portions of this section are estimated to cost $14,282,403 per year until replacement of private systems is complete.

COMPLETED ACTIONS

1. Permanent holding tanks shall not be permitted within the watershed.
   Status: Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds implemented this action.
   Reductions: This action minimizes additional loading of nutrients from holding tanks.

2. No new drainfields on parcels recorded 30 calendar days or more after the publication of these final Regulations in the Delaware Register of Regulations may be present within 100 feet landward from State-regulated wetlands, or the mean high water line of all tidal waters, whichever extends farther upland, and from the ordinary high water mark of all other primary water features.
   Status: Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds implemented this action.
   Reductions: This action reduced the additional nutrient loading if drainfield placement were allowed closer to the protected wetlands.

3. All properties utilizing an onsite wastewater treatment and disposal system that are sold or otherwise transferred to other ownership shall have their systems pumped out and inspected prior to the completion of the sale. For transfers of a new property, the certificate of completion will fulfill the requirements of this section. If an inspection has occurred within the previous 36 months and the property owner can provide documentation of such pump out and inspection, then such documentation will fulfill the requirements of this section. If the owner of an individual OWTDS provides proof of a licensed operator or has an annual service contract with a certified service provider then the requirements of this section have been met.
   Status: Currently, most, if not all, mortgage lending institutions require the inspection of a septic system prior to sale. A 2014 revision of the Regulations Governing the Design, Installation and Operation of On-site Wastewater Treatment and Disposal Systems required inspection of all septic systems prior to property transfers regardless of requirements from mortgage lending institutions.
   Reductions: Unknown.

4. All new or replacement on-site wastewater disposal systems must be designed to achieve performance standards as specified in the PCS regulation. These standards vary based on system size.
   Status: Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds implemented this action.
   Reductions: Current reductions and time to achieve completion are unknown. Full implementation of this action will result in a reduction of 304 lb/day of nitrogen.

5. Sussex County converts an additional 2,359 individual onsite systems to central sewer.

   Status: Since 2007, 8,527 EDUs were converted.
   Reductions: This action resulted in an estimated load reduction of 245 lb/day of nitrogen and 20 lb/day of phosphorus.

6. Economic assistance for those in need will be available through the Financial Assistance Branch, Division of Water Resources.
   Status: The Septic Rehabilitation Loan Program provides low interest financing for replacing failing septic systems and cesspools with on-site wastewater disposal systems that will function in an environmentally sound and cost effective manner. The loan is secured by a mortgage lien on the rehabilitated property. This program is managed by DNREC Environmental Finance with technical assistance from the Ground Water Discharges Branch.
   Reductions: Reductions are not associated with this action.

7. Maintain the existing Holding Tank inspection program.
   Status: The Holding Tank inspection program is continuous.
   Reductions: This action resulted in a reduction of 22.5 lb/day of nitrogen and 8.45 lb/day of phosphorus.

IV. Stormwater management facilities

Stormwater management is the primary technique to control nonpoint source pollution from developed areas. Prior to 1990, stormwater was managed by moving it off of the land as quickly as possible and without treatment in an attempt to avoid flooding damage. Rapid development with minimal stormwater management led to the environmental consequences of erosion and flooding that contributed to water quality to degradation. In 2012 and 2013, Delaware's stormwater regulations were overhauled to be volume based and maximize on-site storage of stormwater. Although these regulations provided water quality protections for new construction, much of the construction in the watershed was prior to 1990.

- *General Action:* Stormwater runoff shall be managed for nutrient reductions when practicable.
- *Summary of Achievement:* Stormwater retrofits of pre-1990 development are minimal in the Inland Bays watershed because this is a costly action with inadequate cost share programs to encourage wide spread retrofits.
- *Estimated Cost to Reach Full Implementation:* $8,281,245 per year (not including operation and maintenance)

COMPLETED ACTIONS

None

ACTIONS IN PROGRESS

1. Innovative designs such as rain gardens, natural landscaping, and constructed wetlands are encouraged where appropriate.

   Status: As a voluntary action that is not tracked, the status is largely unknown. Through the Center's 1,000 Rain Gardens for the Inland Bays, a program to education about and implement rain gardens, an estimated 3 acres of rain gardens were planted.

2. Created stormwater management facilities for 4,500 acres of urban and residential lands developed pre-1990.

   Status: Since 2008, 101 acres of urban and residential lands were upgraded with stormwater management facilities.

ACTIONS WITHOUT PROGRESS

1. When the Delaware Sediment and Stormwater Regulations require the creation of a permanent sediment and stormwater management plan, that plan shall be designed and implemented to reduce nutrient contributions to be consistent with the Pollution Control Strategy. Several methods are available to determine compliance. Consistency will be determined at the conceptual stormwater plan process. Compliance will be determined before approval of final site or subdivision plans.

2. Develop a program to assist homeowners' associations in the creation of a stormwater maintenance plan as well as to assist in the establishment of a funding mechanism to meet financial obligations for related stormwater facility maintenance.

3. Encourage Sussex County to create a stormwater utility for the Inland Bays Watershed. This utility will collect fees for the construction of stormwater management structures where needed.

4. Institute tax incentives that encourage an increase in open space (green areas) in commercial developments, thus, reducing the percentage of impervious surface and reduce nutrient contributions.

CONCURRENCE

Implementation of the PCS requires cooperation from multiple jurisdictions at several levels of oversight. An effort of this magnitude necessitates firm partnerships and a system of accountability.

- *General Action*: A higher level of government accountability is necessary if nutrient reductions are to be affected. There exist numerous instances of government

inconsistencies and lapses in application and enforcement of policies, laws, and regulations. A mechanism shall be established to ensure concurrence of policies, laws, and regulations within, between, and among government and other agencies.

- *Summary of Achievement*: There is a need to develop a system of accountability for the Inland Bays region. Nutrient reductions are not quantified for this action, but improved coordination between agencies and government will facilitate implementation of actions in the other sectors.
- *Estimated Cost to Reach Full Implementation*: Unknown

COMPLETED ACTIONS

None

ACTIONS WITHOUT PROGRESS

1. Form a task force to examine laws, regulations, and ordinances that are in effect within the Inland Bays Watersheds. This group will then identify areas where adjustments are needed in order to have concurrence.

2. All water quality impacting permits shall be consistent with the Surface Water Quality Standards (SWQS). The Department will begin creating a process to ensure that all wastewater and stormwater permits meet these standards.

3. The use of advanced nutrient reduction technology on lots subdivided after the promulgation of the Pollution Control Strategy shall not be used as justification for reductions in isolation, set-back and/or separation distances.

RECOMMENDATIONS

To achieve full implementation of the PCS, the following actions are recommended:

1. Clear coordination, accountability and tracking between DNREC programs is necessary to successfully implement the PCS. This may be achieved through the creation and hire of an experienced full-time planner position within DNREC to coordinate responsible parties in the revision, tracking, and implementation of the strategy.
2. Development of an accompanying project-level watershed implementation plan prioritized by cost effectiveness, feasibility, and responsible party, and including milestones for completion.
3. Establish regularly-meeting working groups of responsible parties by sector (agricultural, stormwater/urban land use, OWTD) to oversee tracking and implementation of the strategy.

4. Establish dedicated Inland Bays Watershed funding programs for full implementation of best management practices in each sector.
5. Revise current Sussex County water quality buffer ordinance based on the recommendations developed by the Center for Inland Bays as outlined in Bason (2008).
6. Revise current Title 3 Chapter 22 Nutrient Management to incorporate nutrient management regulation of the composition and application of nutrients to turf (residential, commercial, and publicly owned land that is planted in closely mowed and managed grass, except golf courses or land used in production for sale of sod or seed).
7. Revise nutrient reduction estimates and cost estimates associated with each action using the best available science. This will be used to inform the anticipated 2018 revision of the PCS.

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Appendix A
Cost estimate for full implementation of actions

Practice	% Action Complete	Cost to Reach Completion (in 2016 dollars)
AGRICULTURE		
Nutrient Management Plan	100	-
Cover crops	19	$1,272,449
Manure shed/composter	56	$137,809
Forested buffer	<1	$687,139
Grassed buffer	<1	$353,509
Establish wetlands	<1	$1,406,105
Maintain habitat, grassed buffers, etc.	100	$14,825
Water control structure	12	$24,418
Phytase	100	-
Manure relocation	59	$133,916
Total Cost for Agriculture		*$4,056,573*
ONSITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS		
Conversion to central sewer	463%	-
Maintain holding tank program	100%	$917,633
Performance standards-small system	Unknown	$13,364,770
Performance standards-medium system	Unknown	Unknown
Performance standards -large system	Unknown	Unknown
Total Cost for Onsite Systems		*$14,282,403*
STORMWATER MANAGEMENT		
Retrofits-pre 1990 construction	2	$8,281,245
Stormwater plan consistent with TMDLs	Unknown	$819,410
Total Cost for Stormwater		*$9,100,655*
Total Cost		*$27,439,631*