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Acting Commissioner

Final Phase I
Nutrient and Sediment Water Quality Improvement and Protection Plan

for

New York Susquehanna and Chemung River Basins

and

Chesapeake Bay Total Maximum Daily Load

December 2010

Prepared by: New York State Department of Environmental Conservation

In collaboration with:

New York State Department of Agriculture and Markets and
Upper Susquehanna Coalition

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Introduction

EPA has projected the total amount of nitrogen, phosphorus and sediment that Chesapeake Bay and its tidal tributaries can receive while still attaining water quality standards for dissolved oxygen and clarity. The resulting Total Maximum Daily Load proposal for Chesapeake Bay by EPA is shown in Table 1.

Table 1. Nutrient and Sediment Total Maximum Daily Load for Chesapeake Bay

	Bay Total	Basin/Jurisdiction Total	Atmospheric Deposition	Temporary Reserve
Nitrogen	203.14	187.44	15.70	9.37
Phosphorus	12.52	12.52	--	0.63
Sediment	6,066-6,673	6,066 – 6,673	--	--

Values are delivered load and units are million pounds per year (mpy)

EPA divided the total amount of these pollutants among the Bay watershed major river basins/jurisdictions. The initially proposed allocation for New York in the September 24, 2010 Draft TMDL is shown in Table 2 column 1. New York has one set of allocations at the major river basin /jurisdiction scale because all pollutant loads from New York are conveyed to Chesapeake Bay by the Susquehanna River. Within New York, the Susquehanna River basin is described as two separate basins, the Susquehanna and Chemung River Basins.

Also shown in Table 2 are the draft nutrient allocations (labeled December 2010 Final Draft Phase I) that New York expects will be identified by EPA in the Final Phase I TMDL.

Upon New York's request, EPA calculated and modeled a TMDL allocation based on a 1985 starting year rather than a 2010 starting year. This change of starting point is an important consideration for New York because New York has had a substantial decrease in its baseline "no-action" nutrient pollution loading from 1985 to 2010. Other jurisdictions have grown, often dramatically, since 1985 when severe impairment to Chesapeake Bay was well established. EPA determined that New York's allocations would go up by 1.43 mpy nitrogen and 0.12 mpy phosphorus, if calculated and modeled based on a 1985 start year rather than a 2010 start year.

EPA modified the New York baseline nitrogen allocation of 7.48 mpy by 0.75 mpy, resulting in an 8.23 mpy allocation in the Draft TMDL. There remains a technical justification for increasing the New York draft 8.23 mpy nitrogen allocation by an additional 0.68 mpy to 8.91 mpy and draft 0.52 mpy phosphorus allocation by 0.12 mpy to 0.64 mpy.

At this time, however, EPA has only 0.25 mpy nitrogen and 0.10 mpy phosphorus available with which to provide New York additional allocations. Following its designated 5:1 exchange ratio between nitrogen and phosphorus, EPA could apply one half of the 0.10 mpy unallocated phosphorus to the New York nitrogen allocation. Such a determination by EPA would bring the New York nitrogen allocation up to 8.73 mpy and the phosphorus allocation up to 0.57 mpy.

Table 2. EPA Proposed Nutrient and Sediment Allocation for New York Susquehanna and Chemung River Basins

	New York Allocations	
	September 2010 Draft Phase I	December 2010 Final Draft Phase I
Nitrogen	8.23	8.73
Phosphorus	0.52	0.57
Sediment	293-322	293-322

Values are delivered load and units are million pounds per year (mpy)

New York submitted to EPA a watershed model input deck in November 2010 with a refined suite of agricultural practices and New York's Bay-significant wastewater treatment plants (WWTP) at a combined or aggregate equivalent of 0.5 mg/l phosphorus and 8.0 mg/l nitrogen and using the permitted flow for these facilities. The result of this, combined with the other source sector model inputs, was delivered loads of 9.25 mpy nitrogen and 0.57 mpy phosphorus.

There remains a 0.53 mpy nitrogen difference between the December 2010 Final Draft Phase I TMDL allocation that EPA is expected to adopt and the level of nitrogen reduction New York is proposing in its Final Phase I Watershed Implementation Plan. New York offers the following suite of actions that could be undertaken to address this difference before the Phase II WIP and TMDL:

- EPA's re-evaluation in 2011 of its watershed model version 5.3, primarily involving agriculture nutrient management and urban land use.
- EPA's re-evaluation in 2011 of its suite of models (watershed, bay water quality, air transport, etc.) it uses to assess Bay restoration in light of air modeling improvements.
- Anticipated changes to EPA's air quality standard for Ozone and the resulting implementation of controls which also reduce nitrogen oxide emissions.
- New York placeholder management practices related to passive hay production and manure crop application.
- Refinement of nitrogen to phosphorus exchange ratios for the New York Susquehanna and Chemung River Basins.
- Other unforeseen events and outcomes from the Phase II process occurring in 2011.
- Additional nutrient control practices applied to wastewater treatment plant, stormwater pollution, air emission sources and agricultural activities by the year 2025.

New York anticipates that EPA will employ a gross backstop of 0.53 mpy nitrogen waste load allocation for New York's Bay-significant WWTPs. New York also anticipates that the EPA backstop would be deferred until the Phase II WIP and revised TMDL are completed.

The following source sector chapters (Agriculture, Wastewater, Urban Runoff and Other Remaining Sources) represent New York's Phase I Watershed Implementation Plan associated with the Chesapeake Bay Total Maximum Daily. The source sector chapters show how the nutrient and sediment allocations for New York will be achieved and maintained. They may be modified based upon:

- Federal implementation funding criteria.
- Application of adaptive management stemming from lessons learned associated with two-year milestone results.
- Other unforeseen events and outcomes of advances in scientific understanding and technology.

Interim and Target Loads

EPA's objective is for watershed jurisdictions to implement the actions necessary to achieve the nutrient and sediment allocations by 2025 and to have controls in place by 2017 that will achieve 60% of the necessary reductions from 2009 loads. Table 3 depicts this reduction schedule.

Table 3. New York Nutrient and Sediment Reduction Schedule

	Nitrogen	Phosphorus	Sediment
2009	10.54	0.80	327
2017 60% goal	9.77	0.66	307 - 324
2025 TMDL Phase II allocation goal	9.26	0.57	293 - 322

Values are million pounds per year. All 2009 values are delivered load and an output of USEPA Chesapeake Bay Watershed Model Version 5.3.

Table 4 shows the description of the loads delivered to Chesapeake Bay from New York from major source categories based on EPA watershed model version 5.3. When comparing categories, it is important to note the 2009 wastewater load is based on the actual quantity discharged from wastewater treatment plants in the year, whereas the remaining non-point source loads are based on an average hydrologic year.

Table 4. 2009 Nutrient and Sediment Contribution from Major Source Categories

	Nitrogen	Phosphorus	Sediment
Agriculture	4,109,874 (39%)	346,992 (43%)	155,222,452 (47%)
Urban Runoff	597,147 (6%)	73,311 (9%)	53,920,725 (16%)
Point Source (wastewater)	1,648,004 (16%)	202,902 (25%)	2,374,683 (1%)
Septic	539,254 (5%)	0	0
Forest	3,647,206 (35%)	178,074 (22%)	115,636,379 (35%)
New York Totals	10,541,483	801,278	327,154,238

Values are pounds per year. In parentheses is the per cent of the total. Because both are largely uncontrollable load, the Forest category includes 107,438 pounds per year of nitrogen and 8,012 pounds per year of phosphorus attributed to Non-tidal Water Deposition. All 2009 values are delivered load outputs of EPA Chesapeake Bay Watershed Model Version 5.3 and units are pounds per year.

Based on several factors, including pollutant magnitude, technical feasibility, implementation capacity and nutrient and sediment control benefits, New York divided its total nutrient loads among the major source categories in the following manner[1].

Sub-allocation to the Major Source Categories in New York

Agriculture
Within the framework of New York's Agriculture Environmental Management program (NY Ag & Mkts Law §11A-150, *et seq.* enacted into law in 2002, http://www.nys-soilandwater.org/aem/index.html), the management practices and associated implementation levels are the recommendation of the collaborative effort of the Upper Susquehanna Coalition (Soil and Water Conservation Districts) the New York State Department of Agriculture and Markets, the New York State Department of Environmental Conservation (CAFO work group), and Cornell University.

Wastewater
The waste load allocation for significant wastewater treatment plants will be implemented in stages.

Stage 1: Enforce existing permits requiring treatment optimization and engineering evaluations until EPA revises this TMDL or modifies allocations associated with development of the Phase II Watershed Implementation Plan.

Stage 2: Issue discharge permits with limits to achieve the 2017 waste load allocations

Stage 3: Issue discharge permits with limits to achieve the 2025 waste load allocations

The New York State Department of Environmental Conservation is proposing an aggregate 2025 wastewater load which would be the equivalent 7.4 mg/l nitrogen and 0.5 mg/l phosphorus at the permitted flow of the 28 largest discharges (referred to as "Bay significant"). Taking into account losses estimated by the watershed model during river transport to the Bay, the "Bay Delivered" nitrogen concentration would average approximately 4 mg/l and the phosphorus concentration would average 0.2 mg/l. Upon completion of EPA refinements to the Bay TMDL planned in 2011, New York will initiate permit modifications with individual waste load allocations for these 28 discharges.

Urban Runoff
The type of management practice and associated implementation levels are an outcome of the New York stormwater regulatory program (construction stormwater and municipal separate storm sewer system permits.) It also incorporates the New York fertilizer law enacted in 2010. The quantification of the nutrient load reduction resulting from these efforts was assisted by the EPA watershed implementation plan contractor in collaboration with the Southern Tier Central Regional Planning and Development Board.

[1] New York does not describe the same for sediment as the sediment allocation is a modeled outcome of the nutrient controls.

Forest
Forest harvest management practices are included on lands where the NYSDEC Division of Lands and Forests is involved in timber harvest management.

Septic Systems
No new septic system controls are proposed. Connections to municipal sewers or other remedies of areas of inadequate systems may occur based on local water resource or public health concerns.

Table 5 shows the breakdown of the nutrient load targets among the various source sectors based on the modeled result of aforementioned controls.

Table 5. Major Source Category Nutrient Targets[2].

		Nitrogen Delivered			Phosphorus Delivered		
		2009	**2017**	**2025**	**2009**	**2017**	**2025**
Agriculture	Total	4.11	3.59	3.07	0.35	0.30	0.25
	CAFO	*de minimus*	*de minimus*	*de minimus*	*de minimus*	*de minimus*	*de minimus*
Urban Runoff	Total	0.60	0.54	0.50	0.07	0.06	0.06
	Non-regulated	0.37	0.33	0.31	0.04	0.04	0.04
	MS4	0.23	0.21	0.19	0.03	0.02	0.02
	Const. SW [3]	0.004	0.004	0.004	0.001	0.001	0.001
	Indust. SW	*de minimus*	*de minimus*	*de minimus*	*de minimus*	*de minimus*	*de minimus*
Point Sources (wastewater)	Total[4]	1.65	1.43	1.39	0.20	0.11	0.08
	Bay-Significant		1.31	1.27		0.10	0.07
	Other (nonsigs)		0.1	0.1		0.01	0.01
	CSO	0.12	0.02	0.02	0.011	0.002	0.002
Septic		0.54	0.55	0.55	0.00	0.00	0.00
Forest[5]		3.65	3.69	3.73	0.18	0.18	0.18
Watershed Model Total		10.54	9. 80	9.24	0.80	0.65	0.57
2017 60% target			9.77			0.66	
2025 target[6]				9.26			0.57
Modeled Difference			(0.03)	0.02		0.01	(0.00)

Federal Funding
New York expects EPA's funding criteria to be commensurate with the level of burden to remove a "delivered" pound of nutrients. This is significant to New York because of its distance to the Bay and the resulting appearance of funding being less cost-effective in New York.

[2] All target values are subject to verification in future model runs before TMDL is finalized. All values are million pounds per year. All values are delivered load and an output of USEPA Chesapeake Bay Watershed Model Version 5.3.
[3] Construction not in MS4 area
[4] Note that 2009 model results use actual WWTP discharge flows in 2009, a relatively dry year, whereas an average hydrology year is used for nonpoint source values.
[5] Because both are largely uncontrollable load, the Forest values include New York non-tidal water deposition.
[6] Targets are 9.26 mpy nitrogen and 0.57 mpy phosphorus for purposes of this WIP.

A. Agriculture

New York State supports **"Environmental and Economically Sustainable Agriculture."**

The DEC has been working with both environmental and farming stakeholders in New York State for over a decade to achieve environmental compliance for all of New York State agriculture. New York State recognizes the historic, cultural, environmental and economic importance of maintaining agricultural viability in the Upper Susquehanna region. On-going communication is critical to finding ways to reduce the environmental impact of farms while protecting the open space, vistas, rural economic development, food, fiber and energy that they provide to all of us.

A carefully coordinated effort between the DEC, the New York State Department of Agriculture and Markets, New York State Soil and Water Conservation Committee and the Upper Susquehanna Coalition actively supports increased planning for, use and performance of conservation practices with best management practice (BMP) implementation on farms through programs such as the Agricultural Environmental Management (AEM) program and the Agricultural Nonpoint Source Abatement and Control Program (AgNPS). New York State contributes over $10 million annually statewide of Environmental Protection Funds (EPF) to these programs to implement practices on farms to protect water quality.

This coordinated effort to support environmental and economically sustainable agriculture works to document farm statistics and BMPs, develop watershed and site specific agricultural plans and implement and evaluate those practices. New York farmers are active stewards. More than 12,000 farms statewide of all types and sizes are involved in AEM, a program that responds to environmental needs with cost effective improvements that benefits farms and communities. Utilizing the tools the AEM program provides, the status of agricultural BMPs in New York is accurately documented by the Upper Susquehanna Coalition and reported to the Chesapeake Bay Program.

New York State has invested in an environmentally sound voluntary incentive based program that works. Since 1994, $90 million in State Environmental Protection Fund grants have been allocated through Soil and Water Conservation Districts, cost sharing more than 5,000 conservation projects on over 2,000 farms in 50 counties. Approximately 25% of these resources affect the Chesapeake watershed effort.

Current Loading Baseline and Program Capacity

Agriculture represents nearly 25% of the watershed land use and, in a 2009 Chesapeake Bay Model run, delivered approximately 39%, 43% and 47%, respectively, of the total nitrogen, phosphorus and sediment loads from New York.

There are two primary and intertwined programs in New York that address agriculture: the New York Concentrated Animal Feeding Operation (CAFO) regulatory program and the New York Agricultural Environmental Management (AEM) Program. The careful coordination of a strong regulatory program with financial incentives and a strong local implementation team all based on

sound science and applied research is the recipe for a successful agricultural water quality program.

It is important to note that the New York CAFO program covers all farms with as few as 200 cows with binding permits, whereas under the USEPA program, only some farms with greater than 700 animals would be covered by regulatory permits. 65 CAFOs are permitted in the New York Chesapeake Watershed. New York's AEM program is currently working with 2,285 additional farms in the New York Chesapeake Bay watershed.

The success of the New York Program is clear. New York's CAFO and AEM programs cover 95% of the dairies in the New York portion of the Chesapeake Bay watershed. According to the latest "progress run" modeling by USEPA R3, comparing 2002 to 2009 the agricultural nitrogen load delivered from New York decreased more than 27%[7]. (As previously noted, under USEPA R3's proposed protocols, however, New York gets no "credit" for this useful reduction in nitrogen loadings).

Agricultural Environmental Management Program

The New York State Agricultural Environmental Management (AEM) Program (www.nys-soilandwater.org) works to support farmers in their efforts to protect water quality and conserve natural resources, while enhancing farm viability. Started as an initiative in 1996 and codified in New York State law in 2000, New York's AEM Program has aided farmers in protecting water quality by providing a framework to assess environmental stewardship and coordinating technical and financial assistance from the Federal, State, and local levels to address priority water quality issues on the farm. The driving principle of AEM's success is a farm specific focus, coordinated through locally developed watershed based strategic plans and an educational component to elicit landowner confidence. Core concepts of AEM include:

- Voluntary, incentives based
- Locally-led
- Watershed focus
- Works within the resources of each farm
- Promotes teamwork
- Coordinates assistance

Why AEM was Developed

AEM was created to provide a consistent format to address environmental challenges facing NY agriculture in a manner that enhances long-term economic viability. Many Federal and State programs exist to assist the farmer with environmental stewardship; these programs lack coordination and often compete against each other. AEM is the "umbrella program" that efficiently identifies environmental concerns through a comprehensive environmental assessment and matches these identified needs with existing financial opportunities for farms. With over 30,000 farms making up New York State's diverse agricultural industry the coordination and screening function of AEM is critical to targeting technical and financial assistance to the issues and farms that will yield the greatest environmental benefit. AEM also is the cornerstone of the

[7] From 5,917,424 pounds in 2002 to 4,293,439 pounds in 2009.

agricultural component of New York's Nonpoint Source Water Quality Management Strategy[8] developed to meet requirements of the Clean Water Act, The Safe Drinking Water Act, and the Coastal Zone Management Act.

Who is Involved

AEM is administered by the New York State Soil & Water Conservation Committee (SWCC) housed at the New York State Department of Agriculture and Markets. Key partners advising the SWCC that helped develop and have endorsed AEM include the New York State Departments of Environmental Conservation, Health, and State; the USDA – Natural Resources Conservation Service; Cornell University, State University of NY College of Environmental Science and Forestry, Cornell Cooperative Extension, and New York State's County Soil and Water Conservation Districts. AEM is administered and implemented at the local level through County Soil and Water Conservation Districts who engage local partners such as Cooperative Extension, NRCS, AEM Certified Planners, Certified Crop Advisors, USDA Technical Service Providers, and agri-businesses to work as a team to develop, implement, and evaluate conservation plans on farms. New York's Conservation Districts have also formed coalitions of Districts that include partner agencies, universities, and organizations working together on the needs of our major watersheds to promote cooperation, coordination, and the sharing/pooling of resources in advancing AEM. Such coalitions include the Upper Susquehanna Coalition, the Finger Lakes-Lake Ontario Watershed Protection Alliance, Mohawk River Coalition, and others throughout the State.

How it Works

The AEM process at the County level begins with the Conservation District forming an AEM Steering Committee made up of local resource professionals and stakeholders. These committees often include local representatives of USDA NRCS and Farm Service Agency (FSA), Cornell Cooperative Extension, County Health and/or Planning Departments, Farm Bureau, environmental organizations, watershed associations, agri-business, farmers, and interested citizens. The committee is tasked with developing an AEM Strategic Plan meeting minimum criteria developed by the State Soil & Water Conservation Committee to guide the local AEM effort for the upcoming five years. Key to the strategy is the targeting/prioritization of watersheds, environmental concerns/opportunities, and the types of BMP systems needed to address concerns/opportunities. Technical information leading to the decisions made in the strategic plans comes from a wide range of sources including Federal and university studies, the State's Priority Waterbodies List (PWL) and Source Water Assessment, and numerous locally funded and generated studies and assessments. From their AEM Strategic Plan each County AEM Steering Committee develops an Annual Action Plan (AAP) outlining what will be done in the coming calendar year to advance their Strategic Plan. Coordination of AEM Strategic plans and AAPs as they relate to addressing the needs of watersheds shared by multiple counties are addressed through the previously mentioned coalitions of Conservation Districts. As an example the Upper Susquehanna Coalition coordinates the activities for the Susquehanna River watershed not only in NY but also three counties in PA. A basic tenant of AEM is that State and Federal water quality priorities will be solved through addressing local water quality priorities. New

[8] The NYS NPS Water Quality Management Strategy was last updated by NYSDEC in 2000. It had four priority issues with agriculture as one of them and it was to be addressed through AEM.

York State supports the implementation of each AAP by providing up to $75,000 in technical assistance funding to Conservation Districts supporting identified activities including farm inventories, environmental assessments, conservation planning, BMP design, and BMP and/or conservation plan evaluations. Associated activities such as related educational programs, outreach activities, and data management can also be funded, but emphasis is placed on identifying priority concerns and providing technical assistance to address concerns and work toward continuous environmental improvement. Implementation of planned BMPs is supported by directing the farm to the appropriate Federal, State, or local program that best meets the needs of the resource concern being addressed and the practice to be implemented.

AEM's on-farm framework is designed to be highly interactive and utilizes resource professionals and peers working with the farmer throughout the process. This framework and associated process increases farmer awareness of the impact farm activities have on the environment and by design; it encourages farmer participation and seeks behavioral change, which are important overall goals. AEM utilizes the NRCS Planning Process that is enhanced through a five-tiered framework:

- **Tier 1** – A resource professional collects farm contact information; inventories farm infrastructure, land use, and livestock; determines the farm's future plans; informs the farmer of their watershed(s) and watershed concerns, and identifies potential environmental concerns and opportunities. Tier 1 activities are supported by technical assistance funding supplied to Conservation Districts through the AEM Base Program which is supported by an annual allocation from New York State's Environmental Protection Fund (EPF). www.nys-soilandwater.org/aem/techtools.html
- **Tier 2** – A resource professional utilizes pertinent worksheets to conduct an on farm environmental assessment based on watershed concerns and the potential concerns and opportunities identified in Tier 1. Tier 2 documents existing environmental stewardship, provides an educational opportunity with the farmer, and verifies environmental concerns or flags issues for further evaluation during the planning process. Information gathered at this stage allows for the prioritization of farms and resource concerns on the farm to receive further technical assistance and potentially financial assistance with relatively little time invested on the part of the resource professional. Tier 2 activities are supported through the AEM Base Program. www.nys-soilandwater.org/aem/techtools.html
- **Tier 3** – Priority farms develop a conservation plan with assistance from a team of resource professionals addressing priority resource concerns derived from the integration of the farm's business objectives, watershed concerns (as derived through the local AEM Strategic Plan), condition of the involved resources (water, soil, air, plants, and animals), and environmental risk. The level and extent of planning considers farm resources and is often progressive (on-going and seeking continual improvement through behavioral change). All BMPs must be planned according to NRCS Conservation Practice Standards and Cornell University Guidelines. Plan components addressing nutrient management must be completed by an AEM or NRCS Certified Planner. Conservation planning activities are supported through the AEM Base Program or competitive State and Federal programs such as NYS Agricultural Nonpoint Source Abatement and Control Program (ANSACP) or USDA's Environmental Quality Incentives Program (EQIP).

- **Tier 4** – Implementation of priority BMPs in priority conservation plans. All BMPs must meet NRCS Conservation Practice Standards and Cornell University Guidelines. BMPs designated as engineering must be designed by Professional Engineers licensed in NYS. Technical assistance for BMP design and installation oversight is supported by the AEM Base Program, or by successful application to NYS ANSACP or USDA Farm Bill Programs. Financial assistance for BMP implementation (generally cost sharing) is provided to the farmer through successful application to the appropriate program such as ANSACP or USDA Farm Bill programs. If approved for funding within a State or federal cost share program, farms must implement practices according to strict technical requirements and within the timelines set forth by contract.
- **Tier 5** – Conduct evaluations of conservation plans, and implemented BMPs to ensure effectiveness in protecting the environment, proper operation and maintenance, and needed support to the farmer to safeguard public investment. Conservation plan updates according to current standards and guidelines assure continuous improvement and address concerns resulting from expanding operations and management changes. Tier 5 activities are supported through the AEM Base Program. Through various AEM tools evaluation can take place at the BMP, farm, watershed and/or county levels.

Initiation of the AEM process is recognition by the farmer of their potential environmental impact.

Associated Programs

State and Federal programs are coordinated through AEM to work together to efficiently provide technical and financial assistance to priority farms and priority environmental issues. Both the AEM and EQIP programs require adherence to the same technical standards as CAFOs under permit. NRCS has, for the past four years, required producers to have a current CNMP to be eligible for EQIP funds to install livestock waste practices. Only practices required in the CNMP are eligible for EQIP funding. New York State and NRCS also provide funding for the development of CNMPs for producers who do not have them. These programs include:

AEM Base Program – www.nys-soilandwater.org/aem/basefunding.html noncompetitive technical assistance funding to Conservation Districts to inventory and assess farms in priority watersheds then plan, design BMPS, and evaluate effectiveness of planning and BMPs on priority farms based on County AEM Strategic Plans and Annual Action Plans.

Agricultural Nonpoint Source Abatement and Control Program (ANSACP) – www.nys-soilandwater.org/aem/nonpoint.html Competitive financial assistance program available to Conservation Districts that provides funding to plan, design, and implement priority BMPs, as well as cost-share funding to farmers to implement BMPs.

USDA Farm Bill Programs – As described above, AEM is an "umbrella program" providing the framework and tools for farmers to assess their environmental risks and opportunities, learn about the impacts of their actions on water quality and other natural resources, and prepare them to participate in programs to address priority concerns and opportunities. AEM participating farmers may utilize several programs to develop

conservation plans and receive cost-sharing and other incentives to implement BMPs through USDA and the current Farm Bill.

Farm Bill programs available in NYS for conservation planning and implementation include:

- Environmental Quality Incentives Program (EQIP) – includes special funds for the Chesapeake Bay Watershed. AEM Tier 2 Assessment Worksheets are used to help rank EQIP applications.
- Conservation Reserve Program (CRP) – CRP/CREP have enrolled 19,332 acres through 2,186 contracts in the NY portion of the watershed.
- Conservation Reserve Enhancement Program (CREP) – NYS has requested assistance from the USDA Farm Service Agency (FSA) to expand CREP eligibility in NYS to all sub-watersheds of the Susquehanna River.
- Conservation Security Program (CSP)
- Agricultural Management Assistance Program (AMA)
- Wetland Reserve Program (WRP)
- Debt for Nature Program

Participation Incentives

CAFOs (large and medium) are required to participate in AEM. Additionally, there are several incentives for small farm participation in AEM. Incentives for AEM participation include:

- Free technical assistance to identify and address environmental risks, watershed needs, and farm goals through conservation plans.
- Technical assistance to implement conservation plans and practices that can improve farm profitability including, but not limited to:
  - Nutrient management
  - Prescribed grazing
  - Conservation tillage including no-till
  - Cover crops
  - Integrated Pest Management
  - Composting
  - Feed ration evaluation and balancing
  - Buffers
  - Pathogen management
- To help maintain and improve farm natural resources for future generations
- Improved consideration when applying for competitive Farm Bill cost share programs
- Eligibility for the NYS ANSACP cost-share program
- Eligibility to participate in NYS Farmland Protection Program
- The desire to be viewed and recognized as an environmental steward. NYS has a program that provides an AEM sign to farms that demonstrate and maintain high levels of environmental stewardship, as well as a Statewide and several County AEM Farmer of the Year Awards
- Discounts for related SWCD services such as Soil Group Worksheets required for Agricultural Tax Assessments
- The desire to be a good neighbor.

- Eligibility for the Agricultural Water Quality Revolving Loan Fund - provides low interest loans to farmers to implement BMPs.

AEM Tools

To improve the effectiveness of the AEM framework and related conservation programs in addressing priority farms, environmental and pollutant concerns, several tools have been developed by the AEM Partnership. AEM tools include:

- AEM Tier 1 Questionnaire
- AEM Tier 2 Assessment Worksheets
    - Core Worksheets – 12 worksheets generally applicable to all farms
    - Commodity Specific Worksheets (to be considered in addition to appropriate core worksheets)
        - Dairy, Livestock, & Field Crops – 8 worksheets
        - Equine – 4 worksheets
        - Vegetables & Fruit – 2 worksheets
        - Vineyards – 8 worksheets
        - Greenhouses – 3 worksheets
- Manure Storage Screening Tool – determines whether or not manure storage is needed in order to apply according to NRCS NY 590, and clarifies for the farmer all the requirements needed to properly operate and maintain a manure storage structure including appropriate application according to an NMP. Steps taken to satisfy the Manure Storage Screening Tool can then be applied to the development of a CNMP.
- AEM Tool for the Evaluation of Manure Storage Structures – a tool to guide the evaluation of existing manure storages to meet applicable NRCS Standards including proper operation and maintenance. This evaluation must be completed by a Professional Engineer.
- AEM Tool for the Evaluation of Vegetated Treatment Areas – a tool to guide the evaluation of existing filter and treatment areas to meet NRCS Standard 635 including proper operation and maintenance. The evaluation must be completed by a Professional Engineer.
- AEM Report Card – A self evaluation tool for Conservation Districts and partners to evaluate their overall AEM effort from Strategic and Annual Action Plan development, through outreach, educational programming, communication, technical assistance, coordination and use of associated programs, and roles of partners, to on-farm evaluation of plans and implemented BMPs.

AEM Training

Training of resource professionals from the public and private sectors is a vital component of AEM. Training is regularly provided to Soil & Water Conservation Districts and their partners at NRCS, Cornell Cooperative Extension, Private AEM Certified Planners, Certified Crop Advisors, Technical Service Providers, and agri-businesses. Training is overseen by the AEM State-wide Interagency Committee that reports to the SWCC. Training is guided by a Technical Development Curriculum developed by the Conservation Partnership and endorsed by the SWCC and the NYS Conservation Districts Employee's Association (CDEA). The curriculum has two tracts; one for planners who generally identify environmental concerns and opportunities

and work with the farmer to plan solutions, and another for technicians who generally develop detailed designs of BMPs and oversee the installation.

Training on the curriculum and related topics is provided annually at three venues:

- NYS Water Quality Symposium (WQS) – 3 days of concurrent training held annually in March. Over 300 participants attend including Conservation District staffs and conservation partners from NRCS, Cooperative Extension, AEM Certified Planners, DEC staff, some farmers and agri-business representatives. The WQS annually hosts the classroom component of the AEM Planner Certification requirements. The WQS has occurred annually since 1979 and is funded through State Funds and participant registrations.
- NYS Conservation Skills Workshop (CSW) – 4.5 days of concurrent field training in support of the curriculum is held annually in October. Training at the CSW is often the field component of classroom training initiated at the WQS. The audience is similar to the WQS and averages 130 participants annually. The CSW has occurred annually since 1997 and is supported through participant registrations and contributions from CDEA, SWCC, and NRCS.
- Northeast Region Certified Crop Advisor Annual Training Session (NRCCA) – 3 days of concurrent training is held annually in December for Certified Crop Advisors and all conservation partners. Sessions are awareness oriented related to conservation programs, regulatory issues, current events, and new technology. Offerings at the NRCCA are coordinated with the Interagency Training Committee. The audience is predominantly CCAs from the public sector (Cooperative Extension, NRCS, and SWCD) and agri-businesses averaging around 150 participants annually. A training component for Professional Engineers associated with AEM Certified Planners is often held in conjunction with the NRCCA or the WQS annually. The training is supported through participant registrations and has been held since 1992.

In addition to the three annual training events described above, numerous other statewide and regional sessions are offered through the AEM Interagency Training Committee as needed to support the curriculum, programs, and regulations, as well as address emerging needs, issues, and technology. Examples of training opportunities held during 2010 available to the conservation partnership, CCAs, TSPs, and agribusiness included:

- AEM: Overview of Procedures and Tools for Inventory and Assessment – 2 sessions held
- AEM: Overview of Procedures and Tools for Conservation Planning – 3 sessions held
- AEM Communications Training Phase 1, 2, and 3
- Cropland Conservation Planning Field Session – 2 sessions held
- Farmstead Resource Concern Identification – 2 sessions held
- Nutrient Management and Groundwater
- Cover Crops Field Day
- Soil Health Training Course
- Conservation Planning on Pasture – 2 sessions held
- Cornell Cropware Nutrient Management Planning and RUSLE2 Training
- NRCS Phase 3 Conservation Planning Training – 5 day session

The coordinated training efforts described above are extended to the farmer through the one-on-one interaction with public resources managers, AEM Certified Planners, Certified Crop Advisors, and USDA – Technical Service Providers. Additional training events for farmers such as workshops, field days, tours, and demonstrations are identified in the AEM Strategic Plan and supported financially at the county and watershed level through the AEM Base Program.

Concentrated Animal Feeding Operation Program

Following the first CAFO general permit issuance in New York in 1999, CAFO operators were required to obtain and comply with state wastewater discharge permits. Today, more than 10 years later, New York has one of the most robust CAFO permitting programs in the nation, covering 150 large and over 450 medium-sized CAFO farms. New York State's CAFO program is clear, actively implemented and enforced, of state-wide applicability, practical and scientifically supported. New York State recognizes the need for farm-specific, technical evaluations by qualified professionals, in the form of Certified Planners and Professional Engineers, to ensure that the farm understands and implements the latest developments in land grant university guidelines, United States Department of Agriculture Natural Resources Conservation Services (USDA-NRCS) technical standards and State regulatory requirements.

Since the start of the CAFO permitting program in 1999, New York has required New York Certified Planners to develop Comprehensive Nutrient Management Plans (CNMPs) for CAFO farms and Professional Engineers to design and certify NRCS engineering practices on farms. This type of science-based, risk reduction approach to CAFO regulation, developed and implemented by New York since 1999, should be considered the national standard; anything less is inconsistent with the Clean Water Act's "best technology" requirements. The historical lack of a consistent program nationally, and between Chesapeake Bay watershed states, that provides objective, consistent regulatory requirements on par with the New York program, has placed New York's CAFOs, along with CAFOs of other States that have sought to be good environmental stewards, at a competitive disadvantage. Nonetheless, the New York CAFO program has persisted in its efforts to afford superior protection of the environment through continued education, enforcement and applied research efforts. These efforts are supported by New York's regulated farms as documented by a very high rate of compliance.

New York's CAFO farms must comply with stringent technical standards designed to afford superior protection of the environment. These technical standards take the form of USDA-NRCS conservation practice standards and state regulatory requirements, both of which exceed the minimum requirements set by EPA and USDA-NRCS and are tailored to be most effective for New York's conditions based on applied research from Cornell University – New York's land grant university. As such, CAFO farms must utilize professional engineers in the design and implementation of their waste management and storage structures, must adhere to stringent setbacks for nutrient applications in farmlands adjacent to New York's waters, must control erosion on crop fields and must make nutrient applications in accordance with science-based nutrient management plans. The CAFO program ensures that manure nutrients from medium and large livestock farms are recycled to grow crops rather than allowing those nutrients to reach the waters of New York State. It is these stringent technical standards and the CAFO program's proven rate of implementation and enforcement that protects water quality.

New York State regulates medium-size CAFOs in the same manner as it regulates large-size CAFOs. Most other states regulate medium-size CAFO under a separate program that is often voluntary in nature. A non-regulatory approach, for a sector that has a significant pollution potential (the smallest medium CAFO has the pollution potential of a major sewage treatment plant), is neither credible nor effective. Professional management of waste at these facilities is critical to protection of water quality. That professional management is ensured by the New York CAFO permit program.

New York Comprehensive Nutrient Management Program

Key among the permit's many requirements is the development, implementation and maintenance of a current Comprehensive Nutrient Management Plan (CNMP), written by a New York State certified AEM Planner and conforming to the technical standards established by the federal Natural Resources Conservation Service (NRCS). As a condition of the permit, the CAFO must have a Comprehensive Nutrient Management Plan (CNMP) developed by an AEM Planner certified through the New York's Agricultural Environmental Management (AEM) Program. Successfully becoming a Certified Crop Advisor (CCA) in the Northeast Region is the first step in obtaining certification to develop CNMPs for farm operations needing the CAFO permit in New York State.

The CCA program is one of the certification programs of the American Society of Agronomy (ASA) and is also governed by ARCPACS, a federation of certifying boards in agriculture, biology, earth and environmental sciences. The CCA program in New York is administered by the Northeast Regional CCA Board, which covers New York and all of the New England states. Nationally, a CCA is recognized by the USDA – Natural Resources Conservation Service (NRCS) as an individual who is qualified to service certain NRCS programs as a Technical Service Provider (TSP). In New York, a CCA is eligible to seek further certification, as an AEM Planner, to develop CNMPs required as a condition of the CAFO permit.

New York Technical Standards for BMPs

All CNMPs developed in New York must be prepared in accordance with "NRCS Conservation Practice Standard No. 312" and all applicable technical standards where invoked by NY312 (NY590, NY748, etc.). All New York NRCS technical standards meet and/or exceed the minimum national requirements as they are tailored to the stringent regulatory requirements and environmental sensitivities found in New York. The New York technical standards are reviewed and revised by a Standards Committee consisting of technical staff from NRCS, DEC, the New York State Department of Agriculture and Markets, Cornell University and others. These revisions under the oversight of the Standards Committee ensure state-of-the-art BMP implementation on New York farms.

Requirements to Become an AEM Certified Planner

1. Be a Certified Crop Advisor in good standing in the Northeast Region.
2. Complete an online 5-module course on the NRCS Planning Process and pass the associated exam with at least an 80% score (www.nedc.nrcs.usda.gov/catalog/consplan.html).
3. Attend a 4-day CNMP Training on the development of CNMPs.
4. Have 3 CNMPs reviewed by a CNMP Review Team to determine if the plans appear to meet NRCS Standard New York-312 Waste Management System and requirements of the DEC CAFO General Permit, and that the planner has demonstrated full understanding of all components of the planning process. The final CNMP is reviewed in the field.
5. To maintain AEM Planner Certification an individual must maintain their CCA certification by earning CEUs and receive acceptable reviews through the AEM Planner Quality Assurance Program. (New York is one of the few states that conduct such ongoing Quality Assurance/Quality Control.)
6. An individual completing the steps outlined above is certified by the State Conservationist of the USDA-NRCS in New York in consultation with the Commissioner of the New York State Department of Agriculture and Markets to develop and/or approve CNMPs required to satisfy the conditions of the DEC CAFO General Permit or for USDA-NRCS and New York State cost share programs. The State Conservationist, in consultation with the New York State Agriculture Commissioner, may revoke an individual's certification for failure to maintain their CCA certification, or for not meeting NRCS standards in developing plans.

Certified Crop Advisor Requirements:

1. Pass two comprehensive exams (state/regional and international) that measure competency in four areas – soil and water conservation, nutrient management, integrated pest management, and crop production. Each exam may be attempted up to 3 times.
2. Subject your credentials including experience, education, and references to a peer review by the CCA Board. Minimum education and experience requirements include – appropriate BS degree with 2 years crop consulting experience, appropriate AAS degree with 3 years experience, or 4 full years of appropriate crop consulting experience. A reference must be provided by a client and employer outlining the candidate's crop consulting experience.
3. Sign and adhere to a Code of Ethics. A CCA pledges to work only in areas in which they are competent and give the highest quality advice. They are ethically bound to make recommendations that are in the best interest of the client and the public. An individual gaining CCA status must then earn 40 Continuing Education Units (CEUs) in a 2- year cycle to maintain their certification. A minimum of 5 CEUs must be earned in each of the previously mentioned competency areas, and the Northeast Regional CCA Board must sanction at least 10 of the CEUs.

CAFO program highlights:

- Since 1999, New York State has exceeded the federal minimum CAFO requirements by permitting over 450 medium-sized CAFO farms
- New York requires erosion control to "Tolerable Soil Loss" on all CAFO crop land, a technical requirement of NRCS NY590 for nutrient management
- No direct discharge of process water is permitted, except during extreme precipitation events
- In 2009, New York State once again exceeded the federal CAFO requirements through the issuance of the State Environmental Conservation Law permit for CAFO-sized farms
    - Covers dairies with 200 or more cows whether or not a process wastewater discharge to surface water is expected.
        - 65 permits, >45% of the total dairy animal numbers in Susquehanna basin
        - The federal CAFO program would require permits for only a small number of the New York permitted CAFOs
    - High level of regulatory oversight
- CAFO permitted farms in NYS are required to utilize the AEM framework and tools when developing their Comprehensive Nutrient Management Plan (CNMP) with their AEM Certified Planner. The advantages of this requirement include:
    - Prioritizing CAFOs for ANSACP and Farm Bill financial assistance programs.
    - Identifying resource needs and opportunities beyond CAFO Permit requirements leading to advanced environmental stewardship.
    - The educational component of AEM helps farmers better understand the impact their farm has on the environment.
    - Opening the door for improved teamwork between certified planners, agency resource professionals, and agri-business in developing, implementing, and evaluating conservation plans and BMPs leading to advanced environmental stewardship and continuous improvement.

Upper Susquehanna Coalition

The Upper Susquehanna Coalition (USC), established in 1992, is a network of 16 Soil and Water Conservation Districts (Districts) in New York and 3 in Pennsylvania that cover the entire headwaters of the Susquehanna River-Chesapeake Bay watershed. Districts were established throughout the country in the 1940's to implement conservation efforts. The Coalition works under a Memorandum of Understanding based on New York and PA state law that allows Districts to enter into multi-District agreements.

The USC's mission is to protect and improve water quality and natural resources in the Upper Susquehanna River Basin with the involvement of citizens and agencies through planning and implementation of conservation projects, education and advocating for water resources. All of the 19 Districts that make up the USC have been designated as the "lead" for water quality issues in their Counties and each has over 60 years of experience working with local landowners, natural resource partners, municipalities, industries and regulators on water quality issues.

The USC uses a "multiple barrier approach" for planning and implementation that addresses issues at the source, across the landscape and in the stream corridor. At the basin-wide scale, the

USC uses its success in soil and water conservation as an active partner in the multi-state effort to restore the Chesapeake Bay and is the lead in New York for developing the agricultural nonpoint source implementation portion of New York's Strategy and this Draft Phase I WIP.

While individual Districts implement BMPs across a wide variety of land uses, the roles and techniques described have led the USC to focus on three core areas: Sustainable Agriculture, Stream Corridor Rehabilitation and Wetland Restoration. Each core area has a team leader and coordinator to facilitate effective and efficient implementation within each District and across the basin to meet local and regional water quality goals.

Sustainable Agriculture uses the New York State AEM Program as the basis for its planning and implementation on farms. The USC promotes prescribed grazing techniques, cow exclusion from streams and riparian buffers, nutrient management, cover crops, conservation tillage, barnyard clean water exclusion and other agricultural BMP's.

Stream Corridor Rehabilitation includes natural stream design, stream rehabilitation and stabilization, floodplain enhancement and the establishment of riparian buffers.

Wetland Restoration includes a comprehensive approach for wetland restoration, construction, conservation, protection and research. This approach serves to improve local water quality and the environment through nutrient and sediment reduction, the attenuation of floods and increasing wildlife and habitat diversity.

Central to the success of the USC is its 'vertical and horizontal' integration. The USC represents a basin wide distribution of natural resources professionals that has established relationships and partnerships with stakeholders at every level (local, state, multi-state and federal). The result has been a productive decades-long history of strengthening and promoting environmental stewardship and protecting water quality at all scales.

Upper Susquehanna Coalition highlights:

- Interstate Coalition of 19 Soil and Water Conservation Districts (16 New York, 3 PA) in Upper Susquehanna region (above Towanda, PA)
- Implements county-level AEM strategies (95% of dairy farms participating)
    - USC and NRCS implementation totals 2005-2009
        - 1,621 acres of Wetland Restoration
        - 377 acres of Wetlands Created
        - 17,278 acres of Prescribed grazing
        - 164 miles of stream fencing
        - 63,078 acres of Comprehensive Nutrient Management Plans
    - Precision Feed Management work is resulting in ~65% reductions in farm mass nutrient balances of Nitrogen and Phosphorus
- Receives Bay Program New York State Implementation Grant
    - Work plan includes in-field documentation of agriculture management practices and annual reporting to the Bay Program

- Institutes additional conservation efforts by integrating its model wetland program (Bay Program Wetland Champion role) and burgeoning stream restoration program into routine discourse with agricultural and other large landowners

Program Implementation and Targeting

The proposed management practice implementation levels in this Phase I WIP reflect practical implementation considering the type of agriculture conducted in New York, climate, social/economic and relevant site specific details, and an estimate of state and federal funding realistically expected to be available through 2025. Funding comes from State sources, a large part of which is awarded in contracts[9] on a competitive basis (includes special request for funding received by Upper Susquehanna Coalition), and through various USDA/NRCS programs (includes the Chesapeake Initiative in Farm Bill).

State and Federal programs are coordinated through AEM to work together to efficiently provide technical and financial assistance to priority farms and priority environmental issues. These programs include:

AEM Base Program – www.nys-soilandwater.org/aem/basefunding.html noncompetitive technical assistance funding to Conservation Districts to inventory and assess farms in priority watersheds then plan, design BMPS, and evaluate effectiveness of planning and BMPs on priority farms based on County AEM Strategic Plans and Annual Action Plans. This program provides the financial resources to prepare and prioritize farms for participation in various State and USDA Farm Bill programs that provide financial assistance to implement BMPs; then supports the farmer as they manage, operate and maintain their plan and the associated BMPs.

- AEM Base also supports outreach, educational, and data management activities needed to assure successful planning, BMP implantation, maintenance, and continuous improvement.
- AEM Base provides a financial incentive to Conservation Districts to put an AEM Certified Planner on staff. Districts with a AEM Certified Planner may earn up to $75,000 in technical assistance funding while Districts without a Certified Planner may only earn $40,000. The 18 Conservation Districts with land in the NY portion of the Chesapeake Bay Watershed employ 10 AEM Certified Planners with another 6 planners working toward their certification. The 18 Districts are currently eligible for $965,000 in AEM Base technical assistance funds.
- NYS Soil and Water Conservation Committee (SWCC) staff perform a quantitative review of AEM Base deliverables such as assessments, conservation plans, BMP designs, and evaluations. These reviews advance quality, adherence to policies and participation requirements on an annual basis.
- AEM Base requires Conservation Districts to complete an AEM Self-Evaluation Report Card to assess impacts and progress toward watershed goals.
- AEM Base Program accomplishments in the Susquehanna Watershed in the 5 years since program inception (2005) include:
    - 1091 on-farm Tier 1 Inventories

[9] State staff review projects before costs are fully reimbursed.

- 767 on-farm Tier 2 Assessments
- 446 on-farm Tier 3 Conservation Plans
- 168 farms implementing BMPs with SWCD technical assistance (this does not include implementation completed through ANSACP or implementation completed solely through NRCS)
- 287 on-farm Tier 5 conservation plan and/or BMP evaluation

- The AEM Base Program is in its sixth consecutive year of operation; funding availability to Districts with land in the Susquehanna Watershed has grown from $380,000 in 2005 to the $965,000 today. The AEM Base Program is funded entirely by the NYS Environmental Protection Fund (EPF).

Agricultural Nonpoint Source Abatement and Control Program (ANSACP) – www.nys-soilandwater.org/aem/nonpoint.html Competitive financial assistance program available to Conservation Districts that provides funding to plan, design, and implement priority BMPs, as well as cost-share funding to farmers to implement BMPs. Farmers are eligible to receive between 75 and 87.5% of BMP implementation costs depending on their contribution to the project.

- Proposals are ranked by SWCC Advisory Members including: NYS Departments of Environmental Conservation, Health, State, and Agriculture & Markets; NRCS; Cornell University; and SUNY ESF.
- Proposal ranking criteria includes: ranking of the farm's watershed and the pollutant(s) being addressed according to the District's AEM Strategic Plan; the level, source, and type of impairment based on the waterbody's PWL or SWA; use of priority BMPs; cost effectiveness; and the District's ability to complete the project. Bonus points are awarded to projects in TMDL watersheds, and those that include the installation of conservation buffers.
- Farms included in all proposals must have a conservation plan meeting AEM criteria. (Waste Storage BMPs must have a complete CNMP reflective of conditions post storage.)
- BMPs included in proposals must meet NRCS design standards. Engineering practices must be designed by a Professional Engineer, and nutrient management plans must be developed by an AEM or NRCS Certified Planner.
- SWCC staff complete final checks on all projects. All engineering practices must be signed off by a PE. Conservation practices must be signed off by an appropriate Certified Planner, TSP, or individual with appropriate NRCS Job Approval Authority.
- The Request for Proposals for each Round of ANSACP is evaluated before each round and improvements are made based on past experience; as an example, Cover Crop and Mulching BMPs were expanded from a 1 year funded practice to a 3 year funded practice to provide the farmer more time to experience the BMP and associated benefits increasing chances of future adoption.
- ANSACP is funded through NYS's Environmental Protection Fund and is in its 17th round of funding since 1994. Funding for the program has increased from $331,630 in 1994 to $9,498,120 today statewide. Since its inception 25 % of all ANSACP funding has gone to projects in the Susquehanna River Watershed totaling over $23.3M. The program is consistently oversubscribed with only approximately 33% of submitted projects funded statewide.

USDA Farm Bill Programs – As described above, AEM is an "umbrella program" providing the framework and tools for farmers to assess their environmental risks and opportunities, learn about the impacts of their actions on water quality and other natural resources, and prepare them to participate in programs to address priority concerns and opportunities. AEM participating farmers may utilize several programs to develop conservation plans and receive cost-sharing and other incentives to implement BMPs through USDA and the current Farm Bill. Farm Bill programs available in NYS for conservation planning and implementation include:

- Environmental Quality Incentives Program (EQIP) – includes special funds for the Chesapeake Bay Watershed. AEM Tier 2 Assessment Worksheets are used to help rank EQIP applications.
- Conservation Reserve Program (CRP) – CRP/CREP have enrolled 19,332 acres through 2,186 contracts in the NY portion of the watershed.
- Conservation Reserve Enhancement Program (CREP) – NYS has requested assistance from the USDA Farm Service Agency (FSA) to expand CREP eligibility in NYS to all sub-watersheds of the Susquehanna River.
- Conservation Security Program (CSP)
- Agricultural Management Assistance Program (AMA)
- Wetland Reserve Program (WRP)
- Debt for Nature Program

Targeting within AEM

AEM was created to provide a coordinating framework to target the limited technical and financial resources available from all levels of government toward the watersheds, issues, pollutants, farms, practices, and BMPs that are of the greatest concern and where the most significant water quality benefits will occur. To accomplish this task, County Soil and Water Conservation Districts are required to form a county level AEM Steering Committee to develop a Strategic Plan identifying priority water bodies/watersheds, associated water quality impairments, pollutants of concern from agricultural sources, BMPs to address the identified pollutants, and potential sources of technical and financial assistance. Coordination on the strategic plans between Counties is accomplished through the existing major watershed coalitions of Conservation Districts established throughout the State (the Upper Susquehanna Coalition is an example). Resources utilized to create AEM Strategic Plans included the State's Priority Waterbodies List (PWL) and Source Water Assessment (SWA), Federal designations such as 303 d watersheds and TMDLs, and locally generated studies and information. Once completed the County AEM Strategic Plan prioritizes all waterbodies/watersheds within the County identifying the impairment associated with agriculture, the priority agriculturally generated pollutants, and the appropriate BMPs generally needed to address the priority pollutants. AEM Base funds are then used to systematically inventory and assess (AEM Tiers 1 & 2) willing farms in order of priority waterbodies/watersheds.

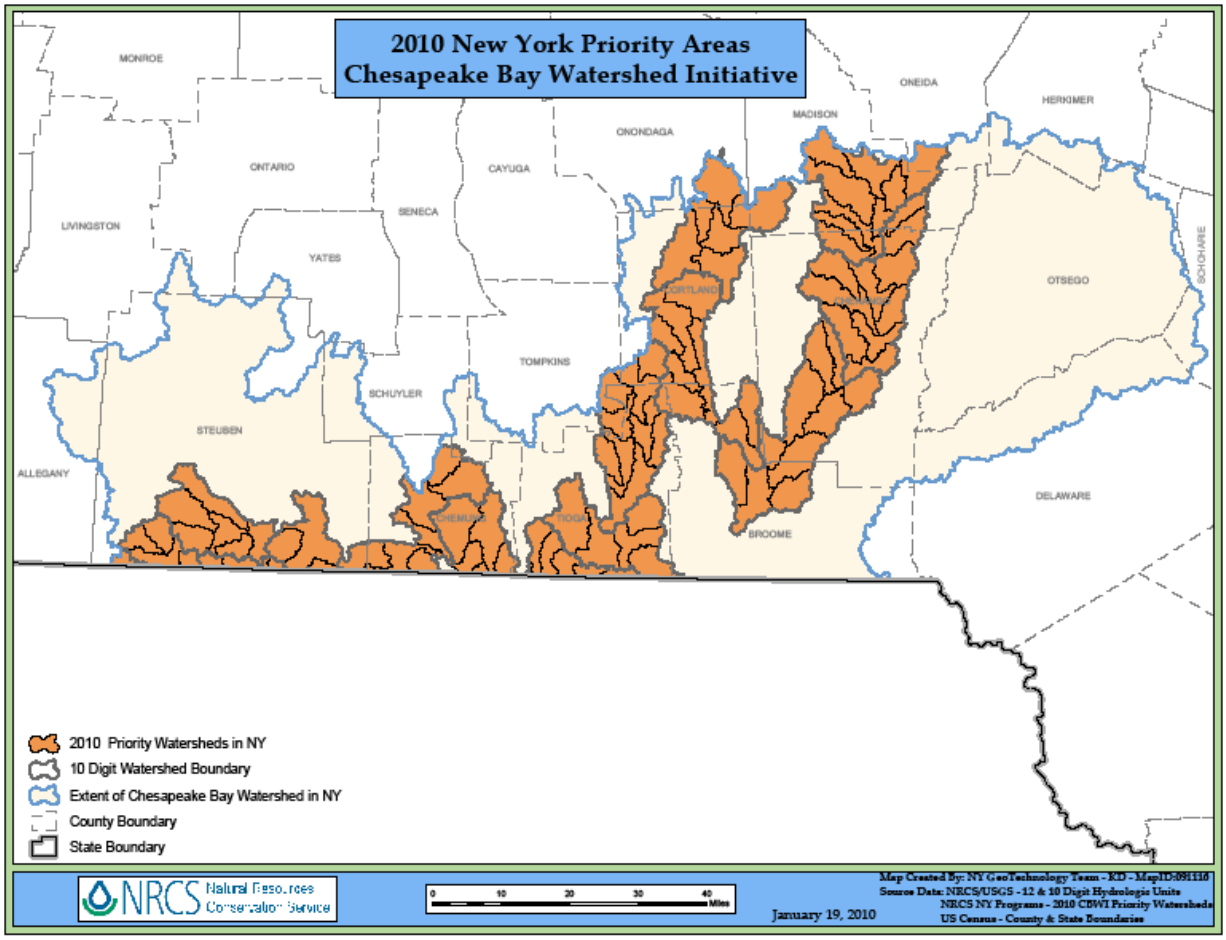
On the farm resource professionals working with farmers utilize the AEM Tier 1 Questionnaire, the Watershed Site Evaluation Worksheet, and appropriate Tier 2 Assessment Worksheets to gather information on the farm's position on the landscape (topography, proximity to waterbodies, soil types, etc.), potential pollution sources, and management practices to determine

the lack or presence of an environmental concern, or the need to collect additional information to be analyzed. Armed with this information, decisions can be made by the Conservation District where to rank farms for further technical and financial assistance.

The Agricultural Nonpoint Source Abatement and Control Program (ANSACP) targets projects based on priority farms, pollutants and watersheds. ANSACP proposals must be cost effective with farm commitment to complete and maintain the project. ANSACP projects receive bonus points when in a Federal TMDL designated watershed and if the proposal includes conservation buffers as part of the proposed BMP system.

In FY 2011 USDA-NRCS, applicants to the EQIP and Chesapeake Bay Watershed Initiative (CBWI) programs who want to address livestock waste or grazing issues will be required to have completed the appropriate AEM Tier II worksheets at the time of application. The results of those worksheets will be used to prioritize and rank applications to direct funding to those that will address the most serious environmental risks, and make the greatest contribution to reduce delivery of nutrients and sediments to Chesapeake Bay. CBWI funds will be targeted to priority areas that have the highest potential for delivery of N, P, and sediment to the Bay. EQIP funds will be utilized in the remainder of the watershed also to address delivery of N, P, and sediment to the Bay.

USDA-NRCS targets funds available through the CBWI to specific priority watersheds in the Upper Susquehanna region of New York (Figure 1).



Current Program Implementation

The following table is from the New York Draft WIP 7 Input Deck submitted to USEPA on November 12, 2010. The best management practices listed are those being proposed for the agriculture sector as part of the New York Watershed Implementation Plan.

Practice	Available Units FROM MODEL	BMPs Prev. Installed FROM MODEL	WIP Implementation Levels	Total Set Up Cost (minus BMPs already installed)	Total Yearly Maintenance Cost	BMP Units to be Installed	Set Up Cost per unit BMP	Total Set Up Costs through 2025	Evaluation and Upgrades	Total Yearly Maintenance Cost through 2025
Conservation-Tillage	152,678 ac/yr	UNK	40% (61,071 ac/yr)	$25/ac	$0	61,071	$25	$1,526,775		$0
Continuous No-Till	152,678 ac/yr		1,000 ac	$0	$0	1,000	$0	$0		$0
Forest Buffers	65,000 ac	18,654 ac	15,000 ac	$1,000/ac	$10/ac	15,000	$1,000	$15,000,000		$1,200,000
Grass Buffers	65,000 ac	37,579 ac	CROP/100%	$175/ac	$8.75 /ac	40,000	$175	$7,000,000		$2,799,993
Land Retirement		5,892 ac	8,692 ac	$0	$0	8,692	$0	$0		$0
Tree Planting	152,678 ac		2,068 ac	$615/ac	$2.21/ac	2,068	$615	$1,271,820		$36,563
Enhanced Nutrient Management (CROP)	152,678 ac		90% (22,456 ac/yr)	$22/ac	$8/ac	336,846	$22	$7,410,612	$16,168,608	$5,389,536
Enhanced Nutrient Management (non legume hay)	326,563 ac	104,968	90% (22,456 ac/yr)							
Cover Crops (SDR) (corn)	~70,000 ac/yr	15-30,000 ac/yr	30,000 ac (row corn)	$54/ac	$0	30,000	$54	$1,620,000		$0
Conservation Plans	835,388 ac	58,929 ac	82%		$0					
Stream Protection with Fencing (PastFence+trp)	1,357 ac		100%	$22,950/mi ($500)	$158/mi ($25)	1,357	$500	$678,500		$271,500
Off-Stream Watering w/ No Fencing		1,000 ac	1,000 ac	$6,750/sys	$5.20/sys	20	$6,750	$135,000		$830
Stream Protection	>182,000 ac	30,585 ac	80,000 ac	$350/ac - $500/ac	$10/ac	80,000	$350	$28,000,000	$5,119,997	$1,279,999

Fencing and Prescribed Grazing										
Upland Prescribed Grazing	>182,000 ac		43,250 ac	$167/ac	$8/ac	43,250	$167	$7,222,750	$2,075,998	$691,999
Horse Pasture Management		50 ac	2,000 ac	$150/ac	$6/ac	2,000	$150	$300,000		$95,998
Animal Waste Management - Large	1,000 dairy farms	1,084 afo ac	60% dairy AMUs	$400,000	$20,000	20	$400,000	$8,000,000		$3,192,000
Animal Waste Management - Medium - Small				$200,000	$15,000	150	$200,000	$30,000,000		$18,000,000
BarnYard Runoff Control Systems	1,000 dairy farms	301 afo ac	65% dairy AMUs	$140,000	$5,000	230	$140,000	$32,200,000		$9,198,000
Precision Feeding Dairy	1,000 dairy farms		50% dairy AMUs	$30,000/ farm	$8,000/ farm	125	$28,000	$3,500,000	$5,997,600	$1,999,200
Mortality Composters			50% dairy AMUs mortality	$9,200/farm	$0	125	$9,200	$1,150,000		$0
Wetland Restoration		4,724 ac	11,124 ac	$4,317/ac	0.5% ($216)	11,124	$4,317	$48,022,308		$2,402,784
							Totals	$193,037,765	$29,362,202	$46,558,402

Total w/out O&M	**$222,399,967**
Total	**$268,958,369**
10% contingency for inflation / price change	**$26,895,836**
Total estimate	**$295,854,205**

Estimates on available funds through 2025:
The following is a linear estimate of available funds through 2025. These estimates are a linear extrapolation based on current funding levels continuing for the duration of the implementation plan.

Farm Bill Funding through NRCS NY EQIP		
	Funding:	$93,720,000
	Technical support (10 FTEs):	$15,000,000
NYS Environmental Protection Fund & County Contributions		
	ANPSCAP funds:	$60,000,000
	AEM Base (30 FTEs):	$30,150,000
Chesapeake Bay Program Implementation Agreement		
	USC funding:	$8,000,000
Upper Susquehanna Coalition		
	USC Special Grants:	$12,000,000
Farmer Contribution (Cost Share)		
	12% for Capital Investments	$22,000,000
	O&M	$46,500,000
	Total:	**$287,370,000**[10]

(Wetlands also utilize separate funds from WRP funds, USC funds, USFWS Partners for Wildlife Funds, EPA Wetland Development Funds and NFWF Wetland Funds)

These funds are expected to be available to implement the suite of management practices proposed in this Phase I WIP. The following narrative describes the detailed thought process New York utilized to determine what to implement and where to put these practices.

Conservation Tillage
According to the Chesapeake Bay Program, conservation tillage involves planting and growing crops with minimal soil disturbance. Conservation tillage requires two components, (a) a minimum 30% residue coverage at the time of planting and (b) a non-inversion tillage method. No-till farming is a form of conservation tillage where the crop is seeded directly into vegetative cover or crop residue. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment and leaves much of the vegetation cover or crop residue on the surface. Though implementing these practices is difficult for farms across the entire Chesapeake Bay Basin, the ability to implement these practices is reduced in New York due to unique challenges in our region.

There are several barriers to implementing conservation tillage on a wide scale in New York. The following barriers are often greater for our smaller farms. First is the **soil suitability**. Upland Channery soils are not conducive to the no-till planting method. Other upland soils

[10] These numbers do not account for funding increases due to inflation of costs

present challenges as they are often clay loams with poor drainage. Soils will also remain wetter later into the spring, especially in years where the snow melt is delayed. Combined with slower spring warm up in NY, conservation cover slows soil warming and delays planting dates. A second challenge for NY is that ensuring **adequate cover** requires either plant residue or vegetation. This would necessitate a change in cropping for most smaller farms as they would be required to either convert from silage to grain corn or would need to apply a cover crop (vegetation). However, grain corn or cover crops are often not feasible due to the slower spring warm up and shorter growing season in New York. Later harvests of grain corn on uplands soils means harvesting off wetter soils and thus creating a tremendous potential for rutting, compaction and erosion. Finally, conservation tillage itself and the cover requirements are also not feasible due to the **additional management complications** that they create for the smaller farms and on upland soils. The additional equipment or equipment conversions necessary are cost prohibitive, especially in a region where nearly a quarter of its inhabitants live below the poverty line. These impacts are a detriment to successful conservation tillage practices, and therefore our estimate of implementation on 40% of available acreage is a responsible target for New York.

The opportunities for success on the proposed acreage for conservation tillage are based on several factors. We recognize that although not currently found in widespread use, this practice can be successful on some of our farms and on our better-drained soils. This assumes a high level of adoption on CAFO farms because larger farms can more readily accommodate changes in management because they already have more versatile equipment, and because they are often better positioned financially to purchase specialized equipment. CAFOs also have a greater ability to adopt this practice because they tend to control larger acreages of the better drained valley soil, and in general they have larger acreages and field sizes which are more conducive to using custom operators, though they are limited in availability. Conservation tillage is already being used on some of these farms as part of a management system to control erosion, reduce runoff, and manage nitrogen as part of their CAFO permit requirements. Given these factors, we are reasonably assured of the estimated application of this practice, and yet reluctant to assert that the level can be increased to any significant degree.

<u>Continuous No-Till</u>

The same factors limiting conservation tillage will limit continuous no-till – late spring warm up, wetter soils, capital expenditures for equipment. The adoption of continuous no-till is also not feasible for New York agriculture which is predominantly dairy with a cropping system and rotation of corn/soybean and alfalfa/grass that is used to supply forages for feed. Some tillage would be needed prior to returning to hay from a row crop. Tillage is also needed to control weed population and pest build-up. It is, however, reasonable to expect that through education and outreach, and by expanding on current practices, some of our better drained soils that will warm and dry more quickly and are more suitable for harvest later in the season could be utilized for continuous no-till. We estimate that 1000 acres of cropland could be reasonably converted to continuous no-till.

A system to support farmers who implement these practices is necessary to buffer the economic risks they take in the early years of implementation. Demonstration sites would augment outreach and education efforts to encourage implementation. Equipment cost-share or rental

options, yield/performance insurance or guarantees, and incentive payments would stimulate long term use and adoption.

Forest Buffers

The proposed acreage for forest buffers is based on current BMP implementation rates extrapolated through 2025. We expect implementation along cropland to continue through the utilization of existing programs such as CRP, recognizing that forest buffers will likely be implemented in 1:4 ratio with grassed buffers. 100% implementation may not be achievable without regulatory control. See Grass Buffers below. Our goal is to convert approximately 15,000 acres over the next 15 years.

Grass Buffers

The proposed acreage for grassed buffers is based on an assumption that buffer implementation will occur as indicated in forest buffers with grassed buffers preferred along cropland areas 4:1. Our goal is 100% implementation on cropland acres (not already buffered). We recognize that without additional incentives or regulations it may not be feasible to achieve this level of adoption, however setbacks are already required per CAFO regulations accounting for 45 % of the dairy livestock. In addition, when compared to other practices, the loss of some cropland to grass buffers, especially in areas where erosion and flooding may already be a concern, may be a cost effective management strategy for our farms. While nothing is absolute, it is anticipated that education and outreach through the AEM program combined with cost-share and incentive payment programs such as CRP, CREP, EQIP, Grazing Lands Conservation Initiative, and state funding, will result in a very high level of implementation. In addition, the USC has an entire agricultural program and Grazing Initiative that promotes cow exclusion from streams and riparian buffers. It includes an Agricultural Team with a team leader, coordinator, and two full-time grazing specialists in addition to the technical staff most counties in the watershed already have dedicated to grazing. Furthermore, the USC has secured additional funding, outside of traditional Federal and State sources. This funding includes National Fish and Wildlife grants that combine “buffer related” projects under an umbrella approach we call the Grass-Based Initiative. The USC initiative combines all buffer types, cow exclusion practices, and prescribed grazing to address both agricultural sustainability and community needs in relation to stream bank erosion, habitat improvement and flooding. Through our education and outreach with the AEM program, combined with both Federal and State cost-share and incentive payment programs already in place, it is anticipated that a very high level of implementation can still be achieved.

Land Retirement

Agricultural land retirement takes marginal and highly erosive cropland out of production by establishing permanent vegetative cover such as shrubs, grasses and trees. Land retired and planted to trees is reported under the “Tree Planting” BMP. Wetland construction could also be considered a form of land retirement. USDA NRCS programs such as CRP, CREP, WRP and WHIP already provide incentives for retirement. Looking at trends and extrapolating to the future we predicted 2% of land retirement per year for an estimated total of 8,692 acres retired through 2025. This is a conservative estimate recognizing that, although some agricultural land will go out of production as farms cease to operate, it is likely that the land will convert to hay or sod before being retired completely. In many cases, when a farm goes out of business another

farm will pick up that land instead. There remains a need to examine high quality versus low quality land across the landscape to help predict which land may convert to grass for beef or horses before being retired completely.

Tree Planting

The Tree Planting BMP or forestation (converting agricultural land to forest) includes tree planting on agricultural lands, except those used to establish riparian forest buffers, which is a separate practice. The tree planting practice targets highly erodible lands and critical resource areas. We estimate 2,068 acres will be converted to forest by 2025. This estimate is reasonable based on the rate at which farms are currently going out of business and average farm size. This estimate reflects the cropland from one farm in the watershed per year planted to trees (or reverting to trees through natural succession) for alternative agricultural operations such as a sugarbush or Christmas tree plantation, or converted to another use such as wildlife habitat. In addition, programs exist at the Federal, State, and local levels to support tree planting and reforestation in the region. The NRCS provides cost share assistance though its CRP and WHIP programs. The NYS Department of Environmental Conservation encourages planting of trees and shrubs by providing nursery service to supply low cost, quality stock that is readily available to the public. The nursery program has been an integral part of forest stewardship on public and private lands since its inception in 1902. Finally, every Soil and Water Conservation District has a seedling program for conservation cover and reforestation to private landowners.

Cover Crops

Cereal cover crops reduce erosion and nutrients leaching to groundwater or volatilizing by maintaining a vegetative cover on cropland and holding nutrients within the root zone. This practice involves planting and growing, but not harvesting, cereal crops with minimal soil disturbance. The crop is seeded directly into vegetative cover or crop residue and captures nitrogen in its tissue as it grows. When the cover crop is incorporated in the spring, trapped nitrogen is released and used by the following crop.

There are several factors that make implementing cover crops in New York challenging for our farmers. As stated many times thus far, the majority of agricultural related land use is dedicated to dairy farming in our region and with dairy comes specific cropping systems. According to the most recent model run we have 651,649 total crop acres (p53_2009aveCSOAA). This includes row crops, hay, and alfalfa. There are 152,678 row crop acres. The most common row crops for dairy in New York are silage corn, grain corn, soybeans, wheat, and barley. Using 2007 Ag census data and multiplying it by the portion of the area that each county has in the watershed, there is estimated to be 70,800 corn silage acres or about 46% of the total row crop acreage. This is important because corn silage is the land use that has the most likelihood of successful cover crop implementation in New York. We are anticipating the implementation of 30,000 acres of cereal and commodity cover crops, which will be on approximately 50% of the total of CAFO row crop acreage and is approximately 20% of the total available row crop acreage. CAFOs are most likely to be the first farms to implement cover crops because CAFOs are required to plant them on marginal soils and soils that have an N leaching index of 10 or above. The remaining acreage will not be easily accomplished because of the types of crops that are grown (77% of crop acres are already in perennial cover as hay and alfalfa), a shorter growing season in New

York, and the NRCS standards that have required planting dates which limit the ability for farmers to receive cost sharing for cover crop implementation.

To demonstrate how crop type and shorter growing season are challenges to planting the remaining row crop acreage for the farmers in New York, the following brief examples are submitted. Grain corn is harvested in late-October or beyond, leaving a short or non-existent window to effectively establish a cover crop before cold air and decreasing soil temperatures halt plant growth. It is also difficult to plant the cover crop into the heavy crop residue left from the corn grain harvest and such efforts may actually reduce soil cover. All of this effort would be for questionable benefit as there is already a significant soil cover from the crop residue, providing ample soil erosion and phosphorus runoff control. Furthermore, soybean acreage is challenging to match with cover crops because they are also harvested later in the year than silage corn (often mid-October) as it is important to ensure that the pods have reached their maturity and they need 5 to 10 days of drying weather to achieve the correct moisture levels. The later the year they are planted, the narrower the window for the cover crop to be able to get established and be effective nitrogen, phosphorus, and sediment conservation practices.

Although there may be some years where earlier planting is possible, it is extremely difficult to get cover crops in early enough to be at an effective established level year in and year out in New York State. In addition there is a significant cost to establishment in a region not accustomed to planting cover crops. There will need to be substantial outreach to overcome the perception of no immediate on-farm benefits. However, as stated above regarding conservation tillage, the use of cover crops is already part of a management system to control erosion, reduce runoff, and manage nitrogen on some AFO farms with suitable soils as well as some CAFO farms. Furthermore, these cover crops do not always meet the requirements of NRCS standard for this practice; they are often not planted within the required planting window and oats or a non-certified seed are often used. With some additional education, demonstrations, and through some management and equipment adjustments, we expect to achieve our implementation goal with the cooperation of farms, large and small, and on some of our better-drained and more suitable soils.

Conservation Plans

Farm conservation plans are a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality, and prevent natural resource deterioration on a farm. Soil conservation plans are comprehensive plans that meet USDA-NRCS Field Office Technical Guide criteria. They help control erosion by modifying operational or structural practices. Operational practices include crop rotations, tillage practices, or cover crops and may change from year to year. Structural practices are longer-term and include, but are not limited to, grass waterways in areas with concentrated flow, terraces, diversions, sediment basins and drop structures. In New York, “Conservation Plans” are completed through the Agricultural Environmental Management (AEM) program on all farms participating at the Tier 3 level. Through AEM Base Program funding, county SWCDs will work with farms in the watershed to progressively plan their farms to the Tier 3 level, and beyond to Tier 4 implementation and Tier 5 plan and BMP evaluation and updates. Given projected AEM base funding levels for planning, the many associated incentives and the requirement for Tier 3 planning in order for farms to be eligible for State grant funding for BMP implementation, the goal of planning on 82% of eligible acreage is realistic and attainable.

Stream Protection with Fencing

Direct contact of pastured livestock with surface water results in manure deposition, streambank erosion, re-suspension of streambed sediments and nutrients, and aquatic habitat degradation. Stream access also affects herd health by exposure to water borne pathogens and risk of hoof problems. Stream access control with fencing involves excluding a strip of land with fencing along the stream corridor to provide protection from livestock. The fenced areas may be planted with trees or grass, or left to natural plant succession, and can be of various widths. To provide the modeled benefits of a functional riparian buffer, the width must be a minimum of 35 feet from top-of-bank to fence line. The implementation of stream fencing provides stream access control for livestock but does not necessarily exclude animals from entering the stream by incorporating limited and stabilized in-stream crossing or watering facilities. By reducing constant stress on streambanks from hooves, cattle exclusion is also a very important practice for stabilizing stream banks.

According to the Scenario Builder, the land use where this BMP can be applied to is categorized as "trp", or "trampled riparian pasture". In other words, it is degraded riparian pasture. The land area is equal to the amount of acreage reported by the Bay jurisdictions in the Tributary Strategies. The regular pasture acres are then reduced according to the trp acreage. Our watershed has approximately 11,600 delivered acres of "trp" (p53_2009aveCSOAAdelacres), or 6% of the total "Pasture" acres. Our goal for this practice is to provide up to 100% coverage of degraded stream corridors that lie within this 6%. 100% of "pasture fence" will be managed as grassed buffers. While nothing is absolute, it is anticipated that education and outreach through the AEM program combined with cost-share and incentive payment programs such as CRP, CREP, EQIP, Grazing Lands Conservation Initiative, and state funding, will result in a very high level of implementation. In addition, the USC has an entire agricultural program and Grazing Initiative that promotes cow exclusion from streams and riparian buffers. It includes an Agricultural Team with a team leader, coordinator, and two full-time grazing specialists in addition to the technical staff most counties in the watershed already have dedicated to grazing. Furthermore, the USC has secured additional funding, outside of traditional Federal and State sources. This funding includes National Fish and Wildlife grants that combine "buffer related" projects under an umbrella approach we call the Grass-Based Initiative. The USC initiative combines all buffer types, cow exclusion practices, and prescribed grazing to address both agricultural sustainability and community needs in relation to stream bank erosion, habitat improvement and flooding. Further assurance of a high level of implementation will be the potential regulatory or enforcement action that could result from a lack of stream protection with fencing as NYSDEC implements its in-stream water quality standards.

Alternative Water

Alternative watering facilities typically involves the use of permanent or portable livestock water troughs placed away from the stream corridor. The source of water supplied to the facilities can be from any source including pipelines, spring developments, water wells, and ponds.

Offstream Watering with Fencing

The primary benefit of this BMP is exclusion of livestock from the stream and stream corridor delineated by the fencing. Livestock either drink from tanks, troughs, or similar systems away from the stream or from narrow hardened access points along the stream, which allows livestock

to drink but not loiter in the stream. This is the most frequent management scenario used in New York as we implement prescribed grazing (see Prescribed Grazing below.) This practice is supported through a variety of funding mechanisms including the AEM program combined with cost-share and incentive payment programs such as CRP, CREP, EQIP, Grazing Lands Conservation Initiative, and state funding. In addition, the USC has an entire agricultural program and Grazing Initiative that promotes cow exclusion from streams and riparian buffers. It includes an Agricultural Team with a team leader, coordinator, and two full-time grazing specialists in addition to the technical staff most counties in the watershed already have dedicated to grazing. Furthermore, the USC has secured additional funding, outside of traditional Federal and State sources. This funding includes National Fish and Wildlife grants that combine "buffer related" projects under an umbrella approach we call the Grass-Based Initiative. The USC initiative combines all buffer types, cow exclusion practices, and prescribed grazing to address both agricultural sustainability and community needs in relation to stream bank erosion, habitat improvement and flooding.

Based on current adoption of this practice and the available sources of funding described for technical and financial assistance to implement grazing, we are reasonably assured that adoption of this practice will continue and will result in our proposed implementation of 80,000 acres, or 47% of the total pasture land. This figure also assumes, when extrapolating existing data, that 10% of the acreage being converted to pasture will be from cropland acreage and 25% will be converted hayland.

Off-Stream Watering w/ No Fencing

It is anticipated from experience that there will be limited situations under which we partially exclude livestock from the stream and stream corridor. The premise of this practice is that, given a choice between a clean and convenient off-stream water source and a stream, cattle will preferentially drink from off-stream water source and reduce the time they spend near and in streams. Off-stream watering without fencing may include off-stream shade. This practice will be installed where fencing is not feasible or wanted. Given experience and the future implementation of NYSDEC's in-stream water quality standards, we estimate that this practice is feasible on 1,000 acres of pasture with riparian corridors.

Prescribed Grazing and Upland Prescribed Grazing

In general, and as defined by the Chesapeake Bay Program, this practice utilizes a range of pasture management and grazing techniques to improve the quality and quantity of the forages grown on pastures and reduce the impact of animal travel lanes, animal concentration areas or other degraded areas.

The New York prescribed grazing implementation goal is 123,250 pasture acres. For cost analysis and modeling purposes, this includes 80,000 acres with off stream watering (as previously described) and an additional 43,250 acres of upland grazing pasture acres and represents 72% of the total "Pasture" acreage. This number was derived in consideration of current implementation rates and present and future support for this practice. Grazing has a long history of implementation in the state and watershed that is expected to continue.

Grazing was first initiated in New York through the Grazing Lands Conservation Initiative (GLCI), established in 1991 to provide voluntary high quality technical assistance and awareness of the importance of grazing land resources on private grazing lands. GLCI is a coalition of individuals and organizations functioning at the local, state, regional and national levels. It includes livestock producer organizations, scientific and professional grazing resource organizations, conservation and environmental groups, and state and federal natural resource and agricultural agencies. USDA NRCS administers the program. In 1995 the "Graze NY" program was developed with the assistance of Congressmen James Walsh, Sherwood Boehlert and Maurice Hinchey. Eleven counties in New York were given the opportunity to provide technical assistance to interested livestock producers. Since that time, these counties have given special attention to informing producers about the benefits associated with prescribed grazing. Information and technical assistance to plan and implement grazing systems is delivered to interested producers through pasture training workshops, informational farm tours, on-site farm visits and individual contacts with interested producers.

Additional grazing initiatives in New York are being supported through the SWCC Agricultural Nonpoint Source Abatement and Control Grants Program. One leader in this initiative is the Finger Lakes Resource Conservation & Development Council that supports work through several grants that cover the entire New York portion of the Bay watershed. Broome and Tompkins County SWCD's have also secured grants to support multiple county grazing projects. Twelve counties in the New York portion of the Bay watershed actively participate in one or more grazing initiatives. As previously mentioned the USC actively supports all such initiatives through its Grazing Initiative by tracking progress, providing additional staff support and securing additional funding to maximize implementation efforts. The initiative is supported by an Ag Team leader, a full-time coordinator, two full-time grazing specialists, and various FSA, NRCS, and SWCD staff. Because of its multiple potential benefits, cost-effectiveness and sustainability, Prescribed Grazing is an important practice to support and promote.

Horse Pasture Management

In addition to prescribed grazing above, we anticipate a limited level of implementation of horse pasture management. Horse pasture management includes maintaining a 50% pasture cover with managed species (desirable inherent) and managing high traffic areas. The horse pasture management practice may be an increasingly important practice as a number of smaller horse farms in the basin have began to appear on the landscape. The goal, based on the available pasture acreage, number of horse farms, experience, and existing levels adoption of this practice, is to add 2,000 effective pasture acres. This is about 1% of the total. The support and resources available for pasture management and grazing (described previously) support this estimate of implementation.

Animal Waste Management Systems

These practices are designed for proper handling, storage, and utilization of wastes generated from confined animal operations. They may include a means of collecting, scraping or washing wastes and contaminated runoff from confinement areas into appropriately designed waste storage structures. Waste storage structures are typically made of concrete and require continued operation and maintenance, making them a significant cost item. Controlling runoff from roofs,

feedlots and "loafing" areas are an integral part of these systems (See Barnyard Runoff Control Systems.)

An estimated 60% of the total dairy animal units on farms will have their manure adequately treated to reduce nutrient losses from the production area. This averages out to be approximately one system per county per year. This number reflects the fact that CNMPs will be fully implemented, including animal waste management systems, on all CAFOs, which are approximately 40% of the dairy animal units. In addition, based on AEM inventories and assessments, and needs as evidenced by federal cost-share and state grant funding requests, an additional 20% of dairy farm operations will require and implement animal waste management systems.

Barnyard Runoff Control Systems

This system includes the installation of practices to control runoff from barnyard areas such as roof runoff control, diversion of clean water from entering the barnyard and control of runoff from barnyard areas. These practices may be installed as part of a total animal waste management system or as a stand-alone practice, particularly on smaller operations. Given that we expect 100% of our CAFO operations to install some form of animal waste management system, it follows that other farms will be more likely to install barnyards because they are less expensive and the current trend has been for more cost-share requests for Barnyards than Manure Storages. According to our current scenario, 65% of the total dairy animal units will be treated with Barnyard Runoff Control Systems by 2025.

Precision Feeding Dairy

New York has proposed to implement Dairy Precision Feeding with 50% of the dairy animal units. Many of these animal units will be under CAFO operations, which represent over 40% of the total dairy animal units in the NYS watershed. The 10 years of experience with PFM in NYS has led to the development of professional capacity to implement PFM on farms, especially in the Upper Susquehanna. In NYS, Cornell Cooperative Extension (CCE) in partnership with the USC has developed the interest and expertise to implement PFM on dairy farms, and has a demonstrated track record of doing so. Since 2007, through the efforts of CCE and the USC, over 100 farms in the Upper Susquehanna have already been engaged in some form of PFM assessment and implementation through PFM pilot projects. At present CCE and the USC are developing the next phase of PFM implementation, a coordinated basin wide strategy to implement PFM in a consistent, quantified manner. All of the CCE agricultural field staff working in the Upper Susquehanna Basin in NYS are participating in developing this strategy and will be involved in its implementation. Having locally based extension and SWCD professionals involved in bringing PFM to farms will enhance farmer participation in the program and successful adoption of this BMP.

Over the next two years several projects are already in place that will build upon the success of PFM over the last 10 years. For example, the Natural Resources Conservation Service has entered into an agreement with Cornell Cooperative Extension of Delaware County to develop feed management plans on dairy farms in the designated priority areas of the Chesapeake Bay Watershed Initiative (CBWI). Under the agreement, CCE of Delaware County will develop 18 feed management plans and conduct several outreach meetings to inform producers about the

benefits of feed management and to make them aware of the pilot opportunity. The purpose of this project is to refine and evaluate the planning process, and increase the awareness among farmers of the benefits of feed management. Furthermore, the USC just received a Chesapeake Bay Small Watershed Grant that will expand on past research to minimize N and P loss by working with 3,000 cows on 20 farms. Precision feed/forage benchmark analysis will be used to determine specific nutrient management challenges that will result in documented manure nutrient reductions and farm nutrient accumulations (mass balance).

Increasingly, the availability of alternative feed from biofuel plants or others may be on the rise in lower jurisdictions in the watershed and our region. This type of potentially cheaper, locally available distiller's grain may negatively affect the implementation of Dairy Precision Feed Management (PFM). However, New York is well positioned to control the impacts on future PFM due to several factors. First and foremost, NY farms have a sufficient land base, especially compared to other jurisdictions in the Chesapeake Bay watershed. This gives them an advantage as they have the ability to continue to grow enough of their own grain to meet their needs. In the current economic climate, it has been more advantageous for farmers in NY to produce their own grain for their herd diet. This is especially true because, the alternative feed industry has not yet indicated that they are ready to dump distiller's grain into the market at minimum pricing. Prices for distiller's grain have remained at high enough levels that they haven't been a viable alternative to purchasing corn meal or growing their own crops. Another factor minimizing the impacts of alternative feed from biofuel plants is that the more you push distiller's grain into the diet of dairy cows, the more you compromise their performance. With a larger land base, NY farmers aren't forced to push to maximum levels of alternative feed inputs in the diet because they can feed locally while recycling their manure nutrients for field crop production. Furthermore, there are years where toxins in distiller's grain could be at high levels thus affecting the health and performance of the animals. Moreover, the PFM team has been currently managing the program accounting for higher levels of distiller's grain in the diet. The levels have remained manageable and are unlikely to increase for the reasons stated above. Finally, the PFM team has established strong relationships with the feed industry in New York and they work together toward common goals. That being said, the PFM in New York is in a position where they can continue to build on the success of their program to date while minimizing the impacts that alternative feed supplies may bring.

Mortality Composters

In the past, rendering plants reasonably priced pickup of dead livestock at the farm. However, recent declines in prices of hides, tallow, meat and bone meal and the other useful commodities produced from animal carcasses have curtailed many rendering operations. There are fewer operators out there and, as a result, many farms no longer have affordable access to rendering services. In contrast, it has been estimated that the state's livestock producers could reap economic benefits with an easily managed, low cost mortality disposal alternative. For this reason, there has been a growing interest in recent years in farms wanting to compost mortalities.

Cornell has developed the Cornell Waste Management Institute (CWMI). Through research, outreach and teaching activities, CWMI staff and affiliated researchers and educators work to develop technical solutions to waste management problems and to address broader issues of waste generation and composition, waste reduction, risk management, environmental equity and

public decision-making. The focus for such work is on multidisciplinary projects that integrate research and outreach. They have funding, a small staff, and partnerships with Extension educators and the USC that engages a wide array of stakeholders in its projects. This program has been in place since 1987.

Given the fact that 40% of the total dairy animal units in the NYS watershed are CAFO farms, we anticipate that nearly all of them will be mortality composting within the next 15 years and many AFO farms will decide to do so as the economic benefits become more apparent through outreach and education. Therefore it is reasonable to anticipate that 50% of the dairy animal units will be subject to farms that mortality compost by 2025.

2-Year Milestones Narrative Description:

Table 1. Overview of 2-year funding levels for New York State agricultural programs 2009-2011.

Source	Amount
AgNPS Abatement and Control Program	$9,857,200
Graze-NY	$229,570
Ecosystem Based Management Grant	$220,000
NFWF Watershed, Stream and Grazing Pilot	$490,000
NFWF Enhanced Nutrient Management Approach	$133,350
Special Environmental Protection Funds for Grazing	$80,000
Army Corps of Engineers Precision Feed and Forage Management Program	$65,600
Chesapeake Bay Program Tributary Strategy Money	$1,000,000
Grazing Lands Conservation Initiative	$226,040
NRCS Contribution Agreement	$154,730
USDA NRCS Farm Bill Programs	$5,622,000
USDA FSA Farm Bill	Pending
	$18,078,490

The USC has completed a 2-year implementation plan and has projected implementation with consistent levels of funding through 2025. Funds are usually obtained from competitive grant programs at both the state and federal levels as well as through the private sector. Since 1994, the New York State SWCC Agricultural Nonpoint Source Abatement and Control Grant Program, has allocated cost-share funds from the New York State Environmental Protection Fund to support farmers' efforts to protect water quality and natural resources that are in the public's interest. The USC has also obtained special grants obtained through RFPs, such as the Special Environmental Protection Funds, EPA Targeted Watershed Initiative, and the Chesapeake Bay Program Small and Targeted Watershed Grants. Total funding from all sources described below is estimated to be over $18,078,490 for the next two years. This total does not include matching funds or farmer contributions. It only includes cost share funds to assist farmers in paying for BMP's. Furthermore, this total does not include FSA CRP/CREP, Cornell Cooperative Extension, or special individual Soil and Water Conservation District's funds because they were not available at the time this document was written. However, the funding described below has provided almost all of the agricultural BMP implementation in this watershed (Table 1).

Pending NYS Agricultural Nonpoint Source Abatement and Control Program (ANSACP) $9,857,200:

This program is a competitive financial assistance program available to Conservation Districts that provides funding to plan, design, and implement priority BMPs, as well as cost-share funding to farmers to implement BMPs. Farmers are eligible to receive between 75 and 87.5% of BMP implementation costs depending on their contribution to the project. There are 40 ANSACP contracts in the Susquehanna River Watershed of NYS that are scheduled to be completed in the next two years representing a farmer and NYS commitment of $9,857,197 toward the projects. These projects will result in the following BMPs being installed:

- Stabilized Access Roads 6 farms
- Alternative Water Supplies 21 farms
- Barnyard Runoff Management Systems 27 farms
- Cover Crops 3 farms (600 Acres)
- Diversions 4 farms
- Filter Strips 10 farms (14 acres)
- Manure Storage Systems 14 farms
- Manure Transfer Systems 5 farms
- Milk Center Waste Treatment Systems 5 farms
- Prescribed Grazing Systems 88 farms
- Riparian Forest Buffers 24 farms
- Silage Leachate Systems 12 farms

The following graph (Figure 1) is for all projects that are under contract to be started within the next two years.

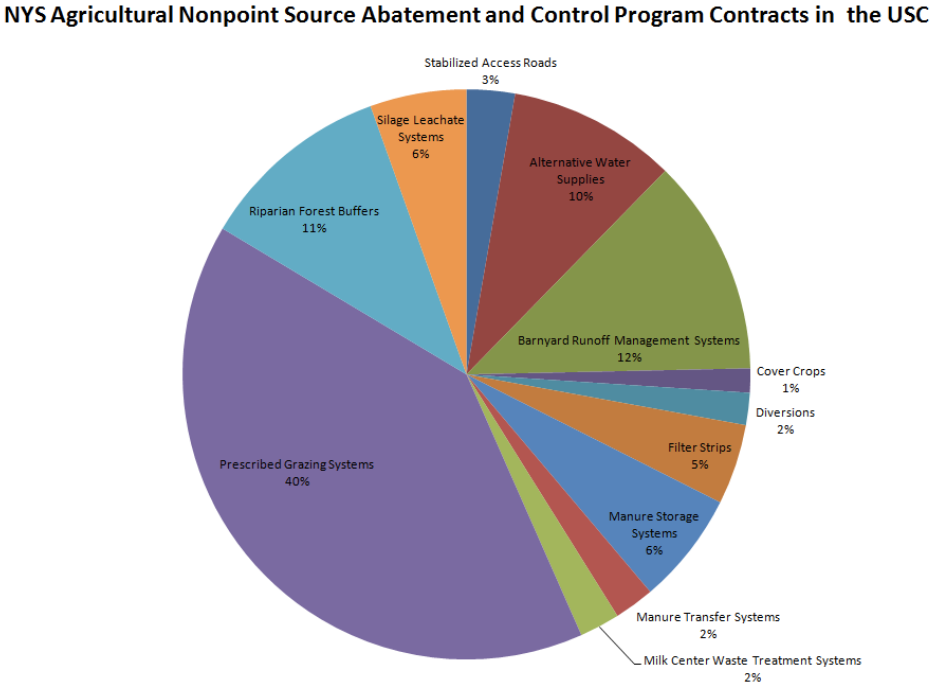


Figure 1. ANSACP funding percentages by practice. Percentages are based on a total of $9,857,200 of funding for the 2009-2011 period.

Graze-NY $229,570:
The Graze-NY Program is a partnership between Congressman Michael Arcuri, 13 Central New York County Soil & Water Conservation Districts, The Natural Resources Conservation Service, Cornell Cooperative Extension, local agriculture agencies, and farmers. This green initiative's mission is to help farm families with the adoption of prescribed grazing management systems that contribute to the financial, environmental and social well-being of local watersheds. The program initially focused on working with dairy farms, but has since expanded to include all livestock. Each county in the program receives money each year to support staff for technical assistance. Assistance includes developing grazing plans, farm visits, and educational events.

Ecosystem Based Management (EBM) $220,000 and National Fish and Wildlife Foundation Stream, Grazing, Wetlands project $490,000: These grants combine "buffer related" projects into an umbrella approach we call the Grass-Based Initiative. We combine all buffer types, cow exclusion practices and prescribed grazing to address both agricultural sustainability and community needs in relation to stream bank erosion, habitat improvement and flooding. Furthermore, it will complement the USC Wetland Program adding further value to both programs.

An Enhanced Nutrient Management Approach in NY Grant $133,350:
Chesapeake Bay Small Watershed Grants 2010 will use Precision Feed Management benchmark analysis to determine specific nutrient problems. It will also include specialized nitrogen testing and modeling with Illinois Soil Nitrogen Test (ISNT), Corn Stalk Nitrate (CSNT), and Adapt-N management tool.

Special Environmental Protection Funds for Grazing $80,000:
4 cow exclusion projects will be implemented in the Chemung River Basin. Soil and Water Conservation District Staff from Schuyler, Steuben and Tioga counties have and will perform all work. 7,300 feet of stream have been fenced from cows, reducing streambank erosion and nutrient loading. 4 alternate clean water sources were developed to meet fresh water needs and improve cow health. 1,500 feet of laneways and 129 acres of pasture were also improved, further reducing sediment runoff to the water courses so far.

Army Corps of Engineers Water Resource Development Act / Water Evaluation and Planning System (WRDA / WEAP) Precision Feed and Forage Management Program $65,600:
This funding, for Delaware County, will use Precision Feed Management benchmark analysis to determine specific excess nutrient sources in feed and develop feed management plans to make dietary changes affecting 1,708 animal units on 3 farms in the watershed.

Chesapeake Bay Program Tributary Strategy $1,000,000:
Tributary Strategy funds will be used for data collection to feed the model. The funding is $500,000 per year which equates to $1,000,000 total for the 2 year milestone period.

The Grazing Lands Conservation Initiative (GLCI) $226,040:
GLCI was founded to provide high quality technical assistance on privately owned grazing lands on a voluntary basis and to increase the awareness of the importance of grazing land resources.

The program in New York has a coordinator, Karen Hoffman, and supports staff for basin wide technical assistance which includes developing grazing plans, farm visits, and educational events.

Upper Susquehanna Coalition / NRCS Contribution Agreement $154,730:
The NRCS and the USC have a mutual interest to accomplish the goals and objectives of the Chesapeake Bay Watershed Initiative (CBWI) Programs in New York by assuring that participants are implementing projects that include but are not limited to livestock waste projects, prescribed grazing systems, related riparian buffers, access control projects, nutrient management, and other high quality BMPs. USC personnel will assist the NRCS by providing such services as planning, design of eligible practices, oversight of installation of eligible practices, and post construction throughout the Upper Susquehanna River Watershed. $54,730 is under contract now through 2011 with another $100,000 for 2011 pending.

USDA/NRCS Farm Bill Programs $5,622,000:
In the Chesapeake Bay Watershed in New York, NRCS staff work closely with USC staff to plan and implement projects through various Farm Bill programs which include EQIP, WRP, AMA and others. This funding is separate from the contribution agreement with the USC mentioned above as this includes implementation money and includes practices that may be completed by NRCS staff. However, individual districts within the USC often have their own contribution agreements to assist the NRCS in getting this work done. For example, Delaware County Cooperative Extension has a contribution agreement for $46,200 to develop 18 feed management plans in the designated priority areas of the Chesapeake Bay Watershed Initiative and conduct several outreach meetings to inform producers about the benefits of feed management. The Contribution agreement money that NRCS has with individual entities is not included in the total because it was not readily available at the time this document was published.
The graph below includes all NRCS planned (but not applied) practices for 2009-2011 (Figure 2). Also included are CSP enhancements which are loosely tied to NRCS practice standards but which are only applicable to the CSP program. This data represents all known planned practices regardless of funding. It is possible additional practices will be planned for 2011 that are not included on this list as additional program contracts are awarded in 2011.

NRCS KNOWN PLANNED PRACTICES BY CATEGORY
2009-2011

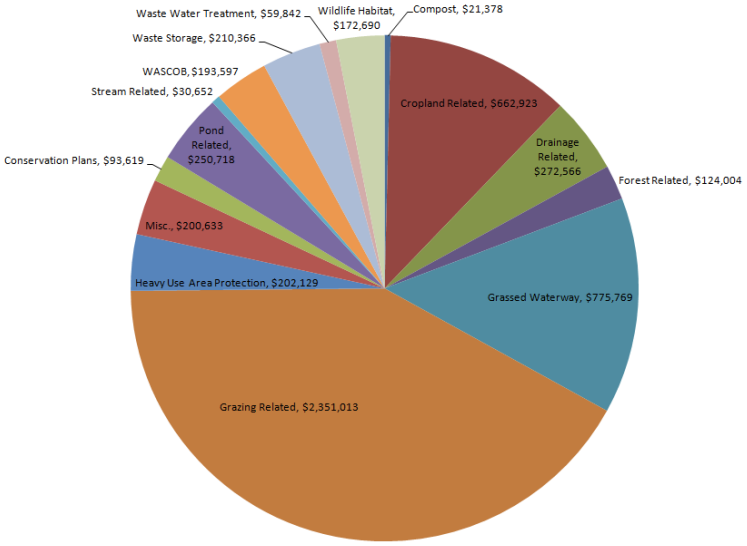


Figure 2. Planned practices were categorized from a larger list of official BMPs. Total NRCS Farm Bill funding is planned for $5,622,000 for the 2009-2011 period.

USDA FSA Farm Bill Programs, CRP/CREP:

This program provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. CRP and CREP are administered by the Farm Service Agency, with NRCS and the Soil and Water Conservation Districts providing technical land eligibility determinations, conservation planning and practice implementation.

2-year NY CRP and CREP contract funding levels were not available in time to be included with this document. However, this program has successful worked with thousands of farmers in New York over the last decade spending several hundred thousand dollars a year to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers and will continue to do so over the next 2 years and beyond.

Science Based Approach

Agronomy – Nutrient Balances

New York CAFOs in the Susquehanna Basin **do not have excess manure**

- 1.5 million tons manure generated
- Over 72,000 acres covered by Comprehensive Nutrient Management Plans that meet the enhanced nitrogen field management practices of the New York State technical standard
  - Only about 50,000 acres needed for compliant land application of manure
- New York exceeds the federal minimum manure application standards with more comprehensive nitrogen accounting in the New York State technical standard
- Up to 65% of nitrogen losses through ammonia volatilization eliminated through management practice implementation of immediate manure incorporation

Nutrient Balances in NYS

Cornell University agricultural researchers have conducted nutrient mass balance evaluations[11]. This research identified that the agricultural lands in the Upper Susquehanna region of New York are in gross balance for phosphorus inputs and cropping systems. This is largely attributed to source reduction efforts including better feed rationing for phosphorus. Cornell research has also demonstrated a negative balance for nitrogen, with a 53% decrease in agricultural nitrogen from 1987 to 2007 for New York. These nitrogen deficiencies are partially the result of unavoidable nitrogen losses from manure in the barn and waste storage systems – making implementation of management practices to further sequester conservable nitrogen critical. From a nutrient perspective, there are no drivers to export manure in New York because all that is produced is presently recycled in our cropping systems, though improved conservation of ammonia N could reduce reliance on purchased N fertilizer.

The percentage of soil samples from the NY portion of the Upper Susquehanna region analyzed at Cornell Nutrient Analysis lab testing optimal or very high for P has decreased from 1995-97 to the 2004-06 period, from 54 to 43%. As of 2006, the P balance in NY (expressed as manure P plus fertilizer P minus crop removal=balance) is 1.5 lbs/A; it is lower for the Upper Susquehanna region. Both figures reflect lower P levels in manure due to a reduction in P content of dairy rations and a reduction in the amount of fertilizer P applied to the Upper Susquehanna region land base (Figure 1). Source reduction results in fewer nutrients potentially prone to loss.

[11] Swink, n.; Q.M. Ketterings; L.E. Chase; K.J. Czymmek; M.E. Van Amburgh (2010.) Nitrogen Balances for New York State: Implications for manure and fertilizer management. Journal of Soil and Water Conservation (in press.)

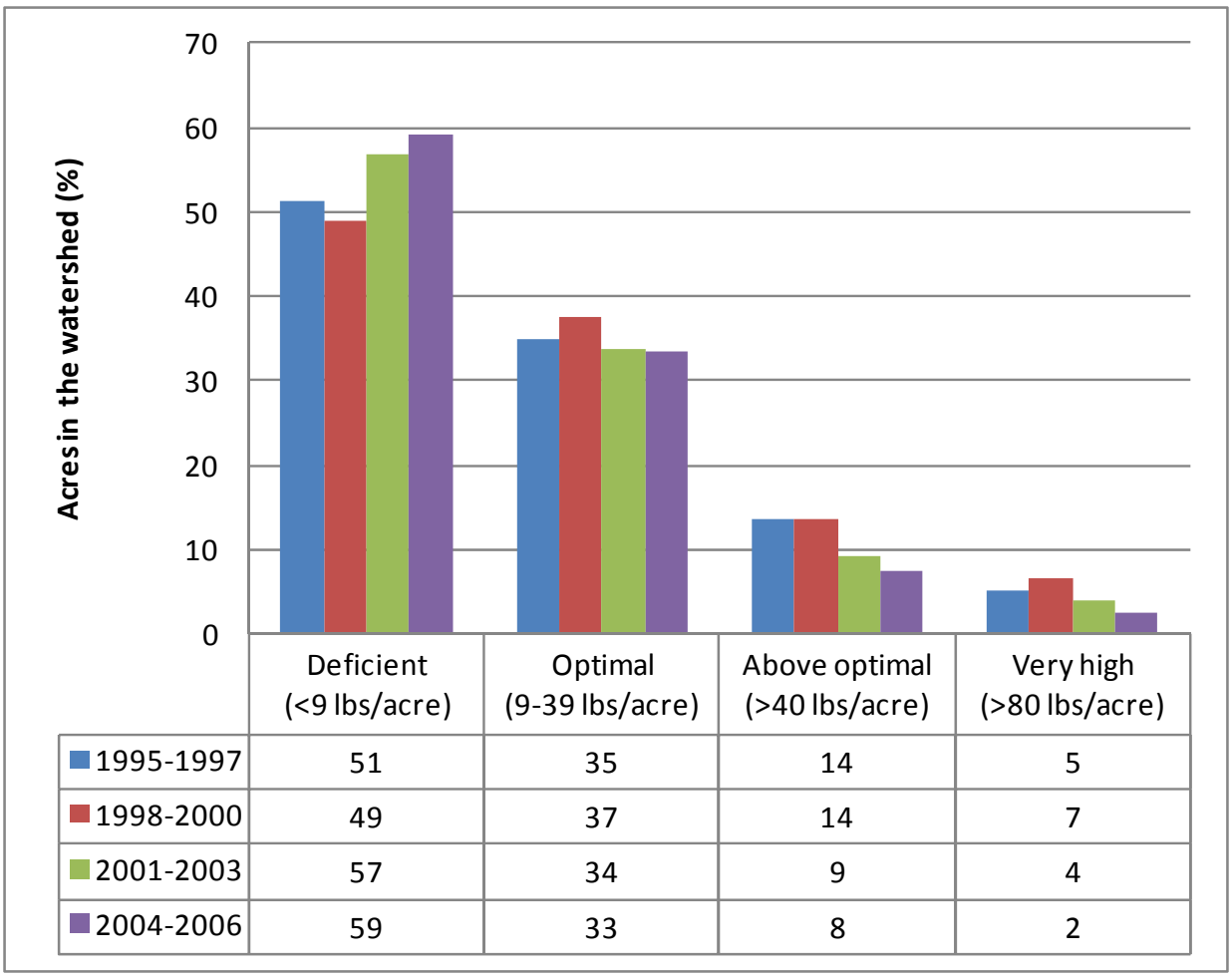


Figure 1: Percent of samples testing deficient, optimal and above optimal in soil test P based on samples analyzed by the Cornell Nutrient Analysis Laboratory between 1995 and 2006.

Based on Ag census data, average animal density (expressed in 1000 pounds of live animal weight per cropland acre) in the Upper Susquehanna region watershed has decreased from 0.53 AU/acre in 1987 to 0.43 AU/acre in 2007 (Table 1).

Table 1: Change in animal density over time for New York Upper Susquehanna Watershed farms.

	Total animal units[1]	Total harvested cropland	Animal density
Year	AU	acres	AU/acre
1987	328,364	619,877	0.53
1992	292,985	547,086	0.54
1997	270,019	574,840	0.47
2002	255,479	585,121	0.44
2007	232,290	534,973	0.43

[1]1000 lb animal weight = 1 animal unit (AU).

In 2007, 52 Upper Susquehanna region dairy and beef farms participated in a whole farm N, P, and K balance assessment. For these farms, the average animal density was 0.57 AU/acre, above the average across watershed farms in 2007. These case study farms still had 2.7 acres per mature cow or equivalent available for manure application. Fifty percent of these farms had a P balance of 7 lbs P/acre or less. These data indicate low density farming is the norm across the Upper Susquehanna region and the trends over time show the drastic improvements farmers have made over the past six years (Figure 2).

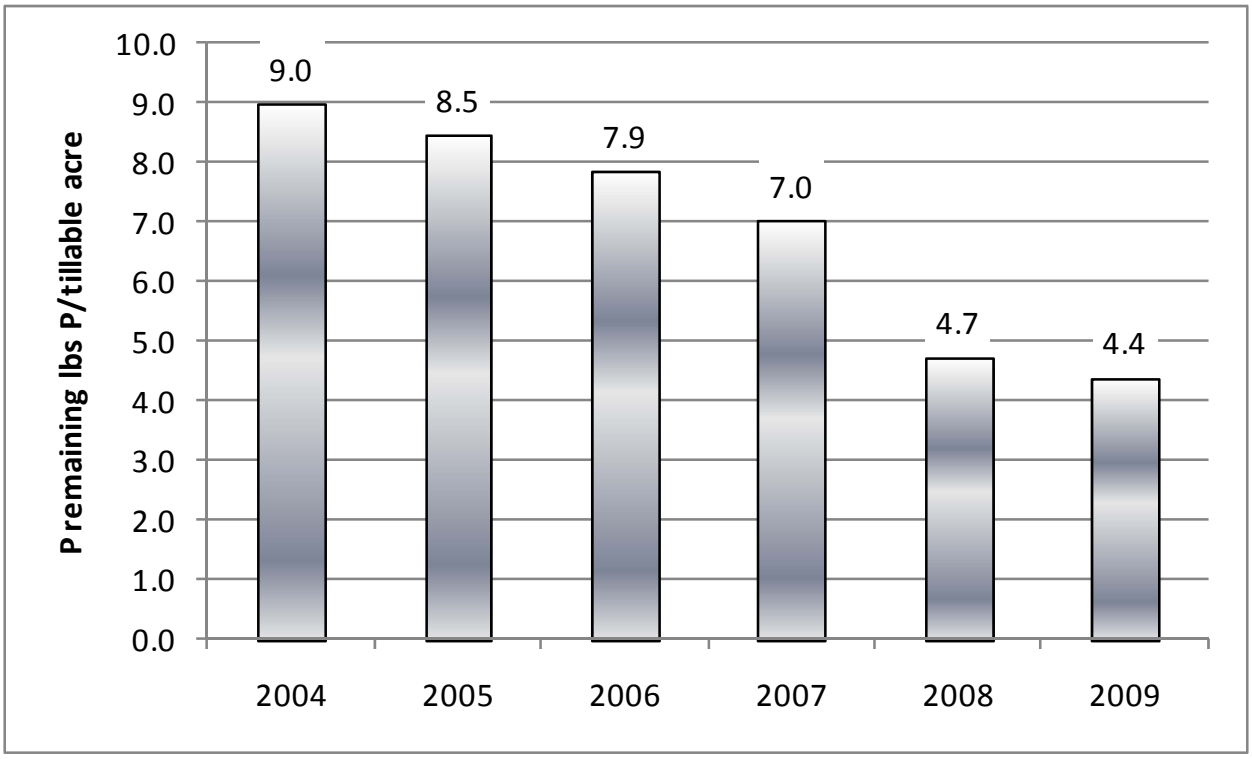


Figure 2: Impact of farm management changes on phosphorus balances of New York Upper Susquehanna Watershed farms.

Census data show we do not have significant numbers of poultry or swine, types of production systems where the animals are fed 100% concentrates, all feed may be imported, and a local land base may not be part of the operation.

Fertilizer N use in the Upper Susquehanna region was cut by about 50% between 1987 and 1992 and remained stable from 1992-2007. Between reductions in cattle numbers and diet changes, manure N has dropped from about 52 million pounds per year to about 32 million pounds per year from 1987-2007 (Figure 3). Given current fertilizer usage, manure quantity and N composition, *even if* manure could be stored and spring incorporated on corn land (providing maximum N use efficiency for manure), the total amount of N in fertilizer and manure is insufficient to compensate for crop N removal (Table 2).

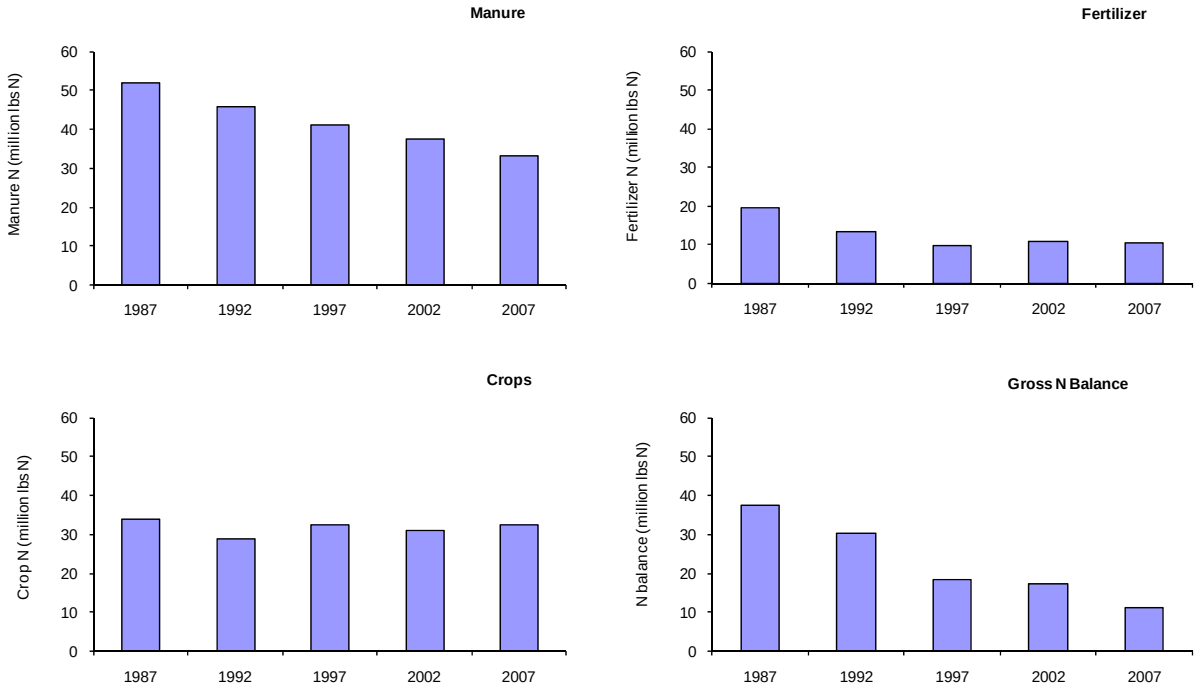


Figure 3: Gross nitrogen balances for the New York Upper Susquehanna Watershed. These balances represent manure N plus fertilizer N (total N) minus N in crop removal for agricultural land in the watershed.

Table 2: Cropland nitrogen (net) balances for New York State.

2007	N in manure	N in fertilizer	N in crops*	N balance	
	(tons)	(tons)	(tons)	(tons)	(lb/ac)
Gross N balance	115,081	69,237	113,973	+70,344	+55
Spring incorporated manure (60% efficiency of manure N; 75% of fertilizer)	45,898	51,928	113,973	-16,147	-13
No incorporation of manure (25% efficiency of manure N; 75% of fertilizer)	19,124	51,928	113,973	-42,921	-34

<u>Limited hot spots, easily rectified</u>

Frugal farm management along with the robust outreach, extension and applied research efforts of New York's Cornell University have already established a neutral (if not negative) state of

nitrogen and phosphorus in the New York land area of the Chesapeake Bay watershed and, as such, our agronomic focus is improved capture and distribution within the watershed.

With low animal density across the watershed, there are very few farms that must export manure to meet Land Grant University nutrient management standards. New York State regulations have required a comprehensive nutrient management plan (CNMP) be prepared by a third party certified planner for medium CAFOs (200 milking cows or 300 heifers) and large CAFOs (700 milking cows or 1000 heifers) starting in 1999. All manure and nutrients must be accounted for in conformance with Cornell Guidelines through a field specific nutrient management plan. Permit compliance requires that all fields be balanced for N, a P index assessment is done for every field on the farm, and P index guidance is followed. This guidance includes discontinuing application of manure (and P fertilizer) for fields that have a high P index (hot spots). While a low stocking density estimate does not preclude misallocation of manure on a field basis, any remaining nutrient allocation issues (hot spots) can be handled within the current land base of most operations through development and implementation of a sound nutrient management plan.

Cornell University guidelines for field crop management

It is also important to understand that the Land Grant guidelines are not the same in every state, in part because there are several ways to develop fertility guidelines. Cornell Guidelines are based on the sufficiency approach to fertilization which means fertilizer guidelines are reduced to a small starter when soil test levels reach the agronomic critical value, and no further addition is recommended when a soil test is classified as very high. For nitrogen, soil N supply is taken into account, leading to soil-type specific conservative guidelines as well. These methods have been somewhat controversial, deemed by some to be the most economical way to fertilize, by others as a good way to get poor yields, but the guidance is based on in-field trials on many soil types. It is important to also understand:

1) **Cornell uses a different soil test than the other Chesapeake Bay states. The Mehlich-3 test extracts 3x to 30x more P as the Cornell Morgan, depending on soil type (especially Al levels).**
2) **Cornell soil test P interpretation scales are different than the other Chesapeake Bay states. What we consider "high" is classified as optimal in some of the Bay states.**
3) **Cornell recommends less. When our soil test is classified as high ("optimum") in NY, the recommendation is reduced to a small starter (10-20 lbs P2O5/acre). Examples from other states show recommended rates that equate to estimated crop removal when soil test P is classified as optimum.**

A comparison of Land Grant University guidelines for corn for New York and the New England states was published in Ketterings et al. (2005) (Table 3).

Table 3: Critical soil test level comparisons for Northeastern states that use the Morgan or Modified Morgan extraction method. The comparison assumes a 25 ton/acre (at 35% DM) corn silage yield. In the ranges for Vermont guidelines, the low number represents fields with a reactive Al level of 10-50 ppm Al and the high values correspond with an Al level of 100-200 ppm (Adapted from Ketterings et al., 2005).

State	Method	Critical soil test level	P_2O_5 recommendation at critical level	Soil test P where no additional fertilizer is recommended
		ppm	lbs/acre	ppm
New York	Morgan	4.5	20	20
Massachusetts	Morgan	7	85	21
Rhode Island	Morgan	7	85	21
Vermont	Modified Morgan†	4	20-25	20
Maine	Modified Morgan	5	100	20
Connecticut	Modified Morgan	7	60	14

† Ammonium acetate extraction (McIntosh, 1969).

Interpretations for the Mid Atlantic states show differences among states as well. These states almost all use Mehlich-3 with ICP detection of P in solution (Table 4).

The states represented in Table 3 have a similar agronomic soil test (Morgan or Modified Morgan) so that we can compare state guidance to each other. Table 1 in that paper (Table 3 above) shows classifications (critical soil test P levels) and what we recommend at the critical soil test P level. It is obvious from this table that New York and Vermont recommend a small starter P application (20 lbs/acre for NY, up to 25 lbs/acre for VT depending on their soil test Al levels) while all other states have recommendations that are considerably higher (crop removal or even higher…average crop removal for us in NY is 4.3 lbs P_2O_5 per ton of corn silage (at 35% DM) which would result in a crop removal estimate of 86 lbs P_2O_5 for a 20 ton crop).

Table 4: Current soil test P critical levels used to guide P fertilization of corn based on Mehlich-3. The number of experimental sites testing below the critical level and the number of sites with yield increases below the critical level. Source: adapted from Heckman et al. (2006).

	Current critical level	
State	P	Maximum soil test P level for which broadcast P is recommended‡
		ppm
PA	30	50
NJ	36	69
DE	NA	50
NH	30	50
MD	50	100

‡ A starter fertilizer containing some P may be applied at higher than these soil test P levels.

This shows a range in interpretations with critical soil test levels ranging from 30 ppm in PA to 50 ppm in MD. Given completely different soil chemistries being used by the Mid Atlantic states (Mehlich-3) and most of the Northeastern states (Morgan or Modified Morgan), it is difficult to compare their critical values; past research has shown that for our state. As mentioned, Mehlich-3 extracts anywhere from 3 to 30 times more P as the Morgan test depending mostly on Al levels in the soil (see Ketterings et al., 2002; Soil Science). The table in the Heckman et al. (2006) paper does not include the actual recommendations for P for corn at the critical value for each of the Mid Atlantic states but if you search for agronomy guides for the different states you will find that for PA (as an example), with soil test levels between 30 and 50 ppm Mehlich-3 (classified as optimal in P in PA), the state recommends 50 lbs P_2O_5 for corn grain and 110 lbs/acre for corn silage (compared to 10-20 lbs P_2O_5 in NY for soils classified as optimal/high in P). Virginia recommends 40-100 lbs P_2O_5 depending on productivity level when their soil test is classified as optimal/high in P (again compared to 10-20 lbs P_2O_5 in NY). In Delaware, a soil is considered high in P when the Mehlich-3 test is 150 ppm or higher and the regulations there state that P loadings for soils high in P cannot exceed three times crop removal:

"A significant requirement of this law is that no more than a three-year crop removal rate of P can be applied to soils that are considered "high" in P, with "high" currently defined as soil test P concentrations above 150 mg P/kg (Mehlich 3 extractant). This requirement assumes that reliable information exists on the amount of nutrient that is removed by commonly grown crops in Delaware." From: http://www.iuss.org/19th%20WCSS/symposium/pdf/1095.pdf.

These examples clearly illustrate the two drastically different approaches being used among land grant university recommendation systems for soils in the optimal/high soil test range: (1) small starter recommended (NY and VT) and (2) P applications equating estimated crop removal or a multiple thereof (PA, VI, DE, New England states).

Cornell nitrogen guidelines take into account soil N supply and are therefore considered to be conservative as well (http://nmsp.cals.cornell.edu/publications/extension/Ndoc2003.pdf or http://nmsp.cals.cornell.edu/publications/factsheets/factsheet21.pdf and http://nmsp.cals.cornell.edu/publications/factsheets/factsheet35.pdf).

Additional P references

1. Swink, S.N, Q.M. Ketterings, L.E. Chase, K.J. Czymmek, and M. van Amburgh (2011). Nitrogen balances for New York State: Implications for manure and fertilizer management. Journal of Soil and Water Conservation (in press).
2. Ketterings, Q.M., K.J. Czymmek, and S.N. Swink (2011). Evaluation methods for a combined research and extension program used to address starter phosphorus fertilizer use for corn in New York. Canadian Journal of Soil Science (in press).
3. Swink, S.N., Q.M. Ketterings, L.E. Chase, and K.J. Czymmek, and J.C. Mekken (2009). Past and future phosphorus balances for agricultural cropland in New York State. Journal of Soil and Water Conservation 64(2):120-133.
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5. Ketterings, Q.M., S.N. Swink, G. Godwin, K.J. Czymmek, and G.L. Albrecht (2005). Maize silage yield and quality response to starter phosphorus fertilizer in high phosphorus soils in New York. Journal of Food, Agriculture and Environment 3: 360-365.
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Farm-Scale Nutrient Management Case Study in the New York State Chesapeake Bay Watershed

Agriculture in the NYS portion of the Chesapeake Bay Watershed is comprised primarily of integrated livestock and forage crop farms (mostly dairies) with low livestock density (0.43 animal units per acre), low to optimum soil test phosphorus levels, low nitrogen and phosphorus balances (i.e., manure + fertilizer nutrient – nutrient removal by crops), low nutrient risk index ratings, and modest annual additions of nitrogen and phosphorus for crop production via fertilizer and manure. These relatively balanced conditions are due to a variety of factors including:

- economics,
- low livestock densities associated with forage-dependent dairy farming,
- a long standing recognition by Cornell Nutrient Guidelines of nitrogen supplied by soil, tilled sods, and manure,
- the efficient and conservative Sufficiency Method to crop nutrient recommendations employed by Cornell Nutrient Guidelines (not crop removal or insurance-factored),
- the Nitrate Leaching Index and Phosphorus Runoff Index restrict/prohibit manure and fertilizer applications to high risk fields (and every field within a Comprehensive Nutrient Management Plan is assessed with these indices),
- locally-led, risk-prioritized voluntary conservation through Agricultural Environmental Management (AEM),
- a progressive farmer response to relatively thoughtful environmental regulation, and
- a strong local extension presence from Cornell Cooperative Extension, Soil and Water Conservation Districts, NRCS, private-sector conservation planners, and other conservation partners.

The balanced nitrogen and phosphorus status of farms in this portion of the Bay Watershed has been well documented at the county scale[12][13] and similar results are the norm when analyzed at the individual farm scale (http://nmsp.cals.cornell.edu/projects/massbalance.html). To further demonstrate this, actual nutrient management plans taken from Comprehensive Nutrient Management Plans (CNMP) for two dairy farms typical of AFO and CAFO farms in this area of NYS have been summarized, below.

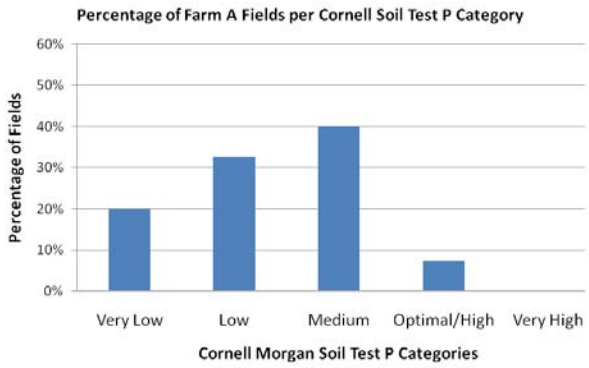
The case studies are based on nutrient management plans developed according to Cornell Nutrient Guidelines using Cornell Cropware, a USDA-NRCS Common Computing Environment

[12] Swink, S.N, Q.M. Ketterings, L.E. Chase, K.J. Czymmek, and M. van Amburgh (2011). Nitrogen balances for New York State: Implications for manure and fertilizer management. Journal of Soil and Water Conservation (in press).
[13] Swink, S.N., Q.M. Ketterings, L.E. Chase, and K.J. Czymmek, and J.C. Mekken* (2009). Past and future phosphorus balances for agricultural cropland in New York State. Journal of Soil and Water Conservation 64(2):120-133.

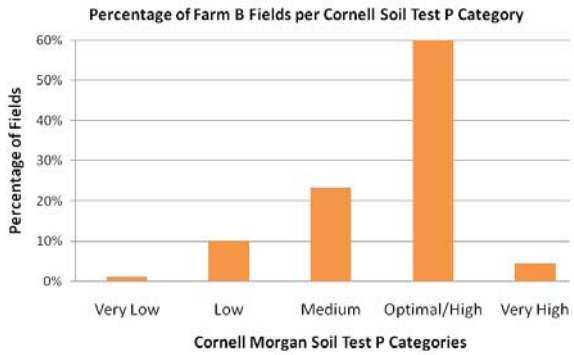
(CCE) certified software tool for NRCS Nutrient Management Standard (590) planning in NYS (http://nmsp.cals.cornell.edu/software/cropware.html). The nutrient balances in the plans represent nutrients allocated minus nutrient recommended by the Cornell Guidelines. These recommendations represent the additional nutrients needed to realize a crop yield response after nutrients from soil, past manure applications, tilled sods, etc. have been credited. This is an important distinction with nutrient management plans in NYS, as many other Bay states calculate nutrient balances as nutrients allocated minus crop nutrient removal, thereby downplaying many nutrient credits already in the field and available to the crop. Therefore, without sacrificing yield, Cornell Guidelines often result in nutrient recommendations that are much lower than systems based on a crop nutrient removal approach (and thereby offer improved nutrient use efficiency). More information and thorough documentation of Cornell Nutrient Guidelines and associated tools are available from the Cornell University Nutrient Management Spear Program website (http://nmsp.cals.cornell.edu).

Farm A	**Farm B**
Overview • 90 cow dairy farm plus replacements (not CAFO; voluntary CNMP). • ~525 acres: 375 hay acres and 150 corn silage acres. • 55 fields; 9.5 acre average field size. • Soils of glacial till, glacial outwash, and alluvial fan origins (range of drainages). • Stocking density = 0.4 animal units/acre.	**Overview** • 360 cow dairy farm plus replacements (CAFO permitted). • ~935 acres: 510 acres hay and 425 acres corn (mix of grain and silage). • 90 fields; 10.3 acre average field size. • Soils of glacial till, glacial outwash, and alluvial fan origins (range of drainages). • Stocking density = 0.7 animal units/acre.

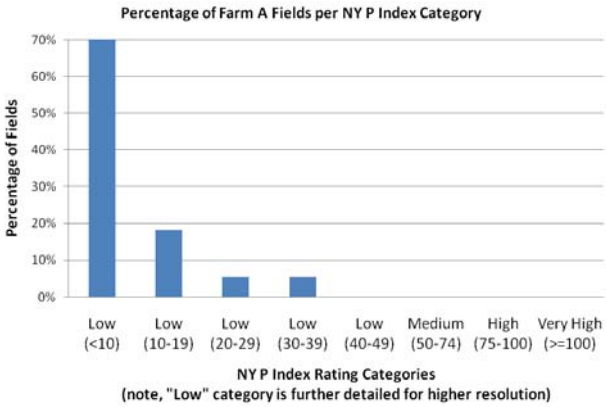
- 100% of fields with Optimal soil test P or deficit and 0% Very High. Cornell Guidelines recommend a small amount of starter P_2O_5 fertilizer at Optimal/High soil test P levels and, as with other Bay states, no P_2O_5 at Very High. However, most other Bay states would still recommend P_2O_5 to crop removal levels at Optimal/High soil test P levels.



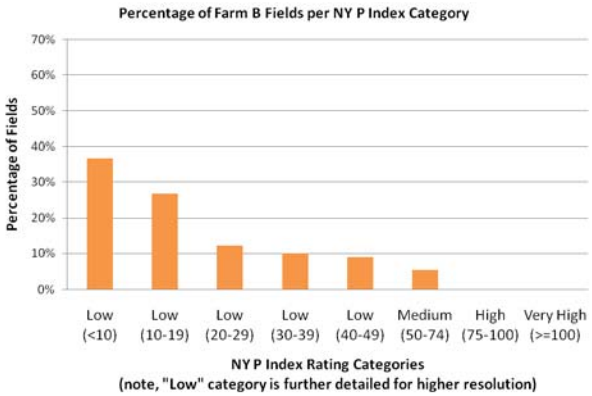
- 96% of fields with Optimal soil test P or deficit and 4% Very High. As a note, a field with a large P_2O_5 balance in a given year, but a low soil test P level and moderate P Index risk is an reasonable scenario to safely build soil test P to the Optimal level.

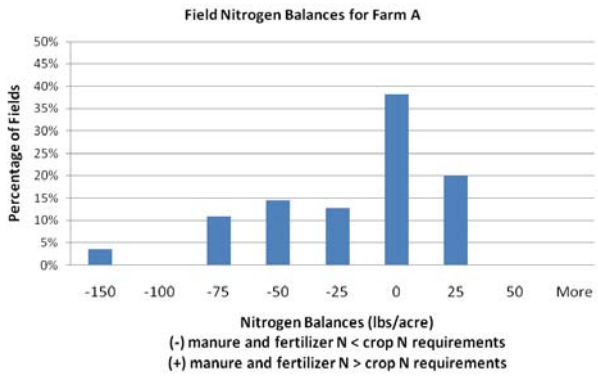
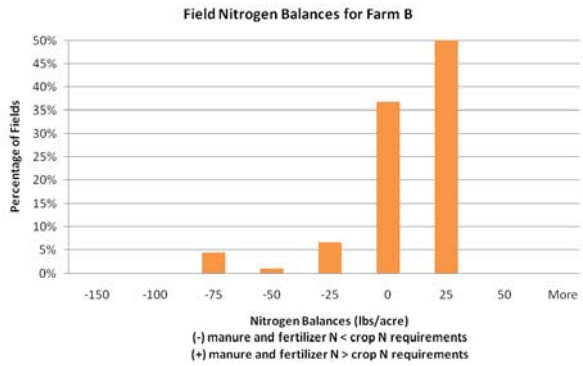


- 100% of fields in low P Index Risk Category.



- 94% of fields in low P Index Risk Category and 6% medium. The medium fields provide a signal to the planner and farmer to shift P management before soils are overloaded.



• 42% of fields have less manure and fertilizer N allocated than needed to meet crop N requirements while the remainder of fields are in balance (i.e., balance = manure and fertilizer nutrients allocated – nutrient recommendation).  	• 12% of fields have less manure and fertilizer N allocated than needed to meet crop N requirements while the remainder of fields are in balance (i.e., balance = manure and fertilizer nutrients allocated – nutrient recommendation). 

Actual Nutrient Plans versus Cornell Guidelines versus Crop Removal for Farm A (averages weighted by field acreage)	**Actual Nutrient Plans versus Cornell Guidelines versus Crop Removal for Farm B (averages weighted by field acreage)**
• Bottom line: manure and fertilizer N plans are often at or below the conservative Cornell Guidelines, with both less than crop removal values. P_2O_5 is moderated for all fields by the P Index.	• Bottom line: manure and fertilizer N plans are often at or below the conservative Cornell Guidelines, with both less than crop removal values. P_2O_5 is moderated for all fields by the P Index.
• Hay field weighted averages: o Plan manure & fertilizer N: 26 lbs/acre o Cornell Guidelines N: 55 lbs N/acre o Crop Removal N: 65 lbs N/acre o Plan manure & fertilizer P_2O_5:22 lbs/acre o Cornell Guidelines P_2O_5: 35 lbs/acre o Crop Removal P_2O_5: 28 lbs/acre	• Hay field weighted averages: o Plan manure & fertilizer N: 15 lbs/acre o Cornell Guidelines N: 32 lbs N/acre o Crop Removal N: 65 lbs N/acre o Plan manure & fertilizer P_2O_5:22 lbs/acre o Cornell Guidelines P_2O_5: 19 lbs/acre o Crop Removal P_2O_5: 28 lbs/acre
• Corn field weighted averages: o Plan manure & fertilizer N: 66 lbs/acre o Cornell Guidelines N: 64 lbs N/acre o Crop Removal N: 162 lbs N/acre o Plan manure & fertilizer P_2O_5:72 lbs/acre o Cornell Guidelines P_2O_5: 43 lbs/acre o Crop Removal P_2O_5: 94 lbs/acre	• Corn field weighted averages: o Plan manure & fertilizer N: 99 lbs/acre o Cornell Guidelines N: 96 lbs N/acre o Crop Removal N: 162 lbs N/acre o Plan manure & fertilizer P_2O_5:66 lbs/acre o Cornell Guidelines P_2O_5: 24 lbs/acre o Crop Removal P_2O_5: 94 lbs/acre

While these studies solely present conditions for the NYS portion of the Bay Watershed, it is extremely challenging to chart similar, low risk nutrient conditions in areas where livestock farms lack an adequate local crop production land base to support efficient manure nutrient recycling. The integrated dairy and crop farms found in NYS, coupled with the long legacy of Cornell soil testing, Cornell Nutrient Guidelines, and nutrient risk indices position agriculture in the NYS portion of the Bay Watershed to address any existing nutrient hotspots (fields) and continue its performance in delivering clean water to the Bay.

See attached tables for actual nutrient plan, nutrient balance, and risk assessment data from the Comprehensive Nutrient Management Plans for Farm A and Farm B.

Farm A Nutrient Management Plan Data

Field ID	Acres	Crop	Residual Sod N	Gross N Req.	Residual Manure N	Total Nutrients Required (lb/a)			Nutrients From Applied Manure (lb/a)			Nutrients From Fertilizer (lb/a)			Nutrient Balance (lb/a)			PI (DP/PP)	LI
						N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O		
1	4.7	GRT9	0	75	21	54	35	85	0	0	0	0	0	0	-54	-35	-85	4 / 4	5
2	3.1	GRT19	0	75	0	75	40	0	0	0	0	0	0	0	-75	-40	0	3 / 2	5
3	7.3	GRT9	0	75	0	75	40	118	0	0	0	0	0	0	-75	-40	-118	2 / 3	13
4	5.6	COS2	18	110	29	81	20	20	0	0	0	30	15	15	-51	-5	-5	12 / 12	8
5	2.8	COS2	0	134	29	105	20	0	0	0	0	30	15	15	-75	-5	15	20 / 20	8
6	7.5	COS1	138	30	0	30	50	80	0	0	0	29	29	29	-2	-22	-52	6 / 6	8
7	4.7	GRE1	8	50	21	29	15	20	0	0	0	19	19	19	-10	4	-1	3 / 3	5
8	6.1	COS3	8	75	0	75	35	20	59	99	146	30	15	15	15	79	141	7 / 20	5
9	8.3	GRT10	0	75	0	75	20	68	42	71	104	0	0	0	-33	51	36	5 / 13	5
10	3.5	GRE1	8	50	16	34	15	20	0	0	0	19	19	19	-15	4	-1	7 / 2	5
11	4.9	COS7	0	85	29	56	35	20	42	71	104	75	29	29	19	-7	9	10 / 10	5
12	7	GRE1	8	50	0	50	5	20	17	28	42	19	19	19	-31	14	-1	1 / 5	5
13	5.1	GRT19	0	75	0	75	40	0	42	71	104	0	0	0	-33	31	104	32 / 4	5
14	4.5	GRT8	0	75	0	75	20	0	0	0	0	0	0	0	-75	-20	0	5 / 2	5
15	6.7	AGT5	0	0	0	0	35	37	0	0	0	0	0	0	0	-35	-37	4 / 1	5
16	9.6	GRT19	0	75	16	59	25	0	0	0	0	0	0	0	-59	-25	0	4 / 1	5
17	12.2	GRT19	0	75	16	59	10	0	0	0	0	0	0	0	-59	-10	0	10 / 10	5
18	26.1	COS1	83	30	0	30	20	25	0	0	0	30	15	15	0	-5	-10	12 / 12	5
19	3.2	PIT19	0	150	0	150	15	20	0	0	0	0	0	0	-150	-15	-20	1 / 1	5
20	10	AGT4	0	0	0	0	50	145	0	0	0	0	0	120	0	-50	-25	1 / 1	5
21	12	COS2	18	70	0	70	55	75	42	71	104	30	15	15	2	31	44	32 / 28	5
22	8	CGT2	0	0	0	0	35	60	0	0	0	0	0	0	0	-35	-60	1 / 1	5
23	10	CGE1	8	0	0	0	55	20	0	0	0	0	40	40	0	-15	20	4 / 3	5
24	12	GRT5	0	75	16	59	45	52	33	48	219	0	0	0	-27	3	167	9 / 11	5
25	29.9	CGT2	0	0	0	0	45	52	0	0	0	0	0	0	0	-45	-52	1 / 1	5
26	9	CGT2	0	0	16	0	15	20	0	0	0	0	0	0	0	-15	-20	3 / 2	5
27	11	GRT15	0	75	21	54	40	57	33	48	219	0	0	0	-54	-40	-57	1 / 1	5

Field ID	Acres	Crop	Residual Sod N	Gross N Req.	Residual Manure N	Total Nutrients Required (lb/a)			Nutrients From Applied Manure (lb/a)			Nutrients From Fertilizer (lb/a)			Nutrient Balance (lb/a)			PI (DP/PP)	LI
						N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O		
28	6.3	GRT14	0	75	0	75	25	30	33	48	219	0	0	0	-42	23	189	11 / 4	5
29	26.2	PIT19	0	150	0	150	45	20	0	0	0	0	0	0	-150	-45	-20	1 / 1	5
30	16.6	GRT2	0	75	21	54	40	13	0	0	0	69	0	0	15	-40	-13	1 / 1	5
31	13.4	COS3	0	100	29	71	55	70	0	0	0	75	29	29	3	-27	-42	1 / 2	5
32	8	COS3	0	100	0	100	60	65	85	142	209	29	29	29	13	110	172	27 / 31	5
33	6	COS2	0	85	37	47	45	20	0	0	0	29	29	29	-19	-17	9	7 / 7	5
34	6.3	GRT3	0	75	21	54	35	0	0	0	0	0	0	0	-54	-35	0	4 / 4	5
35	9.8	COS2	0	85	0	85	50	45	59	99	146	30	15	15	5	64	116	6 / 23	5
36	3.7	COS2	0	85	0	85	60	25	59	99	146	30	15	15	5	54	136	6 / 18	5
37	9.8	GRT2	0	75	21	54	35	0	0	0	0	69	0	0	15	-35	0	4 / 4	5
38	6.6	GRT12	0	75	19	56	40	0	0	0	0	0	0	0	-56	-40	0	2 / 1	5
39	7.6	GRT12	0	75	21	54	45	41	42	71	104	0	0	0	-12	26	64	13 / 7	5
40	19.3	GRT9	0	75	0	75	30	8	33	48	219	69	0	0	-6	-30	-8	5 / 5	5
41	8.4	GRT9	0	75	0	75	30	0	33	48	219	69	0	0	-6	-30	0	5 / 5	5
42	6.4	COS1	83	30	0	30	60	80	0	0	0	29	29	29	-2	-32	-52	2 / 1	5
43	6.1	COS1	83	30	0	30	60	80	0	0	0	29	29	29	-2	-32	-52	4 / 4	9
44	7.1	CGT2	13	0	0	0	45	20	42	71	104	0	0	0	0	-45	-20	1 / 1	5
45	7.1	GRT7	0	75	0	75	35	41	0	0	0	0	0	0	-75	-35	-41	1 / 1	5
46	11.3	GRT19	0	75	0	75	35	68	42	71	104	0	0	0	-33	36	36	14 / 2	5
47	18.5	GRT19	0	75	0	75	45	30	42	71	104	0	0	0	-33	26	75	4 / 2	5
48	20.1	GRT2	0	75	0	75	40	63	0	0	0	69	0	0	-6	-40	-63	1 / 1	5
49	14.6	COS2	0	100	0	100	45	20	85	142	209	30	15	15	15	112	204	27 / 9	5
50	6.1	COS1	83	30	0	30	45	60	0	0	0	29	29	29	-2	-17	-32	5 / 1	5
51	9	COS2	0	100	0	100	35	25	85	142	209	30	15	15	15	122	199	28 / 17	5
52	10	CGE1	0	0	0	0	35	20	0	0	0	0	40	40	0	5	20	3 / 2	5
53	10	GRT2	0	75	0	75	30	19	0	0	0	0	0	0	-75	-30	-19	1 / 1	5
54	5	CGT3	0	0	0	0	30	32	0	0	0	0	0	0	0	-30	-32	1 / 2	5
55	6.1	GRT10	0	75	16	59	10	19	0	0	0	0	0	0	-59	-10	-19	1 / 3	5

Farm B Nutrient Management Plan Data

Field ID	Acres	Crop	Residual Sod N	Gross N Req.	Residual Manure N	Total Nutrients Required (lb/a)			Nutrients From Applied Manure (lb/a)			Nutrients From Fertilizer (lb/a)			Nutrient Balance (lb/a)			PI (DP/PP)	LI
						N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O		
1	10.8	COS5	0	133	13	120	40	25	32	48	117	99	11	0	11	18	92	11 / 6	13
2	4.5	GRT19	0	75	16	59	0	0	0	0	0	0	0	0	-59	0	0	24 / 2	4
3	4	COS3	0	133	0	133	50	20	119	95	233	30	11	0	16	56	213	5 / 5	12
4	3.1	ALE1	0	0	0	0	10	20	0	0	0	10	20	20	10	10	0	37 / 21	4
5	4.8	ALE1	0	0	0	0	65	20	0	0	0	10	60	20	10	-5	0	10 / 6	4
6	8.4	COG4	0	134	0	134	20	35	44	67	163	86	30	16	-4	76	144	17 / 15	7
7	24.8	GRT3	0	75	8	67	0	0	44	67	163	0	0	0	-23	67	163	21 / 9	5
8	24.6	COS6	0	139	22	118	20	0	32	48	117	76	11	0	-10	38	117	42 / 42	8
9	19.6	COS5	0	133	22	111	30	20	72	107	296	30	11	0	-9	88	276	22 / 14	13
10	15.7	ALT2	0	0	20	0	10	0	20	48	117	0	0	0	20	38	117	31 / 31	13
11	21.6	COS5	0	133	8	125	30	0	64	95	233	76	11	0	15	76	233	16 / 5	13
12	4.9	ALT2	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	9 / 5	5
13	5.5	AGT2	0	40	15	25	10	0	35	48	252	0	0	0	10	38	252	15 / 10	5
14	10.8	COG3	10	91	7	84	20	20	0	0	0	76	11	0	-8	-10	-20	4 / 2	5
15	9.4	AGT3	0	40	11	29	10	59	44	67	163	0	0	0	15	57	104	18 / 10	5
16	9.3	AGT1	0	0	6	0	10	0	19	29	70	0	0	0	19	19	70	13 / 7	5
17	9.3	COG3	15	84	2	82	10	0	0	0	0	76	11	0	-6	1	0	8 / 4	5
18	9.1	COS1	110	30	12	18	10	0	0	0	0	30	11	0	12	1	0	9 / 3	5
19	9	ALE1	0	0	12	0	40	20	0	0	0	10	40	20	10	0	0	7 / 4	5
20	6.6	GRT19	0	75	0	75	25	79	89	133	327	0	0	0	14	108	247	11 / 7	5
21	9.8	COG2	18	74	0	74	55	80	64	95	233	30	11	0	19	51	153	35 / 24	5
22	15.3	COS3	10	91	18	72	10	65	53	79	226	30	11	0	11	79	161	24 / 14	5
23	6.9	COG5	0	143	0	143	10	0	0	0	0	145	11	0	2	1	0	48 / 48	8
24	5.9	COG4	0	139	18	122	10	0	0	0	0	122	11	0	0	1	0	13 / 17	8
25	7.1	AGT3	0	40	15	25	10	0	44	67	163	0	0	0	19	57	163	18 / 24	8
26	7.4	ALE1	0	0	13	0	40	20	0	0	0	10	40	20	10	0	0	7 / 9	8
27	7.8	COS1	110	30	15	15	20	0	0	0	0	30	11	0	15	-10	0	11 / 13	8
28	8.9	COG2	24	105	20	85	20	0	32	48	117	53	11	0	0	38	117	42 / 42	8
29	5.6	AGT1	0	40	12	28	10	0	32	48	117	0	0	0	4	38	117	29 / 29	8

Field ID	Acres	Crop	Residual Sod N	Gross N Req.	Residual Manure N	Total Nutrients Required (lb/a)			Nutrients From Applied Manure (lb/a)			Nutrients From Fertilizer (lb/a)			Nutrient Balance (lb/a)			PI	LI
						N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	(DP/PP)	
30	5.7	COS3	10	94	21	73	20	0	37	53	196	30	11	0	-7	43	196	46 / 42	5
31	3	COS5	0	126	19	107	20	0	32	48	117	76	11	0	1	38	117	37 / 41	8
32	2.2	ALE1	0	0	3	0	20	20	0	0	0	10	20	20	10	0	0	28 / 28	12
33	20.8	GRT19	0	75	0	75	40	0	0	0	0	0	0	0	-75	-40	0	3 / 3	5
34	21.5	GRT19	0	75	0	75	40	24	0	0	0	0	0	0	-75	-40	-24	2 / 1	5
35	13.4	GRT5	0	75	0	75	40	24	0	0	0	0	0	0	-75	-40	-24	2 / 1	5
36	8.1	COS1	138	30	2	28	10	20	0	0	0	30	11	0	2	1	-20	33 / 33	8
37	8	ALE1	0	0	51	0	20	20	0	0	0	10	20	20	10	0	0	33 / 29	8
38	10.3	AGT2	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	45 / 45	8
39	16.1	COS5	0	101	21	81	10	20	35	48	252	30	11	0	-16	49	232	65 / 65	5
40	10.3	AGT2	0	0	10	0	10	0	19	29	70	0	0	0	19	19	70	20 / 5	5
41	11.4	COG5	0	101	14	87	25	45	64	95	233	30	11	0	6	81	188	48 / 13	5
42	11.4	ALT2	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	8 / 5	8
43	8.6	COS5	0	101	13	88	20	0	64	95	233	30	11	0	5	86	233	52 / 11	5
44	3.7	AGT1	0	40	7	33	10	0	32	48	117	0	0	0	-1	38	117	15 / 9	5
45	1.4	COG4	0	92	3	88	45	0	0	0	0	100	35	23	12	-11	23	7 / 2	5
46	11.1	ALT2	0	0	12	0	30	0	0	0	0	0	0	0	0	-30	0	2 / 1	8
47	19.9	COG5	0	139	14	125	40	0	89	133	327	53	11	0	17	104	327	39 / 39	8
48	14.9	GRT2	0	75	6	69	0	0	44	67	163	0	0	0	-24	67	163	40 / 10	5
49	7	GRT8	0	75	0	75	35	2	0	0	0	0	0	0	-75	-35	-2	3 / 1	5
50	8.9	AGT1	0	40	19	21	40	0	32	48	117	0	0	0	11	8	117	15 / 15	5
51	7.5	AGT2	0	40	3	37	0	25	2	2	13	0	0	0	-35	2	-12	15 / 10	8
52	7.8	GRT1	0	75	1	74	0	15	0	0	0	69	0	0	-5	0	-15	11 / 7	8
53	11.1	COS3	10	189	29	160	10	0	49	72	243	99	11	0	-11	72	243	25 / 14	8
54	6.2	COS5	0	203	23	180	0	0	58	84	306	122	11	0	0	94	306	31 / 19	8
55	7.5	AGT2	0	40	11	29	0	6	35	48	252	0	0	0	6	48	246	18 / 12	8
56	7.2	COS4	0	203	51	152	20	60	76	108	432	76	11	0	0	98	372	24 / 16	8
57	9.4	ALT3	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	9 / 6	8
58	9.6	AGT2	0	40	18	22	10	0	32	48	117	0	0	0	10	38	117	13 / 9	8

Field ID	Acres	Crop	Residual Sod N	Gross N Req.	Residual Manure N	Total Nutrients Required (lb/a)			Nutrients From Applied Manure (lb/a)			Nutrients From Fertilizer (lb/a)			Nutrient Balance (lb/a)			PI (DP/PP)	LI
						N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O		
59	9.6	COG3	10	189	12	177	25	20	89	133	327	99	11	0	11	119	307	27 / 18	8
60	13	COG3	10	156	12	144	20	20	71	103	352	76	11	0	2	93	332	52 / 5	5
61	13.2	COS3	10	119	7	113	40	45	32	48	117	76	11	0	-5	18	72	11 / 11	13
62	13.6	COS2	24	101	6	94	20	30	32	48	117	76	11	0	13	38	87	13 / 7	13
63	7.9	COS1	110	30	10	20	30	30	0	0	0	30	11	0	10	-20	-30	3 / 2	13
64	9.7	AGT1	0	0	34	0	10	0	0	0	0	0	0	0	0	-10	0	9 / 8	8
65	3.4	COS5	0	126	11	115	20	0	0	0	0	112	7	0	-3	-13	0	24 / 24	8
66	11.8	AGT2	0	40	16	24	20	0	0	0	0	0	0	0	-24	-20	0	9 / 5	5
67	3.9	COG3	10	82	0	82	20	0	0	0	0	76	11	0	-6	-10	0	8 / 5	4
68	8.8	AGT2	0	40	19	21	10	62	32	48	117	0	0	0	10	38	55	12 / 9	13
69	8.3	COS1	110	30	18	12	20	0	0	0	0	30	11	0	18	-10	0	5 / 4	13
70	23	PLT14	0	40	7	33	0	20	0	0	0	0	0	0	-33	0	-20	14 / 14	4
71	12.4	PLT14	0	40	9	31	10	20	0	0	0	0	0	0	-31	-10	-20	10 / 10	4
72	53	PLT14	0	40	3	37	45	20	0	0	0	0	0	0	-37	-45	-20	1 / 1	4
73	9.3	COS2	24	99	9	90	25	20	44	67	163	30	11	0	-15	52	143	51 / 51	13
74	6	COS2	24	86	2	84	20	35	32	48	117	30	11	0	-22	38	82	5 / 10	8
75	10.3	ALT2	0	0	7	0	10	0	0	0	0	0	0	0	0	-10	0	5 / 2	13
76	14.5	AGT2	0	40	11	29	10	120	32	48	117	0	0	0	3	38	-3	12 / 8	13
77	6.1	COS4	0	107	45	62	0	0	0	0	0	76	11	0	14	11	0	73 / 73	5
78	8.7	AGT1	0	40	12	28	0	0	0	0	0	0	0	0	-28	0	0	41 / 41	5
79	6	COS1	110	30	20	10	50	25	0	0	0	30	11	0	20	-40	-25	4 / 3	5
80	12.7	COS3	10	113	28	84	20	20	19	29	70	76	11	0	11	19	50	4 / 7	8
81	14	COS5	0	96	17	80	25	20	0	0	0	76	11	0	-4	-15	-20	11 / 11	5
82	11.7	AGT2	0	40	27	13	20	0	32	48	117	0	0	0	19	28	117	11 / 7	8
83	5.8	COS3	10	119	19	101	30	55	32	48	117	76	11	0	7	28	62	11 / 15	13
84	13.3	ALE1	0	0	15	0	40	20	0	0	0	10	40	20	10	0	0	2 / 4	8
85	4.5	COG5	0	133	0	133	55	45	64	95	233	76	11	0	7	51	188	35 / 40	13
86	12	AGT2	0	40	7	33	15	117	0	0	0	0	0	0	-33	-15	-117	3 / 2	8
87	7.3	GRT2	0	75	3	72	0	0	0	0	0	69	0	0	-3	0	0	10 / 2	5

Field ID	Acres	Crop	Residual Sod N	Gross N Req.	Residual Manure N	Total Nutrients Required (lb/a)			Nutrients From Applied Manure (lb/a)			Nutrients From Fertilizer (lb/a)			Nutrient Balance (lb/a)			PI (DP/PP)	LI
						N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O	N	P2O5	K2O		
88	8	AGT2	0	40	16	24	10	28	0	0	0	0	0	0	-24	-10	-28	7 / 5	13
89	4.8	COS2	24	70	0	70	30	25	0	0	0	76	11	0	6	-20	-25	7 / 1	5
90	9.9	COS1	83	30	0	30	30	25	0	0	0	30	11	0	0	-20	-25	1 / 4	12

Precision Feed Management (PFM) on Dairy Farms[14][15][16]

Nutrient management planning on dairy farms, with a focus on nutrient source reduction, is vital for farm economic sustainability and water quality improvement. Previous studies at Cornell University have reported that 60 to 80% of nitrogen and phosphorus imported onto dairy farms remains after accounting for all nutrients that leave. Long term and sustainable nutrient reduction will only occur by reducing nutrient imbalances i.e., decreasing imports and/or increasing exports. As two thirds or more of the imported nutrients to dairy farms come in purchased feed, significant reductions in nutrient imports can be accomplished with changes in ration and crop management. Several studies have demonstrated, and it is widely accepted that precision feed management can reduce manure nutrient excretions, including volatilized ammonia, an important atmospheric pollutant.

New York State has a track record of implementing PFM on dairy farms in the Delaware River Basin since 2000 and the Susquehanna River basins since 2005. In 2005 the USC, Cornell University and Cornell Cooperative Extension began a collaborative effort through a CIG project to define, streamline, pilot and quantify PFM in the Upper Susquehanna basin to prepare to eventual basin wide implementation. To these ends, the achievements of this project included the following:

- Development of a common definition of PFM in New York State;
- Development of a farm level PFM implementations process and software tools to aid in the quantification and documentation of PFM impact;
- Provide educational outreach on PFM to farm and feed industry communities;
- Provide input to NY NRCS for the development and implementation of NY 592 feed management standard;
- Develop professional capacity to implement PFM on farm in the Upper Susquehanna;
- Quantified the environmental and economic impact of PFM on farms;

The NYS PFM Definition and Process

In New York, PFM is the providing of adequate, not excess, nutrients to the animal to maintain or improve environmental and economic sustainability through the integration of feeding and crop management.

PFM is a continuous improvement process voluntarily adopted and directed by the farm management with goals of optimized nutrient efficiency, homegrown feed utilization and milk

[14] Cerosaletti, P.E., D.G. Fox, and L.E. Chase. 2004. Phosphorus reduction through precision feeding of dairy cattle. J. Dairy Sci. 87:2314-2323

[15] Ghebremichael, L.T., P.E. Cerosaletti, T.L. Veith, C.A. Rotz, J.M.Hamlett, W.J. Gburek. 2007. Economic and Phosphorus-Related Effects of Precision Feeding and Forage Management at a Farm Scale. J. Dairy Sci. 90:3700-3715.

[16] Cerosaletti, P.E., 2008. Phosphorus reduction through precision feeding implementation project phase I; Final technical report. Available at: http://cornellpfm.org/technicalReports.htm. Accessed November 9, 2010.

income overfeed costs. In NYS we have developed a process to facilitate the implementation of PFM on farms. This process includes:

- Assessment of feed management at the farm level using key indicators. These indicators are:
  - Ration P as a percentage of requirement
  - Diet crude protein under a recommended percentage
  - Milk Urea Nitrogen (MUN) concentration
  - Neutral Detergent Fiber intake as a percentage of body weight
  - Forage as a percentage of diet
  - Home grown feeds as a percentage of diet
  - Gauge the efficacy and efficiency of management of dairy cattle during a critical stage of lactation
- Development and implementation of farm feed management plans;
- Evaluation and quantification of impact of implemented feed management strategies.

Cornell Cooperative Extension and Cornell University have developed software tool applications to aid in generating implementation of PFM on farms and to assist in the quantification of economic and environmental impact.

Quantified Impact of PFM in NYS

The Delaware County (NYS) Precision Feed Management Program (www.cornellpfm.org), operating in both the Susquehanna and Delaware River Basins in NYS over the last ten years, has studied the impact of PFM on the over 40 farms engaged in their program. They have collaborated with Cornell University and USDA-ARS to assess impact of PFM on farms using both actual data as well as modeled scenarios. The resulting environmental impacts of these efforts are presented in Table 1:

Table 1. NYS PFM Impact

		Manure P Excretion reduction	Manure N Excretion reduction	Farm Mass P Balance Reduction	Farm Mass N Balance Reduction
Cerosaletti et al. 2004	actual	33%	NA[1]	50%	NA[1]
Ghebremichael et al. 2007	model	21%	NA[1]	52%	NA[1]
Cerosaletti, 2008	actual	22%	8%[2]	66%	65%

[1]Not applicable in this study

[2]Nitrogen reduction was not original focus of the project, so reduction presented may not represent extent of N reduction possible.

Given these reported impacts, the USC conservatively estimates that nutrient excretion can be decreased by 8 to 25% and whole farm mass balance by 30 to 40% on many dairy farms in the Upper Susquehanna watershed through PFM. The PFM source reductions compliment other agricultural waste and stream corridor management practices, adding to their nutrient reduction potential.

Accounting for Growth

New York does not project significant growth within the agriculture sector. CAFO farm expansions are required to be accompanied by the addition of appropriate land base prior to additional animals being brought on. New York has an abundant land base available to handle additional expansions for CAFO size farms.

Gap Analysis

Specific USEPA WIP Questions

The Watershed Implementation Plan guidance from USEPA R3 dated April 2, 2010 includes the following specific questions about agriculture:

1. Question: Is there a minimum set of management practices to be included in nutrient management plans? If so, how is the inclusion and implementation of these practices verified?

Answer: Yes. Comprehensive Nutrient Management Plans CNMPs and NMPs written in New York as part of the New York CAFO Program and AEM Program all utilize the minimum requirements of New York-NRCS Conservation Practice Standard 590 which includes the New York Land Grant University (Cornell) Guidelines for nutrient applications as well as soil conservation requirements. The Cornell nutrient guidelines are based on applied research and are actively maintained through on-going field trials with the goal of nutrient use and efficiency. Unlike the land grant university guidelines of some other states, Cornell recommendations do not allow for over application of nutrients under the guise of "insurance factors." Full CNMPs are developed according to NY-NRCS Conservation Practice Standard 312, which includes standard 590 as well as a long list of other standards to address manure/process wastewater concerns on farmstead facilities. These CNMPs and NMPs are written by New York State Certified Planners that undergo a rigorous training and continuing education process including a quality assurance program.

2. Question: How is phosphorus managed in soils?

Answer: In accordance with the New York P Index as per the requirements of NRCS New York-590

3. Question: How are appropriate agronomic rates determined for application of manure/biosolids/organic byproducts?

Answer: Manure application rates are developed as part of a New York CNMP. The certified planner developing this plan utilizes an iterative approach that looks to restrict applications based on the field specific characteristics and risk assessments assigned by the nitrogen and phosphorus indices.

Contrary to some phosphorus indices, the New York phosphorus index does not allow for the disposal of manure. The New York phosphorus index considers phosphorus loss runoff risk based on both particulate and soluble phosphorus forms, reflecting predominant pathways for

phosphorus runoff formation, and results in phosphorus application restrictions. The New York phosphorus index was developed at Cornell University, based on local research, knowledge and conditions, and with input from professionals in State and Federal agencies. The New York phosphorus index has been in place for several years and where soil test phosphorus and transport risk potential is high, it has caused farms to change management of that field or apply manure elsewhere. The New York phosphorus index continues to undergo changes as greater insights are gained into phosphorus movement in our landscapes, but it is an effective tool for environmental protection[17].

Biosolid land application is extremely limited in New York. That which occurs is regulated via 6NYCRR Part 360.

Commitment and Strategy to Fill Gaps

New Initiatives

Under Reported Best Management Practices

Interim Best Management Practices

Research

Policy Changes and Program Implementation

Regulatory Revisions

Under Reported Best Management Practices
NYSDEC continues to work to implement enhanced technical requirements for agriculture. Many New York requirements far exceed the standards of the Chesapeake Bay model and need to be accounted for. Some examples include:

- **Engineering Requirements**
  NY CAFOs are currently working to complete evaluations of existing manure storage and transfer systems and vegetated treatment areas by Professional Engineers.

- **Stream Setbacks**
  New York's CAFO permit requires stringent setbacks for nutrient applications in farmlands adjacent to New York's waters.

- **Comprehensive Nutrient Management Plans**
  The watershed model reveals that a full suite of agricultural BMPs associated with the implementation of Comprehensive Nutrient Management Plans in New York yields only a 10% nitrogen reduction. This stems from an assumption in the model that there is an excess of manure. While this may be true in other areas of the Chesapeake watershed it is not true in New York. It may also stem from USEPA R3 overestimating the amount of purchased fertilizer in New York by basing such information on county-level data. This

[17] Czymmek, K.; Q. Ketterings; L.Chase, L. Geohring. (2010) The New York Phosphorus Site Index: The Sky is Not Falling. Bay journal (submitted)

is significant because more fertilizer (different soil types, types of agriculture) is used in northern parts of many counties that are outside of the Chesapeake watershed.

- **Enhanced Nutrient Management**
  USEPA R3 baseline assumption that land grant universities all recommend fertilizer application rates 35% above agronomic needs is not true in New York. This holds true for all crops, including non-legume hay, because the Cornell nutrient guidelines are based on applied research and are actively maintained through on-going field trials with the goal of nutrient use efficiency (no insurance factors are included in the guidelines).

- **Agricultural Waste Management Systems**
  It is not clear how the watershed model accounts for the "system-based" planning required for CNMP development in New York. For example, a waste storage system or other production area management practice, when implemented without a complementary field management practice is inappropriate and should not be credited in the model.

This level of implementation and commitment to quality best management practices needs to be captured in the model and adequate credit given for the work being done. New York is committed to continue to work with EPA to look at the currently acceptable best management practices and definitions and to provide science-based adjustments to better reflect the New York programs.

New York is also proposing adjustments to already accepted interim best management practices and proposing additional best management practices to be included in the next model calibration and to be credited in the Phase II Watershed Implementation Plan. Specifically, New York is looking to address:

- Manure Incorporation
- Crop Nutrient Application
- Passive Hay Production

Interim BMPs – Manure Incorporation

On August 20, 2010, EPA published interim agricultural best management practice definitions and effectiveness values including for liquid manure injection[18]. EPA defines the Liquid Manure Injection BMP as:

> *"The subsurface of liquid manure from cattle and swine has been demonstrated in research studies to significantly reduce nutrient losses for both surface runoff and ammonia emissions. Recent studies by Pennsylvania State University (PSU) and USDA-ARS indicate that the effectiveness of the practice is dependent on the technology used for injection, and that some systems are not consistent with the USDA-NRCS management requirements for high residue management systems; e.g. Continuous No-Till. This proposed practice is indicative of low disturbance soil injection systems and is not appropriate for tillage incorporation or other post surface application incorporation methods.*

[18] Interim Agricultural BMP Definitions and Effectives Values, Chesapeake Bay Program Phase 5.3 Modeling Suite,August 20, 2010

The current placeholder effectiveness value for this practice has been proposed at 25% TN, 0%TP and 0%TSS, utilizing a conservative estimate in combined nutrient and sediment loss reductions by current university and ARS research as a reference. The proposed practice is applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive manure, pasture and hay with manure."

Longstanding guidelines and recent studies by Cornell University and USDA-ARS document that incorporation of manure immediately after surface application conserves a significant portion of ammonium in manure from volatilization as ammonia and reduces surface runoff losses relative to surface application.

- http://nmsp.cals.cornell.edu/guidelines/nutrientguide.html
- http://nmsp.cals.cornell.edu/projects/manureapplicationmethods/year2summary.pdf
- http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=251340 (accepted JEQ)

The proposed practice of manure injection should also address manure incorporation. New York proposes to include immediate incorporation of surface applied manure into the soil with any non-injection incorporation method (see Liquid Manure Injection Interim BMP for injection methods) within the limits set by the NRCS 590 standard (i.e., nutrient and erosion goals met) and the conservation tillage standards set by NRCS and further defined conservation in the Chesapeake Bay Program BMP Assessment Report (http://archive.chesapeakebay.net/pubs/BMP_ASSESSMENT_REPORT.pdf). This shall be performed in close proximity to planting to allow for effective utilization of the conserved ammonium (e.g., otherwise fall incorporation without a growing crop results in loss of conserved ammonium ultimately via leaching and/or denitrification). Immediate incorporation of manure provides a nitrogen benefit and lowers annual application rates, leading to lower phosphorus rates. Such an approach provides a nitrogen and phosphorus benefit in areas where ample crop- and hayland exist for manure application (e.g., areas of lower animal unit/acre densities).

The current placeholder effectiveness value for manure incorporation is proposed at 15% TN, 0%TP and 0%TSS, utilizing a conservative estimate in combined nutrient and sediment loss reductions by current university and USDA-ARS research as a reference. The TN effectiveness value is based on the Powell et al. (accepted JEQ) comparison of aerator incorporation (47% NH3 conserved relative to surface application) with injection (74% NH3 conserved relative to surface application). The difference between ammonia conservation with the aerator and the injector was applied to the 25% TN effectiveness value proposed for the Liquid Manure Injection interim BMP to arrive at 15% TN. New York proposes to increase the TN effectiveness value to 33% based on the ammonia conservation guidelines from Cornell University Research.

The proposed incorporation practice should be applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive manure, pasture and hay with manure. The Manure Incorporation practice will be used as a transition pathway to manure injection practices over time.

Interim BMPs - Crop Nutrient Application BMP for NY[19][20][21][22]

The Chesapeake Bay model calculates non-nutrient management application rates (lb/ac) as the upper limit yield (tons/ac) multiplied by the theoretical uptake (lb/ton). This calculation is overestimating nutrient application rates for the New York Upper Susquehanna River watershed and needs to be adjusted.

Consider the following: the theoretical nutrient uptake for corn silage or greenchop harvested area in the model is 10.235 lbs per ton for N and 1.535 lbs per ton for P. The Upper Susquehanna Coalition conservatively estimates an average of 18 tons per acre yield for corn silage. Therefore nutrient application rates for N and P would be estimated in the model as follows:

10.235 lbsN/ton * 18 tons/acre = 184 lbsN/ac

1.535 lbsP/ton * 18 tons/acre = 28 lbsP/ac

However, based on a Cornell University evaluation of the N and P balances for the New York Upper Susquehanna River watershed, it was determined that the average N application is already below what is recommended by the land grant university. In addition, the study suggests that the watershed is now in balance for P. Using data from this study, it is reasonable to assume 81 lbs/ac of total nitrogen and 15lbs/ac of total phosphorus as the nutrient application rates for the NY portion of the watershed. This was calculated by taking the total amount of manure N and P, adding the total amount of fertilizer N and P, and dividing it by the total number of cropland acres, including legumes, in the NY portion of the watershed. Thus, the adjusted nutrient application rates for N and P would be as follows:

(33M lbsN + 10.5M lbsN) ÷ 534, 973 ac = 81 lbsN/ac

(5.3M lbsP + 2.9M lbsP) ÷ 534, 973 ac = 15 lbsP/ac

Therefore, the current placeholder effectiveness value for this practice as implemented in New York should be adjusted for TN and TP, utilizing the Cornell N and P balance studies. This practice is applied on a per acre basis and should be implemented and reported for the *Crop* land use grouping. There are approximately 651,649 *Crop* acres in New York according to the model p53_2009aveCSOAA run.

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[19] Brosch, C. 2010. Estimates of County-Level Nitrogen and Phosphorus Data for Use in Modeling Pollutant Reduction. Documentation for Scenario Builder Version 2.2. <www.chesapeakebay.net/content/publications/cbp_39284.pdf > Accessed November 8th, 2010.

[20] Swink, S.N., Q.M. Ketterings, L.E. Chase, and K.J. Czymmek, and J.C. Mekken (2009). Past and future phosphorus balances for agricultural cropland in New York State. Journal of Soil and Water Conservation 64(2):120-133.

[21] Swink, S.N., Q.M. Ketterings, K.J. Czymmek, L.E. Chase, and J. Mekken (2009). Upper Susquehanna River Watershed cropland P balances. What's Cropping Up 19(2):1-3. http://css.cals.cornell.edu/cals/css/extension/cropping-up/archive/upload/wcu_vol19no2_2009a1susquehanna.pdf

[22] Swink, N., Q.M. Ketterings, L.E. Chase, K.J. Czymmek, M.E. Van Amburgh (2010). Nitrogen balances for New York State: Implications for manure and fertilizer management. Journal of Soil and Water Conservation (*in press*).

Interim BMP - Passive Hay Production BMP for NY[23][24] [25][26][27]

Late in the spring of 2010 the Upper Susquehanna Coalition discovered that the assumption in the CBP model for the rate of nutrients applied to the land use "hay with nutrients" (200 lbs/acre for nitrogen and 80 lbs/acre for phosphorus) was overestimated for the New York portion of the watershed. The USC did an analysis of 13,000 acres of hay land from nutrient management plans and determined that 79lbs/acre for N and 32lbs/acre for P was more accurate with the incorrect assumption that "hay with nutrients" meant that nutrients (i.e. manure or fertilizer) were being applied to this land use. The USC asked the Chesapeake Bay Program to reduce application rates to 80 lbsN/acre and 40 lbsP/acre thinking this was a conservative estimate. The rates were changed in version 5.3 of the model and now those rates are locked down.

The definition of the approved land use entitled *hay with nutrients* has subsequently been clarified to mean hay land that is harvested, regardless of nutrient input. According to the approved definition, some *hay with nutrient* land can in fact have no nutrient application at all. This is an important distinction for New York because according to the model, there is estimated to be over 100,000 acres of harvested hay land that do not receive nutrient applications. The model uses an average nutrient load per acre for this land use. Therefore hay land that is harvested but not produced with applied nutrients represents the lower end of the average, and is balanced by those hay lands that received higher amounts of applied nutrients and contribute a higher load.

By properly calculating all of the harvested hay, including the hay land with no nutrient application, in the correct ratio of hay with nutrients to hay without nutrients (42:58), the appropriate representative average nutrient application rate for New York is **46lbs of N** and **15 lbs of P** per acre. These rates are based on the USC's Comprehensive Nutrient Management Plan[28] evaluation of 5,460 acres of nutrient hay application, 7,540 acres of non-nutrient hay land and Cornell University's basin-wide study of N and P balances for the New York Upper Susquehanna River Watershed.

The current placeholder effectiveness value for this practice has been proposed at 57% TN, 38% TP, and 0% TSS, utilizing the USC evaluation of 13,000 acres of hay land from nutrient management plans, the Cornell N and P balance studies, and the Chesapeake Bay Programs model version 5.3 N and P load estimates of forest land use. The proposed practice is applied on a per acre basis and can be implemented and reported for hay land on the *hay with nutrients* land use that are harvested with and without receiving nutrient input.

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[23] J. Curatolo, personal communication, 11/2/2010

[24] Swink, S.N., Q.M. Ketterings, L.E. Chase, and K.J. Czymmek, and J.C. Mekken (2009). Past and future phosphorus balances for agricultural cropland in New York State. Journal of Soil and Water Conservation 64(2):120-133.

[25] Swink, S.N., Q.M. Ketterings, K.J. Czymmek, L.E. Chase, and J. Mekken (2009). Upper Susquehanna River Watershed cropland P balances. What's Cropping Up 19(2):1-3. http://css.cals.cornell.edu/cals/css/extension/cropping-up/archive/upload/wcu_vol19no2_2009a1susquehanna.pdf

[26] Swink, N., Q.M. Ketterings, L.E. Chase, K.J. Czymmek, M.E. Van Amburgh (2010). Nitrogen balances for New York State: Implications for manure and fertilizer management. Journal of Soil and Water Conservation (*in press*).

[27] Chesapeake Bay Program Phase 5.3 Watershed Model, 11/8/2010

[28] Comprehensive Nutrient Management Plans for New York farms are written by Certified Agricultural Environmental Management Planners and must meet the Conservation Practice Standards of the Natural Resources Conservation Service

Research

New York is actively engaged in new research to better the best management practices and technical standards for agriculture. New York is considering several practices that may be better at reducing nutrient or sediment loads to waters. These areas of current research include:

- Groundwater Guidance Revisions and Pilot Program
- Variable Source Area Hydrolgoy - Enhanced P index standard using VSA hydrology[29]
- Mass Balancing

Groundwater Guidance Revisions and Pilot Implementation Program
Drinking water well contamination issues related to manure management occur in certain areas of New York State. "Karst" is the term used for areas associated with carbonate bedrock (limestone or dolomite), where cracks, fractures and other solution channel irregularities are present. Karst conditions enhance these bedrock features over time through the action of flowing water to create sinkholes, depressions in the land surface, disappearing streams, etc., which provide a direct connection between surface and groundwater. This type of landscape and geology allows water to rapidly flow into (or out of) bedrock with little or no filtration. In such areas where groundwater is under the influence of surface water, recharge waters influenced by residential, commercial, industrial, wildlife, or agricultural activities may also generate a contaminant risk to surface and groundwater supplies. Protection of groundwater resources requires additional measures in these areas. NYSDEC is currently working with Cornell University, USDA-NRCS and NYSDAM to develop guidance and a pilot implementation program for farmers and planners need to evaluate land conditions in karst areas and implement appropriate best management practices.

Variable Source Area hydrology
A cost effective and meaningful watershed approach also relies on a firm understanding of how each watershed functions in relation to its hydrological characteristics, drainage patterns, topography, land cover, land uses and misuses, precipitation events and other parameters. Targeting implementation sites using a "Variable Source Area" (VSA) hydrology concept may further increase success. Details of the VSA concept can be found at this Cornell University website: http://soilandwater.bee.cornell.edu/Research/VSA/extension.html

This concept asserts that is that a relatively small portion of the watershed that influences a majority of runoff exiting a watershed. By implementing practices in these areas, substantial water quality improvements can be accomplished in a more cost effective manner.

Mass Balance for Agriculture
Source control relies on understanding a farm's nutrient budget. Mass balance analysis (difference between nutrients entering the farm through feed, fertilizer, fixation etc. and the amount leaving the farm through sales of milk, meat, animals, crops, manure etc.) can determine excess nutrients based on nutrient inputs and outputs. Mass balancing information is useful because it:

[29] Hydrologically Sensitive Areas: Variable Source Area Hydrology Implications for Water Quality Risk Assessment by M.Todd Walter, Michael F. Walter, Erin S. Brooks, Tammo S. Steenhuis, Jan Boll, Kirk Weiler

- Provides important baseline information for all planning and many implementation projects
- Prioritizes practices where excess nutrients are documented
- Has outreach potential by showing nutrient loading to farmers in a more understandable format
- Demonstrates economic and yield benefits that should attract greater farmer participation
- Can be used to develop a mass balance for a watershed
- Can be used as a tool for documentation if nutrient trading is initiated

The USC and Cornell University are conducting mass balances on 60 farms under a pilot project to streamline how to develop a more extensive application. Because this process is a precursor for precision feeding/forage management and an aid for targeting many management practices, it is a key planning tool.

Policy Changes and Program Implementation

Program Amendments

In 2010 the NYS Soil and Water Conservation Committee implemented three key policy provisions to the NYS Nonpoint Abatement and Control Grant Program scoring and eligibility criteria. These adjustments advance the implementation of agricultural best management practices in the Chesapeake Bay watershed. Historically, approximately 25 percent of program resources have been used to deploy conservation practices in the Chesapeake Watershed. The Committee estimates that approximately 40 percent of the active implementation occurring in the watershed on an annual basis is a direct result of the introduction or leveraging of these resources. The following changes are now being adopted:

1) The adoption of additional points (Bonus Points) for proposals that address waterbodies with an active TMDL or those included in the most recent New York State 303(d) List of Impaired Waters Requiring a TMDL, where the source of the impairment is agriculture, and the project will contribute to restoration of water quality. For the purposes of assigning additional points, the NY State portion of the Chesapeake Bay Watershed, namely the Upper Susquehanna River and all of its tributaries shall be considered an active TMDL.
2) Agricultural best management practices for Cover Crops and Mulching will now be available for cost-sharing over a three year term instead of the previous one year cost-share period to allow sufficient time to demonstrate the value of the practice to the farmer. This shift in program policy is being made in order to encourage adoption of these two agronomic practice systems for suitable farms and situations.
3) Agricultural best management practices for Pasture Management must demonstrate a water quality (WQ) benefit derived from the system and the individual component practices installed must collectively meet the definition of "Pasture Management – Prescribed Grazing Systems" found in the NYS Agricultural Management Practices Catalog. "Pasture Management: Prescribed Grazing System" is defined in the NYS Agricultural Management Practices Catalog as "a prescribed grazing management

system using **five** or more paddocks for a grazing season, alternating paddocks to allow for forage vigor and re-growth and livestock graze for no more than a week before they are rotated to another paddock."

4) Additionally, the Committee and the Department of Agriculture are actively researching policy adjustments, to direct funding toward resource concerns of statewide significance. The Chesapeake Bay Watershed effort would be designated as such.

Expanding Existing Programs

New York will work with State and Federal partners to expand the use of the NYS Conservation Reserve Enhancement Program (NYS CREP). The USDA/NRCS Conservation Reserve Enhancement Program is essential for the expansion of stream side buffers. At present its applicability is limited to certain geographic areas. CREP eligible watersheds are based on the DEC's 1996 Priority Waterbody List, which is out of date as each basin in the state is updated every 5 years on a rotational basis. Also the PWL reflects waterbody impacts in New York. As such, the existence of a Chesapeake Bay TMDL does not make all the New York water body segments in the Susquehanna Basin CREP eligible. In fact less than half of the watersheds in the Susquehanna Basin show impacts on the 1996 list. The NYS CREP Steering Committee, which includes a representative from DEC Division of Water, have recommended that we amend the current CREP Agreement to use an AEM Tier 2 Environmental Assessment of each farm as a basis for determining CREP funding eligibility. For USDA FSA to even consider that proposed change we would need to fund the preparation of a Programmatic Environmental Assessment of the potential impact to the NYSCREP of making such a change in eligibility. Resources are needed to conduct an environmental impact study to expand program eligibility. FSA has estimated the cost of the environmental assessment that would be prepared by a contractor selected by FSA at between $45,000 and $50,000. **This study is stalled due to a lack of federal funding.**

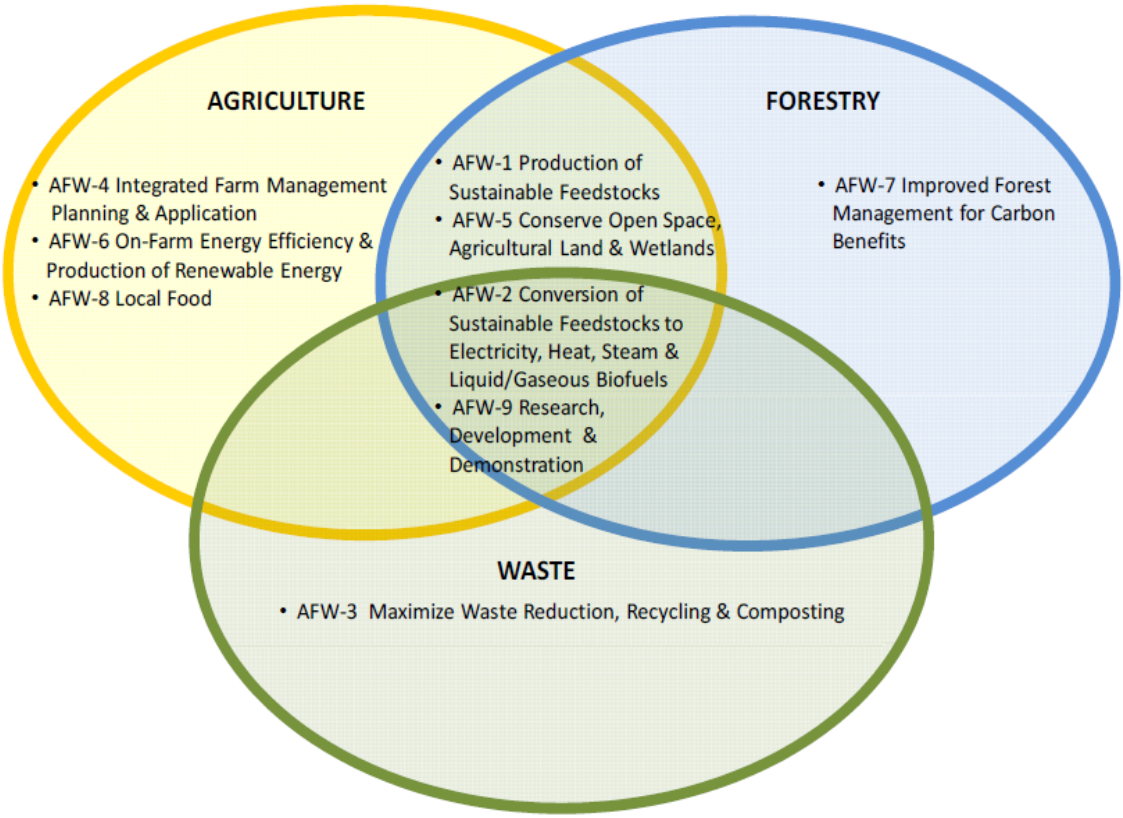
Manure Emissions Controls

Agricultural Innovation *and* Capacity to Conserve Resources

New York State, including the portion in the Chesapeake Bay Watershed, has a proven track record of advancing renewable energy, air quality, water quality, and greenhouse gas mitigation through agricultural solutions. Developing innovative approaches to provide multiple benefits is challenging. New York State has the critical mass of applied research and extension, farmer innovation, public policies and statutes, and private-public partnerships to continue to pursue simultaneous conservation of air, water, soil, energy, habitat and greenhouse gases via economically feasible approaches (as summarized below).

- NYS Executive Order 24 was signed into effect in August 2009 to set a NYS goal of reducing greenhouse gas (GHG) emissions 80 percent below 1990 levels by 2050 (or 80 by 50) and establish the Climate Action Council to determine how to meet the goal. The resulting Climate Action Plan identifies challenges and assesses how all economic sectors can reduce GHG emissions and adapt to climate change in a coordinated fashion. The Plan also identifies the extent to which such actions support New York's goals for a clean energy economy. The Climate Action Plan was posted for review in November 2010 (http://nyclimatechange.us/InterimReport.cfm). The Agriculture, Forestry, and Waste Management Mitigation subgroup (AFW) points to several strategies for renewable energy

production, adaptation, and greenhouse gas mitigation while striving to conserve other natural resources. Agricultural practices included in the AFW portion of the Plan include significant implementation of on-farm anaerobic digesters, perennial biomass production, on-farm energy audits, manure nutrient treatment and recycling, etc. (see figure below). (http://nyclimatechange.us/index.cfm)



- The NYS Biomass Alliance, affiliated with the NYS Farm Viability Institute, is working in the area of grass biomass with a number of small pilot projects underway including: the Catskill Grass BioEnergy project (www.ccedelaware.org), the St. Lawrence Grass Energy project, Cornell University Grass BioEnergy Project (www.grassbioenergy.org), Hudson Valley Grass Energy and others. Woody grass biomass is a sustainable, low input initiative calling for a substantial increase in biomass from agriculture including short rotation woody biomass as well as grass biomass. The Alliance has set to achieve 75% of thermal renewable energy from biomass by 2025 in the Northeast.

- The original, year-2000 NYS Agricultural Environmental Management (AEM) Law focusing on water quality was expanded in 2008 to include risk assessment, planning, implementation and evaluation activities and cost-share funding for air quality, greenhouse gas mitigation, energy conservation, and renewable energy projects on farms, in coordination with traditional AEM water quality projects. (www.agmkt.state.ny.us/SoilWater/aem/index.html)

- The Cornell Dairy Environmental Systems Program has been applying research and extension to help farms in NYS develop solutions for conservation and renewable energy for the past two decades. Their website documents their efforts, by serving several case studies,

papers, and on-going research projects for anaerobic digestion, manure treatment, nutrient management, greenhouse gas mitigation, etc. Anaerobic digestion is often a compatible system component with other manure treatment technologies (e.g., mechanical and chemical separation) aimed at partitioning nutrients for more targeted, efficient use. The Cornell Dairy Environmental Systems Program is also the principle investigator for the NYS component of the National Air Emissions Monitoring Study.
(www.manuremanagement.cornell.edu/index.html)

- Due to its record of supporting innovation, NYS was selected as a pilot state for the Dairy Power Initiative. The industry-led Dairy Power team includes more than 100 members from leading institutions, such as Cornell University, University of California-Davis, World Wildlife Fund, Walmart, Dean Foods, Dairy Farmers of America, National Milk Producers Federation and the USDA.
  (www.usdairy.com/Sustainability/GHGReduction/Projects/Pages/DairyPower.aspx)
  - Dairy Power Goals and Milestones: The milk production segment of the U.S. dairy supply chain contributes 51.5 percent to the fluid milk carbon footprint. Dairy Power will help achieve the Dairy 2020 goal to reduce this by 27 percent.
  - Phase 1 – Stakeholder Engagement Summit in New York: Bring together 200 stakeholders to set goals and identify an action plan to accelerate adoption of methane digesters in New York State. Summit attendees set a 2020 goal that 40 percent of all manure from New York dairy farms goes through the anaerobic digestion process.
  - Phase 2 – Facilitate Access to Resources and Financing: Helping farmers secure access to information and economic support is imperative. Work with USDA to connect farmers to tools and resources, including AgSTAR; and explore innovative financing vehicles such as loan guarantees and tax-exempt bonds.
  - Phase 3 – Develop Rural Electric Cooperative Partnerships: Partner with the National Rural Electric Cooperative Association to explore cooperative models that support digester-generated electricity and connections to the nation's power grid.

- ClimateAndFarming.org is another Cornell University collaboration of scientists and extension educators helping farmers make practical and profitable responses to climate changes. (www.climateandfarming.org)

- The Morrisville State College Renewable Energy Training Center (RETC) provides technical short courses for employed and unemployed individuals seeking marketable skills in the renewable energy field. The RETC is an alliance of employers, training providers, economic development partners, and K-12 schools to address long-term and short-term needs of New York State's renewable energy sector. Course curricula are based upon employer-identified skill gaps and needs. RETC courses are available for all skill levels and those with previous training. Training sessions focus on renewable energy resources and systems, including wind, solar, micro hydro, geothermal and biofuels. (http://retc.morrisville.edu/default.aspx)

- The New York State Energy Research and Development Authority (NYSERDA) continues its long track record of administering electricity rate-payer funds for stimulating agricultural renewable energy projects (e.g., anaerobic digesters) and energy conservation (e.g., energy audits), encompassing approximately $30 million to date with another estimated $70 million

for renewable energy projects in agriculture and waste management sectors through 2015 via the State's Renewable Portfolio Standard program. (www.nyserda.org)

- There are currently 19 operating anaerobic digesters on farms in NYS and another 14 in the planning phases. Three anaerobic digesters are currently operational in NYS' portion of the Chesapeake Bay Watershed (AA Dairy, New Hope View Dairy, and Morrisville State University Dairy), converting (and thereby destroying) methane from approximately 2750 animal units to 250 kW of electricity in the Watershed (enough to cover all farm electricity needs and sell excess to the grid).
    - www.manuremanagement.cornell.edu/Pages/General_Docs/Case_Studies/AA_Case_Study.pdf
    - www.manuremanagement.cornell.edu/Pages/General_Docs/Case_Studies/NHV_case_study.pdf
    - www.manuremanagement.cornell.edu/Pages/General_Docs/Case_Studies/Morrisville_Case_Study.pdf

- The net-metering portion NYS Public Service Law was recently changed to increase the net-metering cap limit for on-farm electricity production from anaerobic digesters from 500 kW to 1 MW. (http://assembly.state.ny.us/leg/?default_fld=&bn=A07987&Summary=Y&Actions=Y&Text=Y)

- New York State is a leader in the Regional Greenhouse Gas Initiative (RGGI), the first mandatory, market-based effort in the United States to reduce greenhouse gas emissions. Ten Northeastern and Mid-Atlantic states in total have capped and will reduce CO2 emissions from the power sector 10% by 2018. States sell nearly all emission allowances through auctions and invest proceeds in consumer benefits: energy efficiency, renewable energy, and other clean energy technologies. On-farm anaerobic digesters are recognized as an offset option for the power sector, although current CO2 prices have limited farm participation to date. (www.rggi.org)
- In line with New York State's Climate Action Plan, several focused efforts to heat New York State with renewable biomass are underway, including the NY Biomass Energy Alliance (www.NewYorkBiomass.org) and HeatNE.org, as well as several grassroots renewable biomass pilot projects such as the Catskill Grass BioEnergy project (www.ccedelaware.org), the St. Lawrence Grass Energy Project, Cornell University Grass BioEnergy Project (www.grassbioenergy.org), and the Hudson Valley Grass Energy Project.

Regulatory Revision

NYSDEC is proposing a comprehensive regulatory revision to Title 6, Subpart 750 of the Codes, Rules and Regulations of the State of New York. One of the objectives of this regulatory revision is to align New York's CAFO program with the CAFO federal rule found at 40 C.F.R. Part 122, which became effective on November 21, 2008.

Tracking and Reporting Protocols

The USC collects and coordinates all BMP data collection to verify information and eliminate double counting. This is done by using a master list of farms that are geo-references to a GIS database. Each year County SCWD Staff update the BMP list. The USC is presently working on developing The National Environmental Information Exchange Network (NEIN) Node necessary for future data reporting to the Chesapeake Bay program. The data base is also used for WIP planning and specific data needs.

Contingencies for Slow or Incomplete Implementation

See Compliance Chapter

Upper Susquehanna Coalition Agriculture and Wetlands

A Nonpoint component to the New York CB WIP

Developed by the

Upper Susquehanna Coalition

Suggestions for Agricultural and Wetland
Best Management Practice Implementation to reduce Nutrients and Sediment Loads

2010

Nutrient Reduction for Agriculture
The USC developed levels of management practice implementation based on USC meetings with knowledgeable agricultural experts and farmers**, that are believed to be practical and reasonable considering available funding, technical staff, time and farm operator cooperation for implementation.** These practices include those that have been shown to be highly cost-effective in reducing nutrient runoff, such as comprehensive nutrient management plans, so they are clear choices to achieve significant nutrient reduction. Many of these practices also involve source control or stream protection, so they have local benefits and tend to be fiscally sustainable. In addition, many practices reduce the impacts of atmospheric nitrogen deposition by reducing ammonia emissions and/or providing nitrogen retention. Agricultural practices can also be very cost-effective because some involve operational changes without major capital commitments.

1. Precision Feed Management (PFM) on Dairy Farms.
Nutrient management planning on dairy farms, with a focus on nutrient source reduction, is vital for farm economic sustainability and water quality improvement. Previous studies at Cornell University have reported that 60 to 80% of nitrogen and phosphorus imported onto dairy farms remains after accounting for all nutrients that leave. Long term and sustainable nutrient reduction will only occur by reducing nutrient imbalances i.e., decreasing imports and/or increasing exports. As two thirds or more of the imported nutrients to dairy farms come in purchased feed, significant reductions in nutrient imports can be accomplished with changes in ration and crop management. Several studies have demonstrated, and it is widely accepted that precision feed

management can reduce manure nutrient excretions, including volatilized ammonia, an important atmospheric pollutant.

New York State has a track record of implementing PFM on dairy farms in the Delaware River Basin since 2000 and the Susquehanna River basins since 2005. In 2005 the USC, Cornell University and Cornell Cooperative Extension began a collaborative effort through a CIG project to define, streamline, pilot and quantify PFM in the Upper Susquehanna basin to prepare to eventual basin wide implementation. To these ends, the achievements of this project included the following:

- Development of a common definition of PFM in New York State;
- Development of a farm level PFM implementations process and software tools to aid in the quantification and documentation of PFM impact;
- Provide educational outreach on PFM to farm and feed industry communities;
- Provide input to NY NRCS for the development and implementation of NY 592 feed management standard;
- Develop professional capacity to implement PFM on farm in the Upper Susquehanna;
- Quantified the environmental and economic impact of PFM on farms;

The NYS PFM Definition and Process;

In New York, PFM is the providing of adequate, not excess, nutrients to the animal to maintain or improve environmental and economic sustainability through the integration of feeding and crop management.

PFM is a continuous improvement process voluntarily adopted and directed by the farm management with goals of optimized nutrient efficiency, homegrown feed utilization and milk income overfeed costs. In NYS we have developed a process to facilitate the implementation of PFM on farms. This process includes:

- Assessment of feed management at the farm level using key indicators. These indicators are:
    - Neutral Detergent Fiber intake as a percentage of body weight
    - Forage as a percentage of diet
    - Home grown feeds as a percentage of diet
    - Ration P as a percentage of requirement
    - Diet crude protein under a recommended percentage
    - Milk Urea Nitrogen (MUN) concentration
    - Gauge the efficacy and efficiency of management of dairy cattle during a critical stage of lactation
- Development and implementation of farm feed management plans;
- Evaluation and quantification of impact of implemented feed management strategies.

Cornell Cooperative Extension and Cornell University have developed software tool applications to aid in generating implementation of PFM on farms and to assist in the quantification of economic and environmental impact.

Quantified Impact of PFM in NYS:
The Delaware County (NYS) Precision Feed Management Program (www.cornellpfm.org), operating in both the Susquehanna and Delaware River Basins in NYS over the last ten years, has studied the impact of PFM on the over 40 farms engaged in their program. They have collaborated with Cornell University and USDA-ARS to assess impact of PFM on farms using both actual data as well as modeled scenarios. The resulting environmental impacts of these efforts are presented in Table 1:

Table 1. NYS PFM Impact

		Manure P Excretion reduction	Manure N Excretion reduction	Farm Mass P Balance Reduction	Farm Mass N Balance Reduction
Cerosaletti et al. 2004	actual	33%	NA[1]	50%	NA[1]
Ghebremichael et al. 2007	model	21%	NA[1]	52%	NA[1]
Cerosaletti, 2008	actual	22%	8%[2]	66%	65%

[1]Not applicable in this study
[2]Nitrogen reduction was not original focus of the project, so reduction presented may not represent extent of N reduction possible.

Given these reported impacts, the USC conservatively estimates that nutrient excretion can be decreased by 8 to 25% and whole farm mass balance by 30 to 40% on many dairy farms in the Upper Susquehanna watershed through PFM. The PFM source reductions compliment other agricultural waste and stream corridor management practices, adding to their nutrient reduction potential the USC estimates that PFFM would need to be implemented on 250 farms, or 50% of the dairy animal units to reach our goal.

According to the CBP, Dairy Precision Feeding reduces the quantity of P and N fed to livestock by formulating diets within 110% of Nutritional Research Council recommended level in order to minimize the excretion of nutrients without negatively affecting milk production. Effectiveness estimates are determined via direct testing, however, without test results, TP reduction is assumed to be 25% and TN reductions are assumed to be 24% with no TSS associated with dairy precision feeding.

2. Comprehensive Nutrient Management Plans (CNMP). CNMPs optimize nutrient use to minimize nutrient loss while maintaining yield. These plans attempt to maximize use of on-farm nutrients such as manure and cover crops and minimize nutrient imports such as purchased fertilizer. Nutrient management BMPs are developed by certified planners in New York. Certified planners come from both the public and private sector. In order to sustain nutrient reductions, technical support for plan development, continued plan implementation and regular updates are necessary.

The estimate for New York is that comprehensive nutrient management planning could cover 90 percent of all cropland under the enhanced Nutrient Management definition (see 3 below). Component practices in CNMPs that receive additional reduction credits are listed separately in the following descriptions of individual practices.

3. Enhanced Nutrient Management (Yield Reserve). Based on the following definition of the Enhanced Nutrient Management practice by USEPA, enhanced Nutrient Management is the reduction in nitrogen applied to cropland beyond the nutrient management (NY_NRCS 590 standard) recommendation. The reduction percentage is currently defined at 15%. Based on research, the nutrient management rates of N application are set approximately 35% higher than what a crop needs to ensure nitrogen availability under optimal growing conditions. In a yield reserve program, the farmer would reduce the N application rate by 15%. Because farmers would be accepting some risk in yield loss, an incentive or crop insurance is used. We are assuming that NY has a greater land base to do 590 nutrient management compared to other states in the basin and that existing CAFO regulations in the USC portion of the basin in NY is regulated sufficiently to meet the federal standard. Therefore it is assumed that everyone following Cornell recommendations will be doing enhanced Nutrient Management.

The reduction efficiencies for Enhanced Nutrient Management are 7% for TN and 0% for both TP and TSS. New York estimates that Enhanced Nutrient Management can be applied to 90% of both crop and hay land.

4. Conservation Plans: Field and Pasture Erosion Control Practices. Farm conservation plans are a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality, and prevent natural resource deterioration on a farm. Soil conservation plans are comprehensive plans that meet USDA-NRCS Field Office Technical Guide criteria. Soil conservation plans help control erosion by modifying operational or structural practices. Operational practices include crop rotations, tillage practices, or cover crops and may change from year to year. Structural practices are longer-term and include, but are not limited to, grass waterways in areas with concentrated flow, terraces, diversions, sediment basins and drop structures. Reduction efficiencies vary by land use and constituent of concern. Conservation plans addressing high till acreage receives a reduction of 8%, 15% and 25% for TN, TP, and TSS respectfully. Low till and hay acreage efficiencies are 3%, 5%, and 8%. Pasture acreage has a 5%, 10%, and 14% reduction for TN, TP, and TSS. **In New York, "Conservation Plans" are usually part of a CNMP. This helps to increase the Goal for conservation plans, estimated at 82% of all farm acreage.**

5. Animal waste management systems. These important practices are designed for proper handling, storage, and utilization of wastes generated from confined animal operations. They include a means of collecting, scraping or washing wastes and contaminated runoff from confinement areas into appropriately designed waste storage structures. Waste storage structures are typically made of concrete and require continued operation and maintenance, making them a significant cost item. Controlling runoff from roofs, feedlots and "loafing" areas are an integral part of these systems (See "6", Barnyard Runoff Control Systems, below). Scraping or flushing manure more frequently can reduce ammonia emissions from barns and animal confinement areas, as would manure transfer systems that separate feces from urine. Covered manure storage also emits less ammonia. Failure to properly collect and store generated manure may result in

losses of liquid manure to surface water and excessive nutrient leachate to groundwater. For dry manure, contact with precipitation or wet soils under stockpiles can result in significant nutrient leaching.

Bay Watershed Model reduction efficiencies for livestock animal waste systems are 100%, 100%, and 0% for nitrogen, phosphorus, and sediment, respectively. **When all CNMPs are fully implemented, an estimated 60% of the total of farms will need these complete systems, which will almost exclusively be on dairy operations.**

6. Barnyard runoff control practices and rotational loafing lots. These practices may be installed as part of a total animal waste management system or as a stand-alone practice, particularly on smaller operations. Barnyard runoff control practices include diversions, rainwater gutters, and similar practices. The rotational loafing lot practice, by proximity, is grouped with barnyard control practices. Reduction efficiencies for barnyard runoff control and rotational loafing lot practices are 100%, 100%, and 0% for nitrogen, phosphorus, and sediment, respectively. **The Goal is to install approximately 65% of all farms, in addition to manure storage structures.**

7. Conservation Tillage. Conservation tillage involves planting and growing crops with minimal soil disturbance. Conservation tillage requires two components, (a) a minimum 30% residue coverage at the time of planting and (b) a non-inversion tillage method. No-till farming is a form of conservation tillage where the crop is seeded directly into vegetative cover or crop residue. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment and leaves much of the vegetation cover or crop residue on the surface. Because the climate in New York results in slower spring warm up of soils from continual cover, the ability to implement this practice is reduced. Incentives may be necessary to stimulate use of this practice. **Conservation Tillage gets credit in the model by changing the land use and reductions are given accordingly. The Goal is to implement conservation tillage on 40% of available land.**

8. Cereal Cover Crops. Cereal cover crops reduce erosion and nutrients leaching to groundwater or volatilizing by maintaining a vegetative cover on cropland and holding nutrients within the root zone. This practice involves planting and growing, but not harvesting, cereal crops with minimal soil disturbance. The crop is seeded directly into vegetative cover or crop residue and captures nitrogen in its tissue as it grows. When the cover crop is plowed down in spring, trapped nitrogen is released and used by the following crop. Two challenges associated with this practice include difficulty in establishing the crop because of early frost and difficulty in plowing under a heavy crop. Crops capable of nutrient removal include rye, wheat, barley, and to a much lesser extent, oats.

The Bay Watershed Model has a complex method for calculating nutrient reduction efficiencies for cereal cover crops. The research-based estimates of cover crop efficiencies need to be adjusted to provide more realistic estimates of efficiencies for widespread adoption of this practice. Effectiveness estimates vary between species, planting dates, and seeding techniques. To be eligible for level 1 reduction credit, referred to as early planting, the cover crop must be planted earlier than 14 days prior to the long-term published average date of the first killing frost

in the fall. To be eligible for level 2 reduction credit, called standard planting, the cover crop must be planted 14 days prior to the average frost date up to the published long-term average date of the first killing frost in the fall. The Bay Watershed Model has no reduction efficiency for legume cover crops such as clover and vetch that fix their own nitrogen from the atmosphere.

Where total nitrogen is concerned, baseline efficiencies were developed for a particular cereal cover crop and then effectiveness estimates were assigned. The baseline calculation for drilled rye uses the baseline and multiples it by the subsurface flow proportion for the location and 0.75 to account for operational effectiveness. For the remaining rye calculations (other and aerial) and the drilled wheat and drilled barley calculations, the drilled rye baseline is multiplied against the individual species/corresponding seeding coefficient, and also multiplied by the subsurface flow proportion for the location and the scale coefficient. For each aerial or other wheat and barley calculation the base value is multiplied against the individual species/corresponding seeding coefficient, the seeding coefficient for the baseline species (drilled rye), the subsurface flow proportion for the location and also the scaling coefficient. See Table 1 for Total Nitrogen Efficiency Reductions.

The total phosphorous (TP) and total suspended sediment (TSS) reductions associated with cover crops are associated with surface flow and are recommended as a 15% and 20% reduction for TP and TSS, respectively for planting cereal cover crops on conventional tillage within 13 days after the first frost. See Table 1. **With the proper incentive, the Goal is to implement cereal cover crops on 20% of cropland.**

9. Commodity Cover Crops. Commodity cover crops differ from cereal cover crops because they may be harvested for grain, hay or silage and they may receive nutrient applications, but only after March 1 of the spring following their establishment. The intent of this practice is to modify normal small grain production practices by eliminating fall and winter fertilization so that crops function similarly to cover crops by scavenging available soil nitrogen for part of their cycle. This practice can encourage planting of more acreage of cereal grains by providing farmers with the flexibility of planting an inexpensive crop in the fall and delaying the decision to either kill or harvest the crop based on crop prices, silage needs or weather conditions.
Because fertilizer may be applied in the spring, the reduction efficiencies are reduced from cereal cover crop efficiencies. The same planting date criteria apply as specified under cereal cover crops. Refer to table 2 for reduction efficiencies.

Table 2. Total Nitrogen (TOTN), Phosphorus (TOTP), and Suspended Solids (TSED) efficiencies for various cereal cover crops on various land uses for three constituents of concern.

Cover Crop BMP	**Land use Type**	**TOTN Efficiency**	**TOTP Efficiency**	**TSED Efficiency**
Early Drilled Rye	High- Till	34%	15%	20%
Early Drilled Rye	Low-Till	34%	0%	0%
Early Other Wheat	High-Till	20%	15%	20%
Early Other Wheat	Low-Till	20%	0%	0%
Standard Other Wheat	High-Till	18%	7%	10%
Standard Other Wheat	Low-Till	18%	0%	0%

Table3. Total Nitrogen (TOTN), Phosphorus (TOTP), and Suspended Solids (TSED) efficiencies for commodity cover crops on various land uses for three constituents of concern.

Cover Crop BMP	**Land use Type**	**TOTN Efficiency**	**TOTP Efficiency**	**TSED Efficiency**
Early Other Wheat	High- Till	8%	0%	0%
Early Other Wheat	Low-Till	11%	0%	0%
Standard Other Wheat	High-Till	6%	0%	0%
Standard Other Wheat	Low-Till	9%	0%	0%

With the proper incentive, the Goal is to implement cereal and commodity cover crops on a combined 20% of cropland acres.

10. Land Retirement. Agricultural land retirement takes marginal and highly erosive cropland out of production by establishing permanent vegetative cover such as shrubs, grasses and trees. Land retired and planted to trees is reported under the "Tree Planting" BMP. Wetland construction could also be considered a form of land retirement. USDA NRCS Programs such as CRP, CREP and WHIP provide incentives for retirement. Some agricultural land is also going out of production as farms cease to operate. All retired land will be documented. This is especially important because agricultural land, namely cropland, is one of the highest nutrient sources in the Bay Watershed Model and agricultural land use changes usually result in less nutrient runoff. **Total retirement of agricultural lands is estimated to be at 8,692 acres. Reduction credit is given as a land use change in the model.**

11. Wetland Restoration (Agriculture). Agricultural wetland restoration activities re-establish natural hydrologic conditions that existed prior to installing subsurface or surface drainage. Projects may restore, create or enhance a wetland. Restored wetlands may be any wetland type including forested, scrub-shrub or emergent marsh. **Preliminary results of work by Binghamton University researchers and others show that wetlands capturing high nutrient runoff from barnyards reduce nitrogen concentrations by at least 50%. Restored wetlands also provide high quality wildlife habitat. However, in the Bay Watershed Model, wetland restoration receives reduction efficiencies equivalent to reverting the area back to upland forest.**

The USC has an active wetland program that is described in more detail in the Wetland Chapter of this strategy. A total of 4,147 wetland acres have been restored since 1990, most of which were on agricultural lands. **The Goal is to create or restore an additional 11,124 acres of wetlands on agricultural lands, including projects funded under USDA Natural Resources Conservation Service's Wetlands Reserve Program.**

12. Tree Planting. The Tree Planting BMP or afforestation (converting agricultural land to forest) includes tree planting on agricultural lands, except those used to establish riparian forest buffers, which is a separate practice. The tree planting practice targets highly erodible lands and critical resource areas.

The Bay Watershed Model treats tree planting as a land use conversion from row crop, pasture or hayland to forest. The tree planting **practice may be sparingly used considering that the New York portion of the Bay watershed is about 70% forest. The Goal is to convert 2,068 agricultural acres to forest with the help of tree planting or preferably through natural succession on voluntarily abandoned agricultural lands.**

13. Prescribed Grazing. The *Prescribed Grazing* system objective is to manage forage availability by reducing the time livestock spend grazing on a paddock. Reducing grazing time improves the uniformity of manure and urine deposition over the pasture. The cattle's urine can be taken up by grass, thus lowering ammonia emissions. Grazing also helps to prevent soil erosion, reduce surface runoff and improve forage cover, while utilizing animal manures. Livestock overgrazing and direct access to surface water are also reduced. Specific practices include exterior and interior fencing, laneway development or improvement, pasture seeding or improvement, watering systems (well, pond, spring development), pipelines, water troughs, and brush management. Prescribed grazing brings added benefits because some of the grazing practices are associated with other practices, such as livestock exclusion from streams and

riparian buffers. A major barrier to overcome with this practice is that switching to grazing can be a major change in operational style.

Grazing was first initiated in New York through the Grazing Lands Conservation Initiative (GLCI), established in 1991 to provide voluntary high quality technical assistance and awareness of the importance of grazing land resources on private grazing lands. GLCI is a coalition of individuals and organizations functioning at the local, state, regional and national levels. It includes livestock producer organizations, scientific and professional grazing resource organizations, conservation and environmental groups, and state and federal natural resource and agricultural agencies. USDA NRCS administers the program. In 1995 the "Graze NY" program was developed with the assistance of Congressmen James Walsh, Sherwood Boehlert and Maurice Hinchey. Eleven counties in New York were given the opportunity to provide technical assistance to interested livestock producers. These counties focus their efforts on informing producers about the benefits associated with prescribed grazing. Information is delivered to interested producers through pasture training workshops, informational farm tours, on-site farm visits and personal contacts with interested producers.

Additional grazing initiatives in New York are being supported through the SWCC Agricultural Non-point Source Abatement and Control Grants Program. One leader in this initiative is the Finger Lakes Resource Conservation & Development Council that supports work through several grants that cover the entire New York portion of the Bay watershed. Broome and Tompkins County SWCD's have also secured grants to support multiple county grazing projects. Twelve counties in the New York portion of the Bay watershed actively participate in one or more grazing initiatives.

The USC actively supports all such initiatives through its Grazing Initiative by tracking progress, providing additional staff support and securing additional funding to maximize implementation efforts. Because of its multiple potential benefits, cost-effectiveness and sustainability, Prescribed Grazing is an important practice to support and promote.

Presently the Bay Watershed Model does not have nutrient or sediment reduction efficiencies for this practice as it is implemented in New York. Until reduction efficiencies are established for this practice, which could be substantial, the Goal, with the right incentives, is to implement prescribed grazing or stream fencing with off-stream watering (see 14a below) on 80,000 pasture acres. For cost analysis and modeling purposes, the USC selected 123,250 of pasture acres to be in prescribed grazing.

14. Stream Protection in Pastures. Direct contact of pastured livestock with surface water results in manure deposition, streambank erosion, re-suspension of streambed sediments and nutrients, and aquatic habitat degradation. Stream access also affects herd health by exposure to water borne pathogens and risk of hoof problems. Two practices in the Watershed Model are relevant in New York: (a) off stream watering with stream fencing and (b) off stream watering without stream fencing. The practices are mutually exclusive, so reduction efficiencies are not additive.

(a) Off-Stream Watering with Fencing – This practice incorporates fence installation that

excludes livestock from narrow strips of land along streams and provides an alternative, clean drinking water source. Fenced areas may be planted with trees or grass, but are typically not wide enough to provide the complete nutrient reduction benefits of buffers. Stream fencing should substantially limit livestock access to streams, but can allow for hardened crossing areas to access additional pastures or for livestock watering.

The Bay Watershed Model estimates a nutrient reduction on three pasture acres for each 208 feet of stream fencing with reduction efficiencies of 10%, 15%, and 32% for nitrogen, phosphorus, and sediment, respectively. Preliminary results from studies in Delaware County show even higher nutrient reductions. By reducing constant stress on stream banks from hooves, cattle exclusion is also a very important practice for stabilizing stream banks. This practice is lumped with prescribed grazing (see 13 above) for a Goal of 100% of pasture acres.

(b) Off-Stream Watering without Fencing – This practice requires the use of alternative drinking water troughs or tanks away from streams. To be effective, this practice should also include shade away from streams for livestock. To be successful, the practice should show reduced livestock manure deposition in and near streams and move heavy traffic areas surrounding water sources to more upland locations. **The Bay Watershed Model reduction efficiencies are 15%, 22%, and 30% for nitrogen, phosphorus, and sediment, respectively. This practice will be installed where fencing is not feasible or wanted. The Goal is to install about 1,000 effected acres.**

15. Buffers (Agriculture). Besides nutrient reduction value, buffers contribute to habitat improvement. Buffer designs based upon "variable source area" hydrology, which incorporate an analysis of field slopes, drainage patterns and concentrated points of entry at the streambank, are priority projects because they maximize water quality benefits. The SWCC Agricultural Non-point Source Abatement and Control Grants Program scoring system gives added priority to buffers.

(a) Agricultural Riparian Forest Buffers are linear wooded areas, usually accompanied by shrubs and other vegetation, that are adjacent to rivers, streams and shorelines. Forest buffers help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. This practice meets some resistance by farmers because of the loss of cropland, added expense of tree planting, maintenance and potential to shade crops. A graded approach that transitions from trees at the water edge to shrubs near the crops provides maximum benefits while reducing farmer concerns of shading. The CBP recommends a buffer width for riparian forest buffers (agriculture) of 100 feet, yet a 35 feet minimum (NRCS criteria) width is required to obtain reduction in the Bay Watershed Model. For New York, this practice reduces nitrogen by 54%, phosphorus by 42%, and sediment by 56%. **The Goal is to install approximately 15,000 acres of forested buffers.**

(b) Agricultural Riparian Grass Buffers are linear strips of grass or other non-woody vegetation maintained between the edge of fields and streams or rivers that help filter nutrients and sediment and improve habitat. The recommended buffer width is the same as riparian forests buffers. This practice has tremendous potential and would be more widely used if it were eligible for CREP funding on more than just cropland and if the

grass grown on the buffer could be cut and utilized. A "natural regeneration" buffer that could ultimately revert to forest also has tremendous potential. This practice is slightly less efficient for nitrogen reduction in the Bay Watershed Model than forested buffers, (38%). Phosphorus and sediment reductions are the same in grass buffers as they are for forest buffers. **The Goal is to install approximately 100% of available land after forest buffers are applied.**

16. Horse Pasture Management (This definition is pending CBP Approval). Horse pasture management includes maintaining a 50% pasture cover with managed species (desirable inherent) and managing high traffic areas. Maintaining a 50% cover will improve the pasture so erosion and nutrient loss is minimized. High traffic areas are concentration areas within the pasture where the grass is sparse or nonexistent. High traffic area management is utilized to reduce the highest load contributing areas associated with pasture lands. These are often feeding areas, such as hay deposits around fence lines. These areas are treated as sacrifice areas.

Horse pasture management excludes offstream watering with and without fencing. Instead these stream protection BMPs are credited as separate practices (See the 14a and 14b BMP description for details). Pasture management applies to all pasture lands, as not every pasture has a stream linked to it. The offstream watering BMPs may be implemented on pastures adjacent to waterways. Where pastures are in contact with a stream managing animal, contact to the stream is critical. The dominant source of nutrient and sediment loss from pasture lands is associated with animal contact with the stream.

Overstocking is also frequently the cause of many nutrient and sediment problems, when preparing horse pasture management plans they should include pasture management, heavy use area improvement, and management of stocking densities.

The horse pasture management **practice may be an increasingly important practice as a number of smaller horse farms in the basin have began to appear on the landscape. According to the Bay Model, the efficiencies for nitrogen, phosphorus and sediment are 0%, 20% and 40%, respectively. The Goal is to add 2,000 effective pasture acres.**

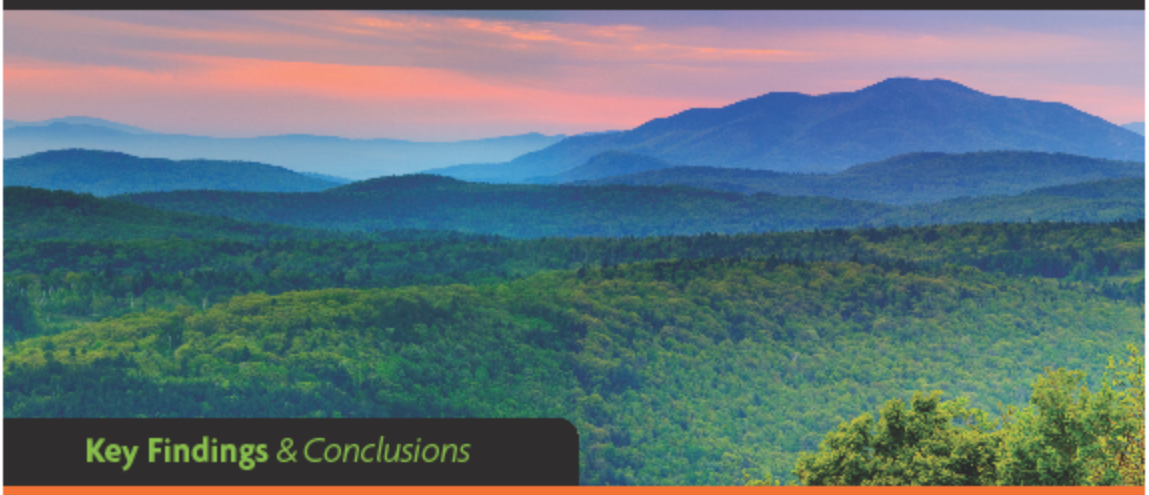
17. Mortality Composting. Composting provides an inexpensive alternative for disposal of all dead animals, butcher wastes and other biological residuals. In addition to water quality benefits, mortality composting benefits both human and animal health. The temperatures achieved during composting will kill or greatly reduce most pathogens, reduces the risk of disease transmission, prevents nuisances such as flies, vermin and scavenging animals, and combats odor resulting from the anaerobic breakdown of proteins. Properly composted material is environmentally safe and a valuable soil amendment for growing certain crops.

Mortality composters involve composting routine mortality in a designed, on-farm facility, with subsequent land application of the compost. This prevents the necessity to bury dead animals that could result in nutrient leachate, or rendering of dead animals for processing into animal feeds or incineration. Mortality composting can be, and is applied, to various species including poultry, swine and dairy calves.

The pollution reductions associated with mortality composting is calculated using a set of equations incorporating the average mortality weight, nitrogen and phosphorus composition, percent mortality, the number of animals each year, and an effectiveness estimate. Mortality is not consistent, it increases with animal weight. To account for this average mortality weight is within the 70th weight percentile. The average nutrient composition, percent mortality and number of animals each year is dependent on each animal type, although in New York it will primarily affect dairy farms. **The effectiveness estimate remains the same regardless of species with 40% reduction for N and a 10% reduction for P when compared to burial. Our Goal is to affect 50% of dairy mortality.**

Heating the Northeast
with Renewable Biomass

A Bold Vision *for 2025*



Key Findings & *Conclusions*

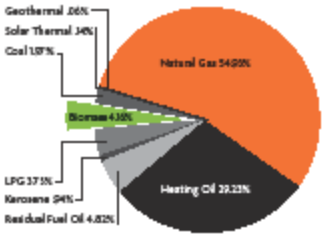
- ✔ **Supply 19 million**
  green tons of sustainable biomass for thermal energy available annually from forest and farm sources
- ✔ **Achieve 25%**
  of all thermal energy from renewable resources by 2025
- ✔ **Achieve 75%**
  of thermal renewable energy from biomass by 2025
- ✔ **Convert 1.38 million**
  households in the seven states to biomass for thermal needs
- ✔ **Reduce 1.14 billion**
  gallons of heating oil annually
- ✔ **Reinvest $4.5 billion**
  in resulting economic wealth in the Northeast economy
- ✔ **Create 140,200 jobs**
- ✔ **Healthier communities**
  Improve air quality, reduce greenhouse gases and build healthier communities

the Vision

We, the five proposing organizations, call for an American Revolution to domestically produce the thermal energy consumed in the six New England states and New York. We propose that 25% of all thermal energy requirements in the Northeast are met with renewable energy resources by the year 2025. This shift in our sources for thermal energy will produce extraordinary economic, social and environmental benefits for the region, which currently relies on fossil fuel for 96% of its thermal energy. Furthermore, we call for three quarters of the renewable energy to come from sustainably produced biomass from forest and farm resources transformed into heat with clean and efficient technology, and for solar and geothermal technologies to provide the balance. Today, renewable energy accounts for 4.3% of the total thermal energy sources for the region, and forest biomass comprises 96% of all renewable thermal energy in the region.

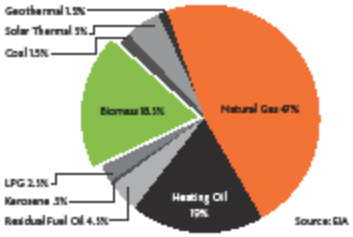
2010

New England and New York thermal energy from:

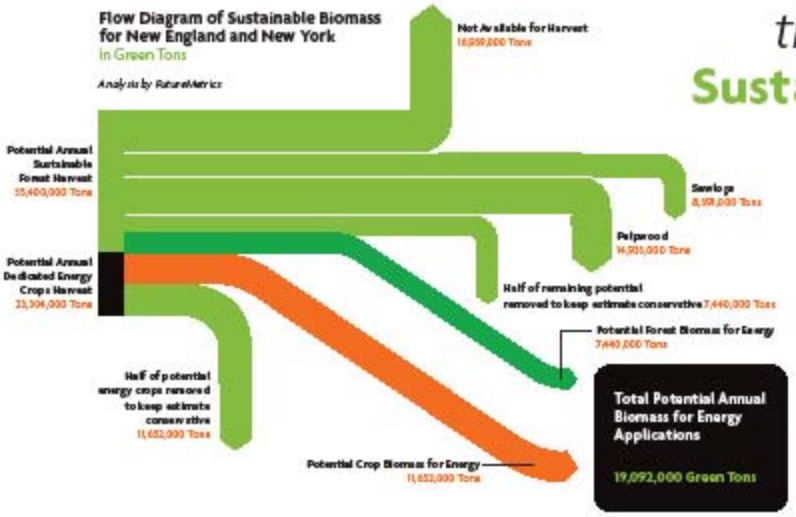


2025

New England and New York thermal energy from:



This vision is consistent with consensus national and regional goals to reduce reliance on non-renewable fossil energy. A robust market economy will provide tens of thousands of new jobs in forest and farm production of biomass feedstocks, manufacturing, distribution and maintenance of clean, high efficiency thermal energy combustion systems, along with fuel processing, production and delivery. Leading academic institutions in the region will provide cutting edge research and development for continuous improvement of technology. State and local governments will recognize and support the continued expansion of biomass thermal through favorable tax, regulatory and incentive policies. The northeast will be recognized as a global leader in the advancement of biomass thermal energy.



the imperative of Sustainable Supply

If sourced responsibly, biomass from forests, crops and clean waste streams can be sustainable, have a low-carbon footprint, protect sensitive ecosystems, and benefit local communities. Overall, we must ensure that biomass for thermal energy reduces carbon in the atmosphere. We must avoid converting the most mature forests to forest plantations harvested for energy. And, we must maintain healthy forests for water quality, soil productivity, wildlife habitat and bio-diversity.

the Benefits Economic, Social & Environmental Benefits of Achieving the Vision

- By 2025, the Northeast would have more than *$4.5 billion new dollars per year* injected into the regional economy
- This retention of wealth and expansion of the thermal biomass industry will result in a total of *140,200 permanent jobs*
- The conversion to biomass thermal will *displace over 1.14 billion gallons of oil annually* by 2025. This represents over 20% of all heating oil consumed in the Northeast.
- The use of biomass *greatly reduces mercury and acid rain causing sulfur emissions* as compared to the heating oil it can replace
- Replacing oil (a high carbon fuel) with biomass (a low carbon fuel) *reduces greenhouse gas emissions* that contribute to climate change
- Achieving the vision will result in the conversion of 1.39 million homes and businesses enabling the *retention of more than $1.6 billion in annual income in our economy* instead of exporting overseas
- The enhanced value of biomass will contribute to *healthy rural communities* through improved economics of forest and farm ownership

the **Strategy**

Strategies and Policies to Achieve the Vision

Action is needed at state, federal, and regional levels to catalyze real change in how we heat and cool our buildings. To meet its stated renewable energy goals and objectives, the government must address fossil fuel use in the thermal sector. By shifting to an outcome-driven approach, the government can level the playing field for all technologies and allow solutions to compete based on their outcome, not their energy source.

Core Objectives of Clean Energy Policy

- Efficiency
- Affordability
- Sustainability
- Security
- Clean Emissions
- Climate Change Mitigation

Effective Policy Frameworks

- Financing, taxes, grants, loans
- Carbon Policy
- Sustainability Measures
- Emissions Measures

Strategies to Achieve the Vision

- Research & Development
- High Efficiency & Ultra-Clean Emissions Technology
- Investment in Fuel Collection, Storage, Transportation, and Delivery Infrastructure
- Investment in pellet & chip manufacturing/refining
- Capturing and Utilizing Heat from Distributed Electric Power Generation
- Education & Promotion

a call to **Action**

What you can do to help make this happen

- ☐ **Contact BTEC to offer feedback, criticism and ideas to improve this Vision:**

  Biomass Thermal Energy Council (BTEC)
  1211 Connecticut Ave., NW, Suite 600
  Washington DC 20036
  Phone: (202) 596-3974
  Email: info@biomassthermal.org
  Web: BiomassThermal.org

- ☐ **Share the Vision document with anyone who may be interested. Invite their feedback.**
- ☐ **Raise these issues with your governor, state and federal officials, and state legislators.**
- ☐ **Join and financially support one or more of the organizations that have presented this Vision.**

Funding for this initiative was provided by the sponsors and attendees at the 2nd Annual Heating the Northeast with Renewable Biomass conference, held April 27th & 28th, 2010 in Manchester, NH. We gratefully acknowledge this support. www.HeatNE.com

want to learn **More?**

The full 40-page version of the Vision report is available online from www.BiomassThermal.org or www.HeatNE.com

this **Vision** *was developed and presented by*

Maine Pellet Fuels Association — www.mapfa.org

Pellet Fuels Institute — www.pelletheat.org

New York Biomass Energy Alliance — www.newyorkbiomass.org

BTEC Biomass Thermal Energy Council — www.biomassthermal.org

ALLIANCE FOR GREEN HEAT clean, renewable & local — www.forgreenheat.org

B. Wastewater

Current Loading Baseline and Program Capacity

Current nutrient loadings from wastewater discharges are shown on Table 5 above. Discharges from the 28 Bay-significant wastewater treatment plants are monitored, while loads from the non-significant plants and CSO's are estimated. A staged implementation approach will be used to reduce loads from the Bay-significant wastewater treatment plants, to allow for refinement of the waste load allocations in future phases of the WIP and TMDL revisions.

Bay-Significant wastewater treatment plants

- 28 facilities in New York (26 municipal, 2 industrial)

Discharges from the 28 Bay-significant wastewater treatment plants in New York State to waters tributary to Chesapeake Bay have not resulted in any impairment of the New York receiving waters. As described in the 2006 New York State Tributary Strategy for Chesapeake Bay Restoration, DEC has employed a logical, staged approach to address phosphorus and nitrogen discharges from the Bay-significant plants. First, the DEC fulfilled a fundamental information need by issuing State Pollutant Discharge Elimination System (SPDES) permit modifications in 2005/6 to add complete nutrient monitoring for all 28 of these Bay-significant facilities. Next the DEC began issuing SPDES permit modification in 2008 that included action levels requiring these facilities to maintain current nutrient removal performance, a schedule of compliance requiring the implementation of nutrient removal optimization with a goal of achieving discharge levels of 2.0 mg/l of phosphorus and 12 mg/l of nitrogen, if they are not already achieving lower concentrations. Finally, the permits required an engineering analysis of feasibility and costs of greater levels of treatment and implementation of treatment modifications that would improve nutrient removal without a major capital upgrade within 18 months. The intent of this approach is to gather reliable facility information, including costs, that will help DEC and the permit holders identify appropriate site specific remedies and priorities of subsequent capital investment in such significant infrastructure.

DEC has issued 24 of the 28 Bay-significant SPDES permits through this process. The remaining four are in the final stages of permit processing. One is at the regional office for final permit drafting and issuance, while the remaining three are undergoing water quality review before final processing. The planning and reporting process contained in the permits has also started to yield results. Nine Nutrient Removal Optimization and Engineering Feasibility Analysis Reports have been received and reviewed by DEC. They have given invaluable information to DEC on the WWTP's abilities to optimize their treatment levels and the costs involved in upgrading their facilities to remove various levels of nutrients.

In addition to biological treatment, some facilities are implementing innovations such as effluent reuse and discharge relocation. One municipal WWTP is currently implementing a natural wetland treatment demonstration project. Natural gas drilling companies are approaching municipal WWTP operators regarding the use of treated effluent for hydraulic fracturing. These and other innovations will result in a reduced nutrient loading to the Bay watershed.

The following is an example of the nutrient action levels and optimization/analysis compliance schedules in already issued permits (Stage 1):

CHESAPEAKE BAY ACTION LEVELS AND MONITORING

PARAMETER	MONITORING ACTION LEVEL			UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	LOCATION		FN
	12 MRA	Monthly Average	Daily Max.				Influent	Effluent	
Phosphorus, Total (as P)	varies	Monitor	Monitor	mg/l	varies	varies	X	X	3.4
Phosphorus, Total\ (as P)		Monitor	Monitor	lb/d			X	X	3,4
Nitrogen, Total (as N)		Monitor	Monitor	mg/l				X	3,4
Nitrogen, Total (as N)		Monitor	Monitor	lb/d		.		X	3,4

FOOTNOTES: \

(3) Action Levels apply as a 12 month rolling average (12 MRA)

(4) **Chesapeake Bay Nutrient Action Level Requirements** - Total Nitrogen and Total Phosphorus requirements are numerical action levels rather than effluent limits. Exceedance of these action levels does not constitute a permit limit violation. However, if one of these action levels is exceeded, then the permittee shall submit a written report which: summarizes the period during which the exceedance occurred; and, describes the cause, immediate corrective actions taken, and long-term corrective actions taken to minimize nutrient levels in the discharge. This report shall be submitted within 30 days of the date the action level is exceeded to the Chesapeake Bay Program Coordinator (NYSDEC, 625 Broadway, Albany, NY 12233-3502) and Regional Water Engineer. Please note that the typical Type I and Type II action level rules, described elsewhere in this permit, do not apply here. Total Nitrogen shall be calculated as the sum of Total Kjeldahl Nitrogen (TKN), nitrate and nitrite. In addition to these action levels, it is also possible to have effluent limits specified for one or more nutrients due to local water quality concerns.

SCHEDULE OF COMPLIANCE

a) The permittee shall comply with the following schedule:

Action Code	Outfall Number(s)	**Compliance Action**	Due Date

25099	001	The permittee shall submit an approvable engineering report which contains recommendations for improving nutrient removal without a major capital upgrade of the permittee's treatment process. The goal is to reduce effluent concentrations of total nitrogen to 12 mg/L or less and total phosphorus to 2.0 mg/L or less, or to achieve an equivalent reduction in the effluent mass load to the receiving water. The report shall address options, including but not limited to, chemical addition, biological or other process operational adjustments, waste stream reduction, pretreatment of industrial users, improved management of hauled waste receipts, and effluent re-use. The permittee shall also identify cost-effective strategies to achieve greater levels of treatment, considering a range of effluent nutrient concentrations from current conditions down to the equivalent of levels achievable using best available technology (BAT). BAT is defined as effluent concentrations of total nitrogen of 5 mg/L and total phosphorus of 0.5 mg/L. These conditions may include changes in plant process control and major capital construction. The necessary technologies and estimated costs shall be summarized. However, such capital upgrades will not be required at this time. Permittees may use findings from existing engineering evaluations or conduct their own evaluation. These recommendations to improve nutrient removal without a major capital upgrade shall be implemented as soon as practicable and no later than **EDP + 18 months**.	EDP + 6 months EDP + 18 months	

b) The permittee shall submit a written notice of compliance or non-compliance with each of the above schedule dates no later than 14 days following each elapsed date, unless conditions require more immediate notice as prescribed in 6 NYCRR Part 750-1.2(a) and 750-2. All such compliance or non-compliance notification shall be sent to the locations listed under the section of this permit entitled RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS. Each notice of non-compliance shall include the following information:

1. A short description of the non-compliance;

2. A description of any actions taken or proposed by the permittee to comply with the elapsed schedule requirements without further delay and to limit environmental impact associated with the non-compliance;

3. A description or any factors which tend to explain or mitigate the non-compliance; and

4. An estimate of the date the permittee will comply with the elapsed schedule requirement and an assessment of the probability that the permittee will meet the next scheduled requirement on time.

c) The permittee shall submit copies of any document required by the above schedule of compliance to NYSDEC Regional Water Engineer at the location listed under the section of this permit entitled RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS and to the Bureau of Water Permits, 625 Broadway, Albany, N.Y. 12233-3505, unless otherwise specified in this permit or in writing by the Department.

The WLA for significant wastewater treatment plants will be implemented in stages:

Stage 1: Enforce existing permits requiring treatment optimization and engineering evaluations until TMDL is revised in 2011

Stage 2: Issue SPDES permits with limits to achieve 2017 WLA

Stage 3: Issue SPDES permits with limits to achieve 2025 WLA

Overview

New York is proposing a gross aggregate Waste Load Allocation (WLA) as articulated in EPA's letter by William Early dated November 4, 2009. Although individual WLAs within the TMDL would facilitate the transparent development of nutrient discharge limits for each permittee, New York is not proposing individual WLA to be included in this version of the TMDL due to impending revisions to the TMDL. As indicated in the June 11, 2010 letter from EPA Region III Regional Administrator, Shawn Garvin, EPA expects the TMDL to be revised in 2011 and expects the States to include finer-scale load distributions in our Phase II Watershed Implementation Plans (WIPs) due November 1, 2011.

New York does not intend to reopen the watershed permits until after the TMDL is revised in 2011. Even though New York included individual discharger nutrient loads in model scenario runs, there has neither been adequate time nor complete information to adequately review individual treatment plant and discharge specifics to equitably sub-allocate among dischargers. New York dischargers are achieving significant load reductions through the Stage 1 optimization approach pursued since preparation of the Tributary Strategy. Given this, and expected modeling and TMDL changes, it makes sense to reopen these permits when these issues are resolved.

DEC will establish a targeted schedule for the necessary SPDES permit modifications so that high value projects are developed prior to 2017. DEC plans to analyze the information currently being gathered through the submission of the required engineering reports (assisted by CBRAP Grant) and TMDL public comments. Although most of the waste load would be reduced by 2017, some plants may need more extensive alterations, including change of process, which would require substantial rebuild and thus time is needed to secure funding.

New York will continue to work with SPDES permitees to develop an equitable sub-allocation approach to the WLA by which New York would recommend individual WLAs for the significant discharges in the revised TMDL in 2011. To maximize both local and Bay water quality benefits, New York would reserve the right to consider trading among the permitted discharges, to the extent allowed under the proposed TMDL (Appendix S) when establishing permit limits, and within permitted discharges, exchanges between individual phosphorus and nitrogen loads.

Phosphorus Improvement Program – Significant Facilities

Stage I: Required treatment optimization to achieve goal equivalent of 2.0 mg/l

- One municipality has already reduced its WWTP phosphorus input by not injecting phosphorus containing substances into its municipal water supply system for corrosion resistance

- Legislation in New York to limit the concentration of phosphorus in automatic dishwasher detergent. In addition to existing 1970s era legislation that essentially banned phosphorus in household cleaning products, this legislation was enacted on July 15, 2010 (http://open.New Yorksenate.gov/legislation/bill/S3780B)

- Additional staged implementation of phosphorus reduction treatment will be needed to reach interim (2017) WLA and overall New York allocation in 2025.

The following descriptions of Stage II (2017) and Stage III (2025) build upon Stage I described above.

Stage II: Achieve SPDES permit WLA for 2017 at Bay-significant WWTPs

In parallel with EPA's reopening of the TMDL in 2011, New York will submit a Phase II WIP intended to achieve 2017 Waste Load Allocations commensurate with the Strategy's overall reduction goals in an accelerated timeframe that will exceed an overall reduction of more than 60 percent of the reduction from 2009 to the 2025 total New York Allocation as shown on Table 5. The WLA for 2017 will exceed the goal by requiring 77% of phosphorus load reductions (refer to table 5). Discharge loads would be capped as 12-month rolling annual average, and even though the TMDL would have individual WLAs, New York will consider issuing permits in a "bubble[30]". As long as the total discharged load, equalized as delivered load, equals the total of the WLA for all permits, all permits would be in compliance. Individual permit limits would only be effective if the "bubble" was exceeded, or the compliance with an individual permit was necessary for local water quality conditions.

The reductions in annual phosphorus loads discharged from the 28 Bay-significant WWTPs would likely be achieved through treatment via chemical flocculation and/or filtration. Individual limits for each stage (2017 and 2025) may be based on consideration of potential growth thresholds and the individual plant's options for increasingly higher levels of treatment.

Stage III/: Achieve SPDES permit WLA at Bay-significant WWTPs

For comparison with other state WIPs, at permitted discharge (design flow) to achieve the total load limit, the average concentration would be equivalent to 0.5 mg/l of TP (equivalent to a "delivered" concentration of about 0.2 mg/l).

[30] New York has experience with this approach, specifically in the Long Island Sound TMDL. For more information http://www.dec.ny.gov/docs/water_pdf/tmdllis.pdf

DEC projects that the overall phosphorus WLA would address potential future phosphorus water quality criteria in New York, although some individual permits may have specific stream limits that would affect the sub allocation of the WLA.

DEC expects the permitees to meet 100% of these phosphorus reductions by 2025.

Nitrogen Improvement Program - Significant Facilities

Stage I:

- **Achieve equivalent of 60% performance improvement (Biologically Aerated Filter technology) at Binghamton-Johnson City WWTP**

This plant represents, on average, more than 30% of the total New York WWTP discharge flow. As prescribed in its SPDES permit, this facility is undergoing a 2-year treatability study to determine its final performance based effluent limit. Expectations are that the nitrogen concentration limit will be between 4 and 6 mg/l. Because this +/- $70million comprehensive upgrade was designed before the Bay Program intimated phosphorus removal expectations, its phosphorus limit will also be a function of measured BAF performance over the same two year treatability study period.

- **Achieve SPDES permit prescribed treatment optimization goal equivalent of 12.0 mg/l at other Bay-significant WWTPs**

Need additional staged implementation to reach interim (2017) and WLA and overall New York allocation in 2025. The following descriptions of Stage II (2017) and Stage III (2025) build upon Stage I described above.

Stage II: Achieve SPDES permit WLA for 2017 at Bay-significant WWTPs

Individual facility discharge load caps, as 12-month rolling annual average, will be put into SPDES permits, either in total or individually, as noted above for phosphorus.

The WLA for 2017 will achieve 85% of nitrogen reductions from WWTPs (refer to table 5).

Stage III: Achieve SPDES permit WLA at Bay-significant WWTPs

For comparison with other state WIPs, at permitted discharge (design flow), to achieve the total load limit, the average concentration would be equivalent to 7.4 mg/l of TN (equivalent to a "delivered" concentration of less than 4 mg/l).

A higher level of nitrogen removal treatment is not required because WWTPs contribute a smaller fraction of New York's nitrogen load (about 15 percent in 2009), making local investment in large capital and energy consuming treatment technology practices economically impractical. Further, nitrogen treatment systems are not as effective in colder climates.

USEPA R3 "everything everywhere by everybody" baseline definition that a discharge at 3.0 mg/l TN is universally applicable across the watershed does not consider the climatic differences which affect the ability to achieve this level of performance. Nitrification is reduced 25% for

every five degrees below 68°F, and effectively ceases at temperatures below 50°F. Average temperatures across the New York State portion of the Bay watershed average 50° or below for six months out of the year. As a result, achieving 3.0 mg/l N limit in New York State would require more advanced treatment at a higher cost, and may not result in a tangible benefit to the watershed. New York does not anticipate that any of the streams in its portion of the watershed will be considered nitrogen limited, so discharge permits would not be affected by the development of numeric nutrient standards.

DEC expects permitted dischargers to meet 100% of these nitrogen reductions by 2025.

Combined Sewer Overflows – 3 Systems

- Johnson City (SPDES No. NY0023981) and Binghamton (SPDES No. NY0024406)
    - Both completed Long Term Control Plans in October 31, 2002
    - The new Binghamton-Johnson City WWTP system currently exceeds the federal CSO policy requirements for primary treatment through the addition of capacity to treat 85% of the wet weather flow (approximately 60 MGD).
        - Average annual wastewater flow treated is about 20 MGD
        - Secondary treatment is required for all flow up to 50 MGD
        - Tertiary treatment is required for all flow up to 35 MGD
- Elmira– Chemung Co. SD
    - One district (SPDES No. 0036986) has eliminated its CSOs
    - The second district (SPDES No. NY0035742) has submitted its LTCP (currently under review)
    - The current LTCP provided a monitoring program of the CSO discharges to the Chemung River, as well as the river itself to determine if fecal coliform water quality standards were being met.
- DEC recommends that USEPA R3 apply its default interim value for CSO Waste Load Allocation based on its assessment of load and 85% reduction from the implementation of Long Term Control Plans for estimating the potential load from these permits for inclusion in the aggregate waste load allocation of the TMDL.

Bay-Nonsignificants (<400,000 gpd)

These nonsignificant facilities represent less than ***3 and 4*** per cent of the 2009 estimated wastewater load for nitrogen and phosphorus respectively. The Gross Waste Load Allocation includes sufficient estimated load to cover these small sources, subject to a transparent verification program. In model runs these insignificant facilities represent less than 8 and 11 per cent of the WLA for nitrogen and phosphorus respectively.

- Existing facilities <50,000 gpd:
    - Legislation limiting the phosphorus concentration in automatic dishwasher detergent will conservatively reduce effluent load by an estimated 10% from these facilities, many of which have simple treatment processes not amenable to additional phosphorus removal.
- Existing facilities between 50,000 gpd and 400,000gpd

- At present there are about 45 discharges with total permitted discharge volume of about 8 MGD
- New facilities at existing communities of Whitney Point and West Windsor have nitrogen and phosphorus limitations of 8 mg/l and 1 mg/l, respectively, which were corrective actions involving inadequate on-site systems so these and future projects should receive nitrogen reduction credit for the septic systems they replace

Accounting for Growth

The 28 Bay significant facilities generally have permitted design flow capacity to accommodate foreseeable growth. Most facilities have received relatively steady or slightly declining wastewater flows over the past several decades. Some of this is due to infiltration and inflow reduction. Some facilities have planned for increased flows from their existing or planned service areas. In stage 2 of the allocation process, when individual waste load allocations will be developed for each of the 28 Bay significant facilities, the capacity of each permit to accommodate growth may be considered. Once individual waste load allocations are promulgated in the revised TMDL, each permittee must stay within their annual nitrogen and phosphorus load limits, so any permitee which accepts additional wastewater flows will need to assess the impact on their ability to meet permitted loads. Growth in wastewater flow may need to be addressed by a higher degree of treatment or trading with other permittees, among other options.

Expansions in permitted flow will need to offset any additional loads. Offset credit would include elimination of septic discharges by connection to new or expanded WWTP, although the Chesapeake Bay model would calculate a credit for only nitrogen.

For new significant facilities (>400,000 gpd), permit nutrient limits will be 0.5 mg/l TP, 5.0 mg/l TN. Because of the general downward trend in population, such new large Bay-significant facilities are not expected to arise. New plants, if built, would likely take the place of older, less efficient facilities.

Offsets would need to be addressed in individual discharge permits. For point sources generating credits, the TMDL assumes that the offsets baseline is the WQBEL included in that discharger's permit consistent with the applicable WLA in the TMDL. New York would likely adjust the discharge limit of the offsetting permit to account for any increases in load due to new or expanded permit limits, such that the effective WLA of nutrients delivered to the Chesapeake Bay does not increase.

If offset is based on the accomplishment of nonpoint source nutrient reduction, DEC will first have to establish a rigorous process to ensure such offsets are verifiable and trackable in line with Appendix S of the proposed TMDL.

Gap Analysis

Non- significants

Currently, there is no program to monitor these discharges for nutrients. Inspection frequency is low for permits that are meeting existing discharge requirements. Staffing improvements are needed to fill this gap as noted in the following sections. Legislation limiting the phosphorus concentration in automatic dishwasher detergent will conservatively reduce effluent load by an estimated 10% from these facilities, many of which have simple treatment processes not amenable to additional phosphorus removal. Some of these dischargers may receive phosphorus limits in the future to meet yet to be developed and promulgated ambient nutrient criteria for streams. Because of the relatively small loads from these facilities in terms of Chesapeake Bay loadings, it is not considered generally cost-effective to initiate permit limits for nutrients that would require treatment upgrades.

Commitment and Strategy to Fill Gaps

NYSDEC will develop a transparent verification program to:

- Provide a list of all non-significant dischargers and their permit dates.
- Establish a monitoring program or add monitoring requirements when their permits come up for renewal to quantify that the load from these facilities is within estimated portion of the WLA attributed to these non-significant discharges.
- Specially designate all discharge permits in Susquehanna and Chemung drainage basins by adding CBW categorization on the SPDES permit identification page so they are clearly marked and easily tracked as belonging to Chesapeake Bay TMDL as was previously done successfully for NYC watershed facilities.

Tracking and Reporting Protocols

Bay-Significant wastewater treatment plants

The 28 Bay-significant WWTP's will be assigned nutrient loads on a 12 Month Rolling Average Basis, however, they will be reporting the results of their monitoring to DEC on a monthly basis. By having the annual limit renew on a monthly basis by using a rolling average, compliance can be ascertained every month. These monthly values will be entered into the DEC's compliance system for proper tracking of compliance and violations. Violations will be quickly referred for appropriate action.

Combined Sewer Overflows – 3 Systems

The three CSO facilities have Long Term Control Plans that require annual reporting. They will report everything from the conditions at the WWTP's, the CSO, the amount and quality of stormwater discharged from the facility and the CSO's. Also, the reports may be able to report the level of pollutants that were prevented from being discharged due to proper operation and maintenance of the facility and the CSO's.

Bay-Nonsignificants (<400,000 gpd)

NYSDEC will develop a transparent verification program to quantify the annual load from all non-significant dischargers based on tracking of annual discharges and results from the established monitoring program.

Contingencies for Slow or Incomplete Implementation

Because permits limits are enforceable, established enforcement protocols would be followed. A separate description follows regarding compliance actions for all source sectors.

C.Urban Runoff

Current Loading Baseline and Program Capacity

Urban landuse is about 3% of the watershed land use and delivered approximately 6%, 93% and 16%, respectively, of the total nitrogen, phosphorus and sediment loads from New York in 2009.

All of the urban best management practices implementation levels are based on an assessment of the past three years of documented implementation from the applicable notice of intent databases for both the construction stormwater and MS4 permits.

To implement the federal phase II stormwater law, the DEC has developed two general permits, one for MS4s in urbanized areas and one for construction activities. The permits are part of the State Pollutant Discharge Elimination System (SPDES) program. Operators of regulated MS4s and operators of construction activities must obtain permit coverage under either an individual SPDES permit or one of the general permits.

To help localities comply with state and federal stormwater management requirements, in 2004, the DEC issued the Stormwater Management Guidance Manual for Local Officials. This manual addresses developing and implementing local stormwater management programs, and minimum measures 4 and 5 under the federal stormwater management program. The manual has been distributed to local governments in print format, with a compact disk that provides associated technical and permit documentation. This Guidance Manual contains information useful to local officials involved in stormwater management, whether in a regulated MS4 or in a community or institution that is not subject to the state/federal stormwater management rules.

Municipal Separate Storm Sewer Systems

Discharges from Municipal Separate Storm Sewer Systems (MS4s) in Urbanized or Additionally Designated Areas must be authorized in accordance with a permit for stormwater discharges from MS4s. The most recent MS4 permit is SPDES General Permit, GP-0-10-002, http://www.dec.ny.gov/docs/water_pdf/ms4gp2010.pdf. This permit was issued April 1, 2010, was effective on May 1, 2010, and contains the bulk EPA recommended actions. The DEC requirements for regulated small MS4s are included in this document.

The following forms are needed to comply with the requirements of the General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems GP-0-10-002:

- Notice of Intent to obtain coverage under the Municipal Separate Storm Sewer Systems General Construction Stormwater Permit - May 2010
- MS4 Stormwater Pollution Prevention Plan Acceptance Form Certification dated January, 2010.
    - This form is used by a regulated, traditional land use control Municipal Separate Storm Sewer System (MS4) (e.g. town, city or village) to indicate acceptance of a SWPPP it has reviewed.
- MS4 Municipal Compliance Certification and Annual Report Form for MS4s implementing their SWMP dated March, 2010.

Instructions for Completing the Municipal Compliance Certification Form and MS4 Annual Report for 2009-2010, including;

- Evaluations of progress toward measurable goals
- Description of measurable goals accomplished
- Observations of overall effectiveness of measurable goals
- Monitoring data
- Future planned activities

DEC has a comprehensive enforceable program in place for covered areas. Highlights are:

- Only 3% of land area in New York Chesapeake watershed is urban/suburban
- 2 relatively small urbanized areas (Binghamton, Elmira), 26 municipalities
    - The 26 municipalities are small Phase II MS4s
        - Additional Phase II MS4 designations (based on 2010 census) may expand the existing Elmira urban area by including the City of Corning and other neighboring municipal areas, roughly doubling in size the current Elmira urban area.
- The 2010 MS4 permit exceeds federal minimums
    - Permit coverage (construction and post-construction controls) extends beyond urbanized areas to municipal boundaries[31]
    - Prescriptive requirements for compliance with the New York State Stormwater Management Design Manual (the Design Manual), including rigorous green infrastructure requirements.
- Post construction controls are required to be designed by a professional engineer (developer) and reviewed by a professional engineer (MS4 permittee)
- Statewide over 2,000 municipal staff were trained to perform construction site inspections
- DEC evaluates progress through review of annual reports and site audits
    - Statewide DEC took six formal enforcement actions regarding MS4 permits in the last quarter of 2009 state fiscal year (from Jan 1 to April 31, 2010)

[31] USEPA R3 model may not reflect current and future MS4 boundaries.

    - The frequency of inspections and subsequent follow-up actions will increase under the pending Chesapeake Bay Regulatory and Accountability Program grant to New York.
- Current estimate of monthly mechanical street sweeping by MS4s is 700,000 feet. DEC expects this will ramp up to 2,000,000 feet monthly.

Construction Stormwater

According to the USEPA R3 watershed model about 0.3 % of land in this part of New York is disturbed by construction activity.

Before commencing construction activity, the owner or operator of a construction project that will involve soil disturbance of one or more acres must obtain coverage under the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001). This permit is available at: http://www.dec.ny.gov/chemical/43133.html). This permit was issued in January 2010, and was effective on January 29, 2010. DEC requirements for construction activities are included in this document.

Owner/operators with projects covered under the SPDES General Permit for Stormwater Discharges from Construction Activity are required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) that meets criteria set forth by New York State DEC. All SWPPPs must include practices consistent with the New York Standards and Specifications for Erosion and Sediment Control. Many construction sites must also comply with the New York State Stormwater Management Design Manual to control post-construction stormwater discharges.

The DEC Stormwater Toolbox provides links to sources of technical information needed to comply with the requirements of the Construction Permit and references that are useful for the design of stormwater management practices. Although it is primarily intended as a resource for consultants and other design professionals, it may also be helpful to local officials and others involved with stormwater management. Among those points of interest to stakeholders, is the Construction Notice of Intent (NOI) Database, which includes information provided to the Department in NOIs submitted to obtain coverage under the Construction Permit.

The Stormwater toolbox includes:

- **New York Standards and Specifications for Erosion and Sediment Controls** (2005): "The Blue Book" provides standards and specification for selection, design and implementation of erosion and sediment control practices, including Engineering Schematics for Erosion and Sediment Controls.
- **New York State Stormwater Management Design Manual** (August, 2010): Provides standards and specifications for selection and design of stormwater management practices to comply with State stormwater management performance standards. The 2010 updates include planning and design based on Green Infrastructure principles.
- **New York State Verified Proprietary Stormwater Management Practices**: Provides proprietary stormwater management practices that meet the performance criteria in the NYS Stormwater Management Design Manual

- **Construction Stormwater Inspection Manual**: This manual is for use of state or municipal construction inspectors in performing compliance inspections, as well as for site operators in performing self-inspections. An inspection form, used by MS4s to document inspections of constructions sites is included in the manual.
- **Better Site Design** - April 17, 2008: This document provides guidance to developers and designers to plan for and implement environmentally sound designs for new development and redevelopment projects while reducing the effects of stormwater runoff through both regulatory and non-regulatory techniques.
- **Deep-Ripping and Decompaction:** The two phase practice of 1) Deep Ripping and 2) Decompaction (deep subsoiling) of the soil material as a step in the cleanup and restoration/landscaping of a construction site, helps mitigate the physically induced impacts of soil compression (i.e. soil compaction or the substantial increase in the bulk density of the soil material.)

The following forms are needed to comply with the requirements of the General Permit for Stormwater Discharges from Construction Activity - GP-0-10-001:

- Notice of Intent - is a request for coverage under the General Construction Stormwater Permit.
    - The Instruction Manual for completing the Notice of Intent is found in the Construction Toolbox, http://www.dec.ny.gov/chemical/8694.html
- Notice of Termination for Construction Activities dated January, 2010
    - When a construction project is complete and has met the requirements of the construction permit, a Notice of Termination (NOT) form should be completed and submitted to the Department.
- MS4 SWPPP Acceptance Form dated January, 2010
    - This form is used by a regulated, traditional land use control Municipal Separate Storm Sewer System (MS4) (e.g. town, city or village) to indicate acceptance of a SWPPP it has reviewed.

New York State has adopted a program that is more comprehensive than the national minimum. Unlike EPA's national program New York requires a full suite of post-construction water quality and quantity controls on any site over 1 acre, with few exceptions[32]. Highlights are:

- Historically New York State has exceeded the federal minimum Construction Stormwater Permit requirements by including post-construction controls to address both water quality (nutrients) and quantity for both development and redevelopment projects
    - Quality performance standard is 80% removal of total suspended solids and 40% removal of total phosphorus

[32]Construction activities that require stormwater pollution prevention plans that only include erosion and sediment controls include soil disturbances of one (1) or more acres of land, but less than five (5) acres for: 1) Single family home not located in one of the watersheds listed in Appendix C and not directly discharging to one of the 303(d) segments listed in Appendix E, 2) Single family residential subdivisions with 25% or less impervious cover at total site build-out and not located in one of the watersheds listed in Appendix C and not directly discharging to one of the 303(d) segments listed in Appendix E, and 3) Construction of a barn or other agricultural building, silo, stock yard or pen.

    - For quantity, stream channel protection, overbank flood control and extreme flood control criteria are applied
- In 2010, New York State further exceeds the federal minimum Construction Stormwater Permit requirements by:
    - Adding rigorous green infrastructure requirements
    - Issuance of a fully updated, state-of-the-art technical design manual
- Requires conformance with detailed design, construction, operation and maintenance, and performance standards of specific control practices that address both water quality and quantity impacts
- Requires inspections by qualified professionals

New York evaluates and verifies post construction implementation from its statewide database of Notice's of Intent submitted for coverage under the DEC SPDES General Permit for Stormwater Discharges from Construction Activity.

A DEC SPDES Compliance Summary Report shows that of approximately 6,800 NOI's statewide received in 2009 state fiscal year (April 1 to April 1), DEC conducted about 500 inspections and that about 100 of these were deemed unsatisfactory. Statewide DEC took 47 formal enforcement actions regarding construction permits in the 2009 state fiscal year. In addition, DEC's environmental conservation officers conducted another 800 inspections during the summer of 2009, leading to another 40 enforcement actions. The frequency of inspections and subsequent follow-up actions will increase in the Susquehanna region under the pending Chesapeake Bay Regulatory and Accountability Program grant to New York.

Requirements for Well Drilling Activities: On April 1, 2010 DEC issued SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001) - Requirements for Well Drilling Activities. These requirements apply to well drilling activities that are consistent with the 1992 Generic Environmental Impact Statement (1992 GEIS) for oil and gas well drilling.

DEC is requiring Construction Stormwater General Permit Coverage for Article 23 Drilling Activities (non-high volume hydraulic fractured wells) that are not covered by the Multi-Sector General Permit. Generally, this means that well activities requiring an Article 23 well drilling permit which disturbs one or more acres of land must also obtain coverage under the DEC General Permit for Stormwater Discharges associated with Construction Activity.

Residential Fertilizer Use

Legislation was signed into New York law on July 15, 2010[33], to limit the use residential fertilizer containing phosphorus. This legislation holds promise to reduce phosphorus in urban runoff.

A new Environmental Conservation Law §17-2103 will prohibit the application of phosphorus fertilizer on lawn or non-agricultural turf, except when: (1) a soil test demonstrates that additional phosphorus is needed for lawn or non-agricultural turf growth, or (2) new lawn or non-agricultural turf is being established. A new ECL § 17-2103 requires retail stores to comply with the requirements of Agriculture and Markets Law § 146-g related to the display of

[33] http://open.nysenate.gov/legislation/bill/S3780B

phosphorus fertilizer and the posting of educational signs. It would also prohibit the application of fertilizer on lawn or non-agricultural turf: between December first and April first; on impervious surfaces; and within twenty feet of surface water except where there is a continuous vegetative buffer of at least ten feet from the water body, and except that, where a spreader guard, deflector shield or drop spreader is used, the application would be prohibited within three feet of a New York surface water. This new Title 21 will not impair or supersede the authority of the Commissioner of Agriculture and Markets under Articles 10 and 25-AA of the AML. ECL §17-2105 will allow local governments to adopt more stringent standards for non-agricultural fertilizer applications after demonstrating to the Department that such action is necessary to address local water quality conditions.

Section 4 of this bill will add a new ECL § 17-1945 to provide for the enforcement of Title 21 of Article 17. This new section will provide that a New York owner, owner's agent or occupant of a household who violates a New York provision of Title 21 would receive a written warning and educational materials for a first violation, be liable for a civil penalty not to exceed $100 for a second violation, and be liable for a civil penalty not to exceed $250 for third and subsequent violations. A New York other person who violates a New York provision of Title 21 would be liable for a civil penalty not to exceed $500 for a first violation, and not to exceed $1,000 for each subsequent violation.

Section 6 of this bill will add a new section AML § 146-g to require retail stores that sell or offer to sell to consumers specialty fertilizer in which the available phosphate content is greater than 0.67 percent to display such fertilizer separately from non-phosphorus specialty fertilizer, and to post a sign in the location where phosphorus-containing specialty fertilizer is displayed stating that phosphorus runoff poses a threat to water quality, and therefore phosphorus-containing fertilizer may only be applied to lawn or non-agricultural turf when a soil test indicates a phosphorus deficiency or new lawn or non-agricultural turf is being established

New York Stormwater Program Timeline

Minimum Resource Commitment for Phase I Implementation (1988 to 2000). From 1988 to 2000, the NYSDEC implemented Phase I Stormwater Requirements through the SPDES program for Large MS4s, Large Construction Sites and Industrial Sites with a commitment of one to three Full Time Equivalents (FTEs – the amount of work time all staff spend working in a particular program area that when added together is equivalent to a full work year's worth of work). Although the focus was shifting during this period, the focus of NYSDEC SPDES programs continued to be controlling toxic discharges through the pretreatment program and traditional SPDES permits for industrial facilities, and municipal discharges, including combined sewer overflows.

Architects of Transition to Phase II Added Multi-Prong Commitment. The architects of NYSDEC's Phase II stormwater program sought to use the program to address impairments blamed on what has traditionally been considered non-point sources, but are increasingly being treated as point source discharges requiring point source (N/SPDES) permits. The total staff commitment (in full time equivalents) rose to near 30 statewide and those resources were and are

being leveraged through technical standards, creative program requirements, teamwork, partnerships, and strategically funded programs.

Program enhancements added in Phase II of New York's stormwater program:

- Technical Standards
- Permits based on EPA Models, with Key Provisions added
- Owner self-inspection of sites by CPESC or PE
- Additional Designation for MS4s
- Teamwork
- Partnership
- Funding
- Robust Inspection, SWPPP review, and compliance presence
- Teaching Developers, Design Professionals, Municipal Officials, Construction Inspectors through SU, then ESF
- MS4 Annual Reports
- Public involvement through Annual Reports
- Review process – 5 days for compliance with technical standards, 60 business days (~84 calendar days) for compliance 'equivalent' projects

New York State also made mid-course improvements in its Phase II program, including:

- Longer NOI including design details
- Redevelopment Chapter
- Enhanced Phosphorus Removal Chapter
- Stormwater Management Guidance Manual for Local Officials, including example law
- Illicit Discharge Detection and Elimination Assistance Document, including example law
- MM6 Guidance

Technical Standards

The NYSDEC has done an excellent job developing standards for construction stormwater discharges. First, the NYSDEC anticipated not having a national standard to base its work upon and hired a national expert, the Center for Watershed Protection, to develop a post construction standard for New York State well before the deadline for implementation of phase II stormwater requirements. Second, in accordance with the recommendations from the Center for Watershed Protection, the NYSDEC chose to set post construction standards based on implementation of best management practices that achieve a minimum level of treatment (the Design Manual). The NYSDEC chose these practices to be, when implemented in accordance with sufficient planning, cost effective treatment as well as easily integrated into construction projects. The NYSDEC also hired another expert in the field, Don Lake, to develop standards that apply during construction based on practices that have been shown to be effective in New York State (The New York Standards and Specifications for Erosion and Sediment Control, hereinafter called the Blue Book). It is these standards that the NYSDEC relies on to control discharges of stormwater from construction activities. Development and maintenance of the standards is not, however, free. The contract for development of the original Design Manual cost $98,664. The contract for development of the Blue Book cost $47,640. The Design Manual requirements raised questions that were addressed under a separate contract with the Center for Watershed Protection

for $55,900. The Design Manual was further updated to include an Enhanced Phosphorus Removal Chapter under a contract with Geosyntec for $75,000. The general permits section has also, historically, dedicated one staff member to construction stormwater standards development and maintenance. That staff member has developed into a nationally recognized expert in stormwater management practices, as an active member of the American Society of Civil Engineers subcommittee on Stormwater Best Management Practices (BMP) Evaluation. The general permits section receives daily inquiries on standards implementation, frequently consuming the whole day for the staff member responsible for construction stormwater standards and other members of the section.

Permits based on EPA Models, with Key Provisions added

Although the basic structure of New York's Phase II MS4 and Construction General Permits was based on EPA model permits, the original architects of New York's Phase II stormwater program added key provisions that exponentially improved the effectiveness of New York's program when compared to the EPA base program. The most important of those additions are the robust foundation and connection with technical standards as noted above. Additionally, New York added:

- **Owner self-inspection of sites by CPESC or PE.** Requirements in the Construction Permit for sites to be inspected weekly by the owner, using 'Qualified Inspectors', where qualified inspectors include Certified Professionals in Erosion and Sediment Control (CPESCs) and Professional Engineers. This requirement provides a backstop of a third party stormwater professional on-site, preparing reports that are reviewed by NYSDEC inspectors when NYSDEC inspectors visit a construction site.

- Authority under the Construction Permit to stop work at non-compliant sites through a 'Stop Work Order'. This has been an extraordinarily useful tool for regional staff to assure responsive corrections to site non-compliance.

- Longer review times under the Construction Permit for sites in Total Maximum Daily Load (TMDL) watersheds, for sites discharging directly to impaired waters without TMDLS (303(d) waters), and for sites not using the Blue Book or Design Manual for SWPPP development.

- **Additional Designation for MS4s.** Additional Designation Criteria for areas where MS4s are required to have MS4 SPDES permits beyond urbanized areas (Additionally designated Areas). The Additional Designation Criteria issued on 2003 added MS4 permit coverage requirements to areas of Eastern Long Island and extended permit coverage requirements to the entire New York City, East of Hudson, Drinking Water Watershed.

- Requirements for Public Review of MS4 Annual Reports. This requirement allows interested parties input to the MS4 stormwater program development and implementation process.

Teamwork
Implementation of NYSDECs Phase II stormwater program was also marked by establishment of the Stormwater Implementation Team (SWIT). The SWIT was and is lead by co-leaders, one from NYSDEC central office staff and one from an NYSDEC regional office. The SWIT collaborates in development of requirements and guidance for stormwater program implementation and coordinates training, inspection, and review activities. Team communication is through the team leaders and is punctuated by periodic SWIT conference calls to discuss implementation issues. The structure is more collaborative than traditional top down program implementation models and has been duplicated in other programs such as the CAFO program.

Partnership
Through funding and shared goals and responsibilities, the architects of the Phase II stormwater program also inculcated the principal of partnership into program implementation. The most salient examples of that partnership are those that the program has with Soil and Water Conservation Districts (SWCDs) through the State Committee and the Department of Agriculture and Markets and the partnerships with Regional Planning Councils through the New York State Association of Regional Councils (NYSARC). SWCDs and NYSARC are conduits for information and services to the regulated communities (developers, designers and municipal officials and staff) and interested parties as well as conduits for feedback from those groups.

Funding
Two salient areas of funding provided and provide support to stormwater programs. One is the non-agricultural non-point source grants provided through the Division of Water's Water Quality Improvement Projects (WQIP) grant program (see http://www.dec.ny.gov/pubs/4774.html for more information on WQIP). Under this program, more than twelve million dollars has been committed to MS4s to assist in MS4 program development. Through a Memorandum of Understanding with the NYS Department of Agriculture and Markets, NYSDEC has provided significant funding to Soil and Water Conservation Districts for training, plan review and site visits and to Syracuse University and the State University of New York – Environmental Science and Forestry for training and development.

Robust Inspection, SWPPP Review, Compliance Presence
The four FTEs staff involvement in stormwater programs in the NYSDEC Central Office has been complemented by 20 to 25 FTE staff involvement in regional offices. Coordinated by the SWIT, this has resulted in, at times, one sixth of the SWPPPs being reviewed by NYSDEC staff and one sixth of active construction sites being inspected. These commitments are shifting as construction stormwater oversight is shifting to MS4s and NYSDEC staff become more committed to auditing MS4s.

Teaching Developers, Design Professionals, Municipal Staff and Officials, and Construction Inspectors
Since the inception of the Phase II stormwater program, New York has also invested substantial resources in stormwater training through NYSDEC staff; Syracuse University; The State University of New York, College of Environmental Science and Forestry; Soil and Water Conservation Districts; Regional Councils; Cornell Cooperative Extension; New York State

Department of State, New York State Department of Transportation, Cornell Cooperative Extension, and other agencies
The training targeted Developers, Design Professionals, Municipal Officials, Construction Inspectors. In a typical year, over 3000 training days were provided to the broad audience of stormwater parties. Design professionals and professionals that review SWPPPs have been receiving between 500 and 1000 training days per typical year.

Mid-Course Improvements in the Phase II Program

Longer Construction Notice of Intent Including Design Details
At the inception of the stormwater phase II program, the Notice of Intent (NOI) for authorization under the construction permit did not require particular design information, relying instead upon a simple question of whether the project meets the technical standards. What NYSDEC staff discovered is that many applicants tended to check the box that said they meet technical standards without confirming the details of that assertion. To better assure projects were actually meeting technical standards, the form was modified to require the applicant to summarize the practices employed for during and post construction activities, as well as the sizing of the post construction practices. That information is now available in the NYSDEC NOI database for all projects authorized since 2004.

Redevelopment Chapter
The original Design Manual did not distinguish between Greenfield projects and Redevelopment projects. In recognition of the unique opportunity that Redevelopment projects provide for reductions in pollutant loadings, as well as the challenges of designing practices for retrofits, the NYSDEC technology expert developed standards for Redevelopment projects. This chapter provided appropriate minimum standards for redevelopment as well as significantly reducing the number of Redevelopment projects that are submitted that deviate from the State's technical standards.

Enhanced Phosphorus Removal Chapter
In the New York City Watershed, the New York City Department of Environmental Protection (NYCDEP) was applying a standard under watershed protection rules for enhanced phosphorus removal that was technically in conflict with the Design Manual. To correct this conflict, NYSDEC's technology expert developed, with the support of the nationally recognized stormwater experts at Geosyntec, an enhanced phosphorus removal chapter for the Design Manual. This chapter required different sizing criteria (capture and treat the one year storm instead of the 90th percentile storm) as well as some qualitative design improvements and consideration of Green Infrastructure as a practice. This chapter is now the unified requirement of both the NYSDEC construction permit and the NYCDEP watershed protection rules.

Stormwater Management Guidance Manual for Local Officials, including sample law
NYSDEC developed a guidance manual for Implementation of Minimum Measures 4 (Construction) and 5 (Post Construction). The guidance manual included a sample law that requires developers to comply with the Design Manual and the Blue Book. The sample law also includes stop work order provisions for MS4s to use with non-compliant construction sites.

Illicit Discharge Detection and Elimination Assistance Document, including model law

NYSDEC developed and assistance manual for IDDE, including a model law. The assistance document includes significant technical details about outfall, sewershed and sewer system mapping.

Municipal Pollution Prevention and Good Housekeeping Assistance Document
NYSDEC developed document that provides local officials including examples of programs for eight basic program areas.

2008/2010 Permit Renewal Adjustments

In 2008, following the first five years of stormwater program implementation, the NYSDEC renewed the Construction General Permit and the MS4 General Permit. In 2008, the Design Manual was also updated to include an Enhanced Phosphorus Removal Chapter (Chapter 10).

Prescriptive Requirements for MS4s
In the first permit term for Phase II stormwater requirements, the MS4 permit included some requirements that all MS4s would be required to meet (Required BMPs) and a menu of other BMPs that an MS4 could choose to implement (Optional BMPs). This structure followed closely the EPA model for MS4 program implementation. In the first five years of program implementation, NYSDEC frequently encountered MS4s resistant to implementing optional BMPs that were essential to effective stormwater control. In addition, the Ninth Circuit Court rejected the EPA permit that was heavily reliant on BMPs proposed by the permittee. To address the issues that surfaced during the first five years of program implementation, as well as the concerns highlighted by the Ninth Circuit Court decision, NYSDEC issued an MS4 permit with Required BMPs that ensure effective program implementation and Optional BMPs to allow for each MS4 to tailor their program to fit their unique needs. The prescriptive BMPs in New York's MS4 permit are:

- MS4s must make annual reports and Stormwater Management Program (SWMP) Plans available for public review. When a Watershed Improvement Strategy is developed, it would be part of the SWMP plan and thus would be available for public review. of the WIS then, in addition to public comment on the guidance document for MS4s to draft their WIS from
- MS4s must utilize the NYSDEC model Illicit Discharge Detection and Elimination law or equivalent.
- Consistent with the EPA IDDE Manual, MS4s must perform an Outfall Reconnaissance Inventory on all outfalls over the course of five years (approximately 20 % per year).
- MS4s must eliminate illicit discharges.
- MS4s must utilize one of the NYSDEC sample construction laws.
- MS4s must review all SWPPPs.
- MS4s must utilize the Design Manual and Blue Book or equivalent.
- Post construction controls that involve engineering must be reviewed by Professional Engineers.
- MS4s must certify all construction NOIs prior to submittal of the NOI to NYSDEC.
- MS4s must inspect all construction sites.
- MS4s must ensure ongoing maintenance of post construction controls.

- MS4s must perform municipal audits of Good Housekeeping and Pollution Prevention Practices every three years.
- MS4s must report explicit information for each minimum control measure to NYSDEC annually.

Enhanced Requirements for Reasonable Potential Areas
For areas where NYSDEC has determined stormwater discharges are a significant portion of the loading to waters with the reasonable potential to violate water quality standards. NYSDEC has included enhanced requirements for MS4s. Those requirements depend on the nature and degree of pollutant contributions for a particular watershed that must meet the enhance requirements. The types of enhanced requirments include septic inspections, small construction project review (5000 sq ft to one acre), enhanced treatment, retrofits, pet waste programs, goose population management, sewer system mapping, catch basin cleaning and enhanced public education programs.

Public review of MS4 NOIs
NYSDEC has provided for public review of MS4 NOIs.

Revised Annual Report Format
NYSDEC has modified the annual report format to include the data elements in EPA's report format, as well as data required to determine compliance with New York's MS4 permit.

Unprecedented Public Review Process
In response to public interest in both stormwater permits and the Design Manual, the NYSDEC renewed the Construction General Permit and MS4 General Permit for two years instead of five and embarked on an unprecedented and demanding two year permit review process. Twelve monthly public meetings were held where parties that commented on the 2008 permit drafts were invited to provide input to development of renewal permits and changes to the Design Manual. Nine of the public meetings were dedicated to discussions about: Better Site Design, Low Impact Development, Green Infrastructure; Inter-municipal agreements; Retrofit Requirements; Public Participation; Numeric Effluent Limits; MS4 Funding; Steep Slopes; Other Impaired Waters Issues; Revisit Retrofits, TMDLs and Effluent Limitation Guidelines. The final three meetings were dedicated to review of proposed additions to the Design Manual, the draft renewal Construction permit and the draft renewal MS4 permit.

From the two year review process, the NYSDEC proposed a revised Design Manual, and draft Construction General Permit and MS4 General Permit for renewal. Those documents were public noticed in the Environmental Notice Bulletin on October 28, 2009. Each of the draft documents were reviewed at five public meetings in Rochester, Albany, Stony Brook, Carmel, and Syracuse, conducted during the public comment period.

Determining Equivalence for Stormwater Practices
NYSDEC's SPDES General Permit for Discharges of Stormwater from Construction Activities (Construction General Permit) each authorized project is required to have prepared a Stormwater Pollution Prevention Plan (SWPPP) as a condition of authorization, prior to submitting a Notice of Intent (NOI).

The Construction General permit includes requirements for SWPPPs as follows:

- Throughout New York State (not just in regulated MS4 areas) construction sites must comply with the New York State Standards and Specifications for Erosion and Sediment Control (the Blue Book) during construction or show the erosion and sediment control practices to be equivalent to Blue Book practices. The Blue Book is a comprehensive Erosion and Sediment Control Manual available for review at: http://www.dec.ny.gov/chemical/29066.html

- Throughout New York State (not just in regulated MS4 areas), post construction stormwater management practices must be designed in accordance with the Design Manual or the practices must be shown to be equivalent to practices from the Design Manual. The Design Manual is a comprehensive Design Manual that was originally prepared by for the Department by the Center for Watershed Protection and finalized in 2001. The Design Manual has been updated in 2003 (technical corrections), 2006 (addressing redevelopment), 2008 (adding an Enhanced Phosphorus Removal Chapter), and 2010 (adding Green Infrastructure requirements). The Design Manual is available for review at: http://www.dec.ny.gov/chemical/29072.html

- All post construction practices must be designed by a "qualified professional" (almost exclusively Professional Engineers). That engineer must sign the Notice of Intent (NOI) certifying the project meets all permit requirements, making the engineer liable for projects not designed in conformance with the Manual.

NOI Review – All Post Construction Practices Meet Sizing Criteria and all NOIs are Reviewed

- All post construction practices must meet defined sizing criteria; there is no allowance for "equivalence" for sizing of practices. Development projects must capture and treat the ninetieth percentile storm (as determined by simple method calculation) or manage the 95th percentile storm on site (as determined by continuous simulation). Redevelopment projects are allowed a menu of sizing alternatives as set forth in Chapter 9 of the Design Manual.

- All projects authorized under the construction general permit must submit a complete NOI providing the basic design information for post construction practices including: Land use before and after construction, total site acreage, acreage to be disturbed, existing and future impervious area, percentage of each Hydrologic Soil Group (HSG) at the site, practices to be employed during construction, post construction practices to be employed, required sizing and design sizing. The design information provides for an abridged review of the SWPPP. Every NOI is reviewed by NYSDEC staff. To be complete, all NOIs must demonstrate compliance with required sizing criteria. The NOI form is available for review at: http://www.dec.ny.gov/docs/water_pdf/noipgr10.pdf

Review of SWPPPs outside of regulated MS4 areas

- If the project is outside of a regulated MS4 area, and the project complies with the New York's Technical Standards (the Design Manual and the Blue Book), the project is

authorized five business days after NYSDEC receives a complete Construction General Permit NOI.

- If the project is outside of a regulated MS4 area, and the project does not comply with New York's Technical Standards, the project is authorized 60 business days (~84 calendar days) after NYSDEC receipt of a complete NOI. The longer review period gives the NYSDEC more time to perform a detailed review of the SWPPP. In addition, NYSDEC may suspend the review period to ask for more information. The longer review period and uncertainty of final acceptance of the project by NYSDEC combined with the comprehensive nature of the Design Manual strongly influences projects to comply with all the requirements of the Design Manual. The following summarizes the numbers of projects that used stormwater management practices not included in the Design Manual:

CHESAPEAKE BAY CONSTRUCTION STORMWATER AUTHORIZATIONS
(as of 11/18/10)

YEAR	TOTAL	*NEED FULL SWPPP	*DESIGN MANUAL	*NON – DESIGN MANUAL	PERCENT NON-DESIGN MANUAL
2007	419	279	240	39	13.9
2008	392	261	223	38	14.5
2009	282	178	166	12	6.7
2010	322	202	184	18	8.9
TOTAL	1,415	920	813	107	13.1

When broken down to show the numbers of projects reviewed by MS4s:

All projects:

YEAR	TOTAL	*NEED FULL SWPPP	*DESIGN MANUAL	*NON-DESIGN MANUAL	PERCENT NON-DESIGN MANUAL
4/1/09 – 3/31/10	316	202	184	18	9.7

Only in regulated MS4 areas:

YEAR	*WITHIN MS4	*NEED FULL SWPPP	*DESIGN MANUAL	*NON-DESIGN MANUAL	*PERCENT NON-DESIGN MANUAL
4/1/09 – 3/31/10	64	47	45	2	4.4

Counties: Allegany, Broome, Chemung, Chenango, Cortland, Delaware, Herkimer, Livingston, Madison, Oneida, Onondaga, Ontario, Otsego, Schoharie, Schuyler, Steuben, Tioga, Tompkins & Yates

Review of SWPPPs by MS4s

- Under the MS4 permit, Traditional Land Use Control (cities, towns and villages) MS4s are required to enact a law, equivalent to the New York State Sample Law, available for review at: http://www.dec.ny.gov/docs/water_pdf/localaw06.pdf. The sample law requires compliance with the Blue Book (during construction) and the Design Manual for post construction practices. MS4s may also include more stringent requirements. The MS4 permit requires that MS4s review every SWPPP and inspect every site.

- For projects subject to review by regulated MS4s, the MS4 permit requires that the SWPPP be reviewed by a qualified professional and that the MS4s reviewer sign the NOI for authorization under the Construction General Permit signifying MS4 acceptance of the plan.

Stormwater Training

This training of designers and reviewers is an informal, preventative compliance activity that is extraordinarily cost effective. Designers generally want to develop designs that comply with all applicable requirements. The training allow for designers to know better what the requirements are and for the reviewers to know better what to accept. Since the inception of the Phase II stormwater program, New York has also invested substantial resources in stormwater training through NYSDEC staff; Syracuse University; The State University of New York, College of Environmental Science and Forestry; Soil and Water Conservation Districts; Regional Councils; Cornell Cooperative Extension; New York State Department of State, New York State Department of Transportation, Cornell Cooperative Extension, and other agencies. The training targeted Developers, Design Professionals, Municipal Officials, Construction Inspectors. In a typical year, over 3000 training days were provided to the broad audience of stormwater parties. The group of Design professionals and professionals that review SWPPPs have been receiving between 500 and 1000 training days per typical year. This training to designers and reviewers is an informal, preventative compliance activity that is extraordinarily cost effective.

Requirements Included in the Design Manual and Blue Book

NYSDEC includes construction and post construction requirements in comprehensive technical standards that are referenced in the MS4 and Construction Permits. NYSDEC chooses to structure the requirements as references because the comprehensive nature (several hundred pages each) of the Design Manual and Blue Book to not lend themselves to be included in permits. If any part of the requirements are included as explicit permit requirements, the remaining aspects of the design would be considered less important. Whereas all aspects of the technical standards are important for effective stormwater controls, devaluing aspects of design requirements would diminish program effectiveness.

More Additionally Designated Areas, Including Extending Coverage to Municipal Boundaries for Minimum Measure 4 and 5

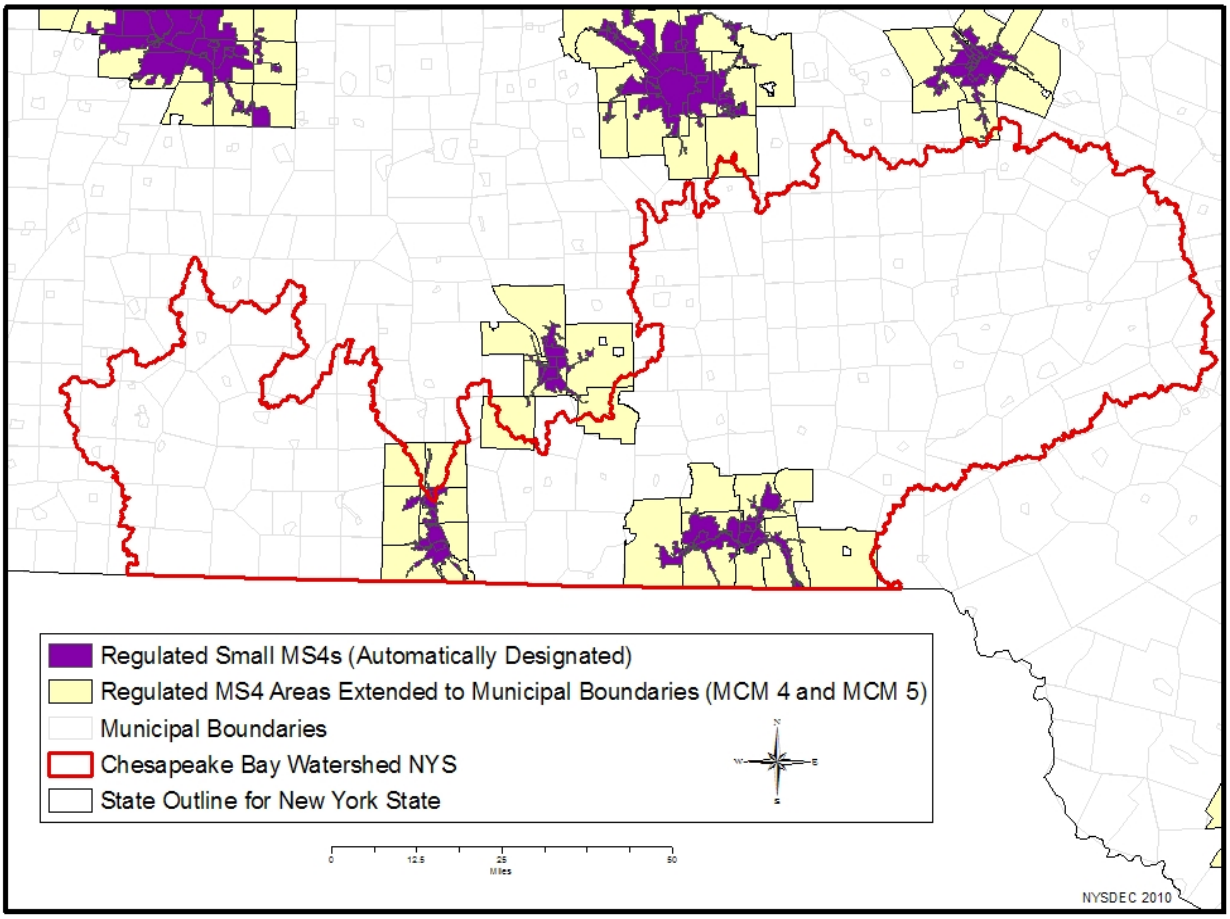
Since the renewal in 2008, several TMDLs were approved by EPA that required MS4s to address the pollutants controlled under the TMDL. For those watershed areas (chiefly far eastern Long Island and the Oscawanna Lake watershed), New York designated those areas as areas that require MS4 permit coverage. In addition, because parties to the two year permit review process

recognized the benefit of increased review of construction projects and all construction projects are reviewed by regulated MS4s under Minimum Measures 4 and 5, New York required regulated MS4s to extend coverage to municipal boundaries for Minimum Measures 4 and 5. A map showing the expansion to municipal boundaries is presented on the next page.

Green Infrastructure Requirements in the MS4 Permit

In addition to the Green Infrastructure requirements that apply to construction sites and that must be implemented by MS4s, MS4s must also consider implementation of GI on all municipal construction projects and in development of local codes and plans. In addition, MS4s must assure that local officials receive training on Green Infrastructure.

Chesapeake MS4 Areas New York State



Commitment and Strategy to Fill Gaps

New York does not have any gaps in Urban Stormwater because New York based reductions on implementation of the existing statewide program enhanced by the increased oversight and inspections funded by the CBRAP.

Contingencies for Slow or Incomplete Implementation

Urban Runoff

- Evaluate potential MS4 Enhancements:
    - Address all municipal road ditch systems and appropriate hydrologic, sediment and nutrient control practices (not just for erosion control during construction/maintenance but long term use of ditches a bio-retention structures for nutrient reduction)
    - Consider information USEPA R3 contractor is developing regarding the cost and effectiveness of urban retrofit practices, including tree planting, riparian buffers, and green infrastructure, to provide guidance to municipalities regarding the implementation of practices that may meet the "maximum extent practicable" standard.
    - Consider information being developed by USEPA to bolster the detection and elimination of illicit connections.
- Regarding construction stormwater:
    - Consider application of Enhanced Phosphorus Design Guidance
    - Consider excluding stream setback area from General Permit coverage

- Work with USEPA R3 to help ensure the comprehensive nature of the New York MS4 and construction stormwater programs are adequately reflected in the watershed model.

- Work to help ensure urban BMPS are documented and annually reported to CBP

- Work to better understand contribution from industrial stormwater

Road side conveyances

- Work with USEPA R3 to help ensure Watershed model reflects the nutrient and sediment reduction associated with potential improvement of maintenance practices and design of road side ditches for use as bio-retention structures. The large network of rural roads makes roadside ditches an important pathway and innovative opportunity to abate stormwater runoff for both quality and quantity issues.

- Although many do already, seek to expand hydro seeding and mulching capacity so that all County Soil and Water Conservation Districts have the capacity to assist local road maintenance.
    - Investigate need to develop management practice regarding disposal practices for soil excavated from roadside ditches.

D. Compliance and Enforcement

Overview

DEC actively protects New York State's water resources through various regulations, policies, and partnerships. Responsibility for much of this oversight lies within the Division of Water (DOW) Bureau of Water Compliance (BWC). BWC manages the compliance and enforcement elements of the State Pollution Discharge Elimination System (SPDES) permit program and enforcement against those discharging to the waters of the state without a permit or beyond the authority of their permit.

The United States Environmental Protection Agency (EPA) authorizes the SPDES program to regulate all wastewater discharges to water in New York State. New York is one of 46 states having regulatory authority to administer wastewater discharge activities falling under the Clean Water Act (CWA), which EPA administers. New York's SPDES program is more stringent than the CWA by also regulating discharges to groundwater.

An essential component of EPA's authorization of the SPDES program is the 1987 Enforcement Agreement between EPA and DEC. This agreement outlines the elements necessary for ensuring compliance by major facilities regulated by DEC. Some of these important elements are:

- Monitoring permit compliance
- Maintaining and sharing compliance information with EPA
- Applying criteria to identify facilities in significant non-compliance (SNC)
- Listing facilities that require action to restore compliance
- Timely and appropriate enforcement of SNC violations

The SPDES program is administered through the issuance of wastewater discharge permits, including both individual permits and general permits.

An individual SPDES permit applies to a single facility, in one location, while possessing unique discharge characteristics. In contrast, a general SPDES permit applies to a class of dischargers, which involve similar operations or pollutants. A general permit also requires similar effluent limits, operating conditions, or the same or similar monitoring.

Once issued, a permit requires the owner or responsible party to abide by specific conditions found in the permit. For larger and more complex facilities these requirements typically include limits on physical, chemical, or biological characteristics of the discharge. For smaller facilities, including those discharging to groundwater, the permit may simply require maintaining data and information for review by DEC staff during an inspection.

One unique feature of the SPDES program is the self-monitoring requirement for each permittee. Because of this DEC receives, each month, a vast amount of data indicative of the quality of wastewater discharged throughout the state from SPDES-permitted facilities. A SPDES permit requires the owner to use a laboratory approved by the Environmental Laboratory Approval

Program (ELAP)[34], a New York State Department of Health (DOH) program, for the analysis of samples required by the SPDES permit.

To further ensure compliance with SPDES permits DEC maintains an active field presence through nine regional offices, with additional support from staff in the Albany headquarters. These staff issue permits, perform inspections, collect samples, certify facility operation staff, provide technical assistance, review discharge data, and respond to citizen complaints involving water quality.

When non-compliance and/or violations occur, DEC has a variety of enforcement measures to encourage or compel the facility to return to compliance. For less serious violations DEC may take informal enforcement action requiring follow-up action by making a phone call or site visit, or by sending a letter. For more serious violations DEC may commence formal enforcement action involving legal staff.

Water Quality Management

To address current challenges and ongoing needs, DOW implements its policy and priorities on a continuous basis through the water management cycle (see Figure 1). This cycle consists of five basic steps, each interdependent upon one another. These steps are:

- Monitoring
- Assessment
- Planning and Management
- Implementation and Permitting
- Compliance and Enforcement

Monitoring

DEC gathers information on the health of the state's waters by monitoring important characteristics such as flow, dissolved oxygen, temperature, or various chemical and biological components in key locations throughout the state. This data is supplemented by collecting samples of aquatic organisms, as the type and number of these organisms assist in determining the health of the waterbody.

[34] http://www.wadsworth.org/labcert/elap/elap.html

Figure 3

Assessment
Waters of the state are assigned a best use, such as a drinking water, swimming, or fishing resource. Water quality standards establish criteria which define a maximum level of pollutants which can be present in a waterbody in order for it to meet its best use designation. The monitoring information is used by DEC to assess waters to determine if these support their designated best uses. DEC then establishes a Priority Waterbody List[35] (PWL) of the waters that do not meet standards or are unable to support their designated best uses.

Planning and Management
Water resources found on the PWL have problems which are attributable to different pollution sources such as malfunctioning sewage treatment plants, street runoff during storm events, or contaminated runoff due to industrial, farming, or construction activities. DEC uses the PWL to manage water resources and plan staff assignments. For example, water quality management plans currently underway include upgrades to municipal wastewater systems discharging to Onondaga Lake or Long Island Sound. Upgrades to those facilities will enhance the removal of phosphorus and nitrogen. An abundance of these nutrients in the wastewater discharge supports undesirable plant growth and reduces oxygen available to aquatic life.

Implementation and Permitting
Monitoring, assessment, and management planning help DEC develop SPDES permits for all discharges to waters of the state. SPDES permits may contain performance standards that protect

[35] http://www.dec.ny.gov/chemical/23846.html

water quality. SPDES permits may also include schedules of compliance that require the permittee to upgrade or install new treatment technology by a specific date. DEC also works cooperatively with local governments and organizations to encourage control of nonpoint sources of pollution, such as polluted runoff from stormwater and agriculture operations.

Compliance and Enforcement

Compliance assurance and enforcement involve the evaluation of data that dischargers submit as a condition of the SPDES permit. These reports detail the water quality discharged from the permitted facility. This data, inspections by DEC staff, and other information collectively determine whether a permittee is in compliance with the requirements of the SPDES permit. When DEC encounters violations of a SPDES permit, it usually initiates action by calling the facility or sending a Notice of Violation (NOV) to encourage the permittee to correct minor violations or deficiencies. DEC considers this an informal enforcement action. Major violations require the discharger to correct deficiencies through a formal enforcement action. Formal enforcement actions include an Order on Consent, Notice of Enforcement Hearing and Complaint, Cease and Desist directive, Commissioner's Order, or ticketing by a law enforcement official, such as an Environmental Conservation Officer (ECO).

SPDES Permits

The purpose of a SPDES permit is to regulate the discharge of wastewater and protect the receiving water's quality. In 1998, there were approximately 11,000 active SPDES permits issued. At that time, SPDES permits were issued to cover the following facility types:

- **Municipal Wastewater Treatment Facility**
  This class of facility includes all Publicly Owned Treatment Works (POTW) (as defined by Section 201 of the CWA[36]), which are owned by either the state or a municipality. Privately owned treatment works, federally owned treatment works, and other treatment plants not owned by municipalities are not considered POTWs. Currently, there are approximately 635 POTWs in New York State.

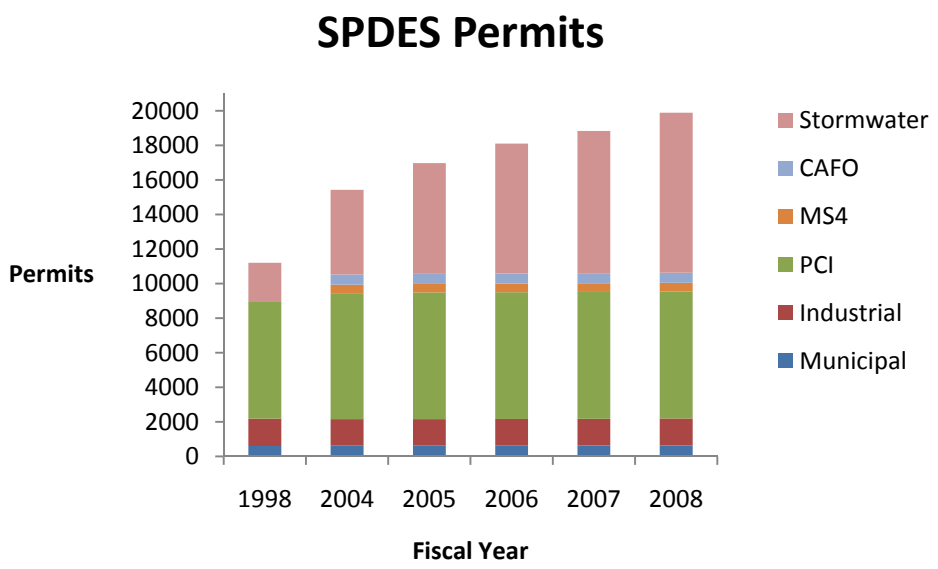
- **Private, Commercial, and Institutional (PCI)**
  This permit class applies to private, commercial, and institutional-type facilities. Examples include laundromats, car washes, privately owned residential wastewater treatment systems, and campgrounds. Currently there are approximately 7300 PCI facilities and 270 significant class PCI facilities in New York State.

- **Industrial**
  These include facilities that are non-municipal, non-PCI, and discharge to surface or ground waters. The type of wastewater generated at this type of facility depends on the specific activities undertaken at a particular site and may include manufacturing or process wastewater, cooling water, sanitary wastewater, and stormwater runoff. Currently there are approximately 1566 industrial class facilities.

[36] http://epw.senate.gov/water.pdf

In 2008, approximately 20 000 SPDES permits were in effect, an increase of over 80% from the 1998 level. Figure 2 shows the recent trend for SPDES permits, including the baseline total in 1998.

Figure 4



Nearly all of this growth is attributable to the addition of four new classifications of General SPDES Permits, covering the following types of facilities:

- **Concentrated Animal Feeding Operation (CAFO)**
  This class of permit regulates the discharge from feeding operations where animals are kept and raised in confined situations, and which meet threshold population criteria (variable depending upon breed/age of the animal). Currently, there are approximately 590 permitted CAFO sites in the state.

- **Municipal Separate Storm Sewer System (MS4)**
  This class of permit regulates those sewer systems carrying stormwater and runoff from municipally or publicly owned entities (city, town, or village) that are not part of a combined sewage systems or treatment plants and which discharge to waters of the state. Currently, there are approximately 500 permitted MS4 sites in the state.

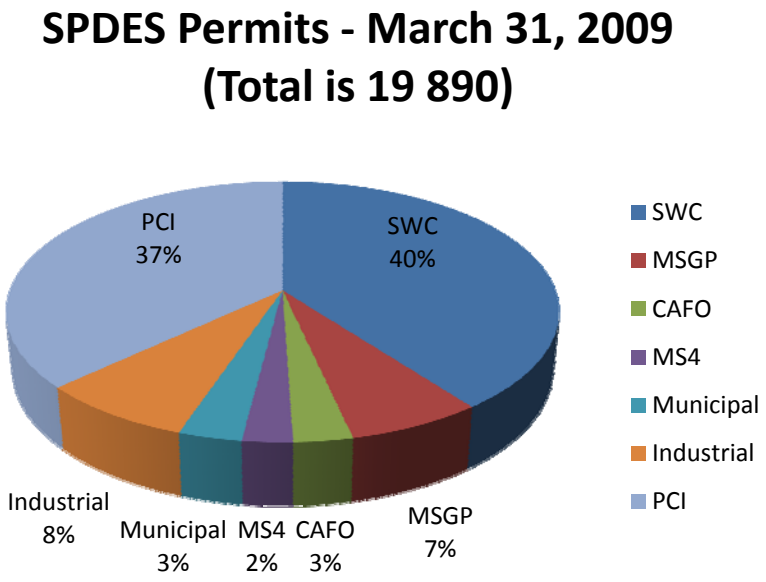
- **Multi-Sector General Permit (MSGP)**
  This permit class applies to non-construction-related stormwater discharges. Examples include site runoff at an industrial or manufacturing site, school bus garage, or airport. Currently, there are approximately 1360 permitted MSGP sites in the state.

- **Stormwater – Construction (SWC)**

This permit class applies to runoff resulting from construction activities which impact areas greater than one acre. Currently, there are approximately 7900 permitted SWC sites in the state.

Figure 3 details the distribution of discharge permits of the entire SPDES permit universe.

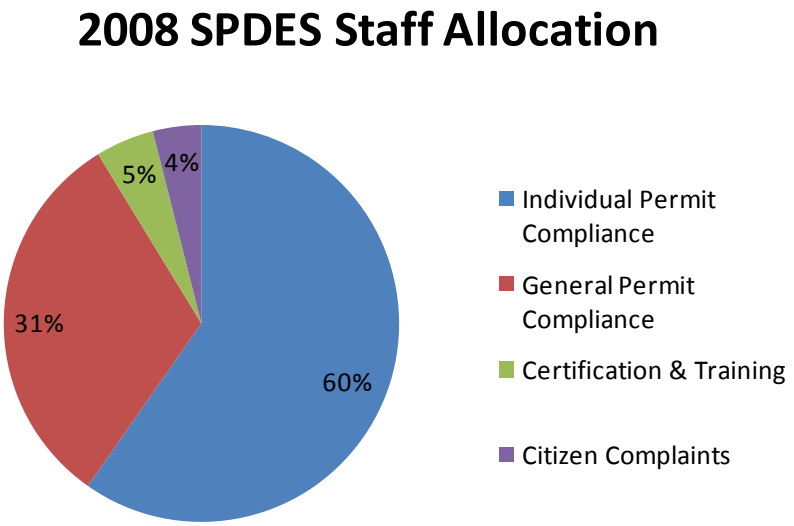
Figure 5



SPDES Work Plan and Staffing

A significant activity of Division of Water staff is to ensure compliance with SPDES permits. Activities relating to compliance assurance include inspection of SPDES-permitted facilities, review of discharge data, sampling and water quality analysis, certifying wastewater treatment facility personnel, investigating citizen complaints, and supporting staff at DEC's nine regional offices. Figure 4 details staff time expenditures for 2008 during which there were 70 full-time employees focusing on SPDES compliance and enforcement activities.

Figure 6



Although the number of permits has risen nearly 100% over the past 10 years, staff overseeing the activities of these permittees has been nearly constant.

Goals for DEC's compliance assurance activities are defined in the annual work planning process. This work plan identifies such components as the number of facility inspections to conduct, the specific permit classes to target for enforcement action, and the response to those discharges causing impairment within a specific water basin. The work plan also sets priorities to meet the compliance goals set by DEC and EPA. This plan is an integral part of DEC's water activity commitments in the annual Performance Partnership Grant from EPA. This grant funds a substantial portion of DEC's water quality programs relating to the water management cycle.

SPDES Permit Monitoring and Compliance

During state fiscal year 2008/09, DEC received discharge monitoring data from nearly 1600 permitted facilities, commonly on a monthly or quarterly basis. These data detail various biological, chemical, and physical characteristics of the water being discharged by these facilities. Factors contributing to the compliance status of a SPDES permitted facility include this self-reported data, DEC staff inspections, and other regulatory oversight activities. Input from citizens and civic groups provide an additional level of oversight at the community level.

A distinctive feature of the SPDES program is the requirement of the permitted facility to monitor discharge water quality and report these findings to DEC. Once DEC receives these data from the facility owner or permit holder it is entered into a nationwide information management system operated by EPA. Through this system DEC staff can assess the compliance status of a facility, determine if any permit limits have been violated, or remain alert to upcoming schedule or construction completion deadlines. With this self-certification approach to reporting, falsification of any Discharge Monitoring Report (DMR) data or supporting information is

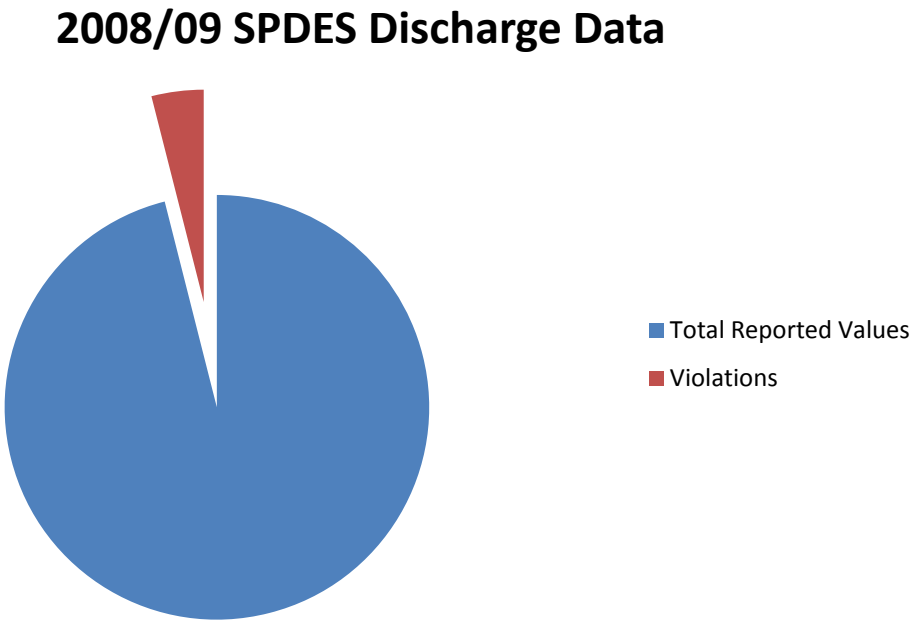
among the most serious of violations and could lead to significant penalties and/or criminal prosecution.

Regardless of the size and discharge capacity of the facility, all SPDES permitted facilities are required to use an ELAP accredited laboratory to analyze a representative sample being discharged. Generally, smaller facilities or those discharging to groundwater must maintain these data results for DEC review during an inspection, while larger facilities and those discharging to surface waters must report directly to DEC the results of these laboratory tests.

Using EPA's data system, each violation is further scrutinized by DEC (and EPA) staff to determine the severity of the violation. DEC is responsible for initial response to any violation, although EPA can take action through the federal CWA and its agreement with DEC.

The vast majority of discharge data that DEC receives are within the limits detailed in the SPDES permit. For example, in state fiscal year 2008/09, DEC received over 228 000 values indicative of the quality of water being discharged. Of these reported values, approximately 9400 were violations of a SPDES permit (approximately 4% of the total). Refer to Figure 5 which illustrates the rate of SPDES permit limit compliance in New York State.

Figure 7



Since the 1980's DEC and EPA address any SPDES violation in a consistent manner to ensure significant violations receive appropriate enforcement action. This unified approach defines threshold criteria that, once exceeded, require enforcement action to return the facility back into compliance (see "SPDES Enforcement" below).

To learn more about the compliance history of a SPDES permitted facility, visit the EPA Enforcement and Compliance History Online (ECHO)[37] website.

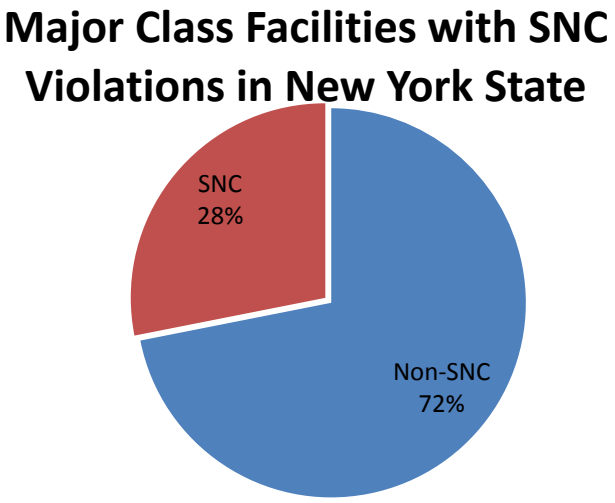
Given that nearly one quarter of a million data values are submitted to DEC each year, EPA and DEC evaluate violations and focus on major facilities deemed to be in SNC. SNC consists of more severe violations, including:

- Discharge monitoring values exceeding an EPA-accepted threshold
- The facility not providing a specific document or report required as a condition in a legally binding Order on Consent or other enforcement action
- A discharge which threatens public health or the environment.

A formal agreement exists between DEC and EPA requiring quarterly compliance meetings of the two agencies to ensure consistent and timely enforcement action to restore compliance at those major facilities with SNC violations.

During state fiscal year 2008, the SNC rate for major facilities was 28%. This is comparable to the national average of 24%, as reported in the EPA Clean Water Act Enforcement Action Plan[38]. Figure 6 illustrates the percentage of the 345 major SPDES-permitted facilities in New York State that were in SNC for at least one quarter during state fiscal year 2008/09.

Figure 6



Given this rate of SNC, it is notable that the majority of facilities comply with the requirements of their SPDES permit. The SNC rate presented here provides a summary of facilities which met the SNC criteria at least once during the entire year. At each quarterly meeting, EPA typically presents DEC with a list of approximately 25 facilities meeting the SNC criteria. The facilities on

[37] http://www.epa-echo.gov/echo/
[38] http://www.epa.gov/oecaerth/civil/cwa/cwaenfplan.html

this list will change from quarter to quarter as some return to compliance while other facilities are newly placed on the list.

A facility can have a violation or meet the SNC criteria for a variety of reasons. These reasons may include operational issues, temporary process upsets caused by illegal dumping into the sewer system, or factors that remain unknown until thoroughly investigated. However, with properly trained personnel and good operational and maintenance programs, minor violations are usually corrected before they become SNC.

While the rate of SNC in New York is comparable to the national figure, New York is unique in the number of facilities it permits through the SPDES program and the age of these, primarily municipal wastewater treatment facilities. Having long been a leader in providing water quality protection through the collection and treatment of wastewater, many of these systems in New York are reaching the end of their effective lives. Presently, these collection and treatment facilities serve over 15 million New York residents.

Once a collection and treatment system reaches the end of its useful life, unexpected or even catastrophic failure may occur, potentially impacting public health and the environment. Recent efforts at the federal and state level have sought to identify these impacts and obtain the necessary public investment to ensure continuing the effective treatment and disposal of wastewater.

In 2008 DEC released the Wastewater Infrastructure Needs of New York State[39] report which details the history and outlook for municipal wastewater collection and treatment in the state. This report details that the projected 20-year needs of New York's municipal wastewater treatment facilities are in excess of $36 billion.

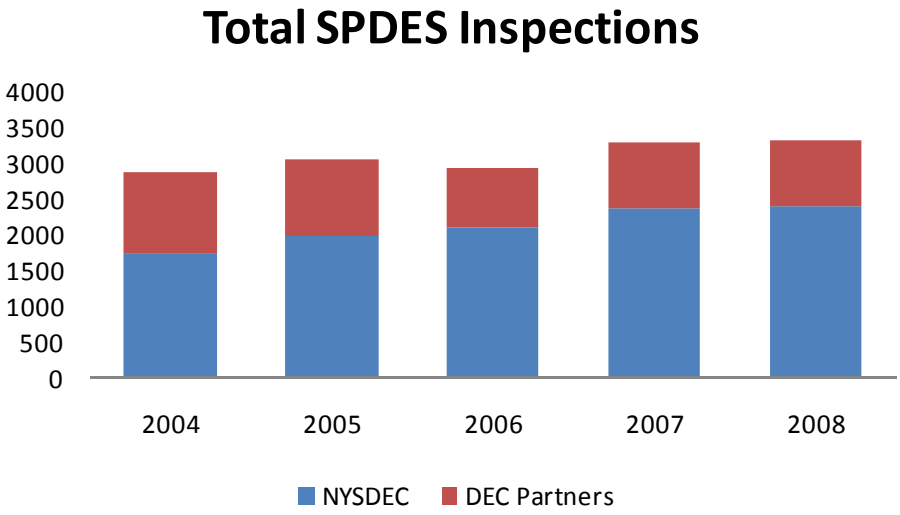
Inspections

Inspections are an essential component in DEC's approach to facility compliance. These visits allow for on-site review of self-monitoring data and relevant laboratory data, observation of the treatment process and discharge characteristics, and assessment of health and safety issues.

During 2008, DEC staff conducted over 2,400 inspections at facilities throughout New York. Inspections can be brief to observe only critical elements of the operation, more comprehensive and involving sampling of water discharged for comparison to DMR data, or they can occur in tandem with other regulatory organizations such as EPA. The DOW annual work plan commits staff to focus on facilities having a greater potential for impact to the receiving water. Figure 6 depicts SPDES inspection activity over the past five years by DEC and partner organizations, including EPA and county health departments.

[39] http://www.dec.ny.gov/docs/water_pdf/infrastructurerpt.pdf

Figure 7



Citizen Complaints

Inquiries and complaints by citizens and observations of possible violations assist DEC's SPDES program compliance and enforcement efforts. DEC investigates these complaints to determine any impact upon the environment or public health. When violations are found, staff seeks corrective action to minimize impacts and, if necessary, pursue enforcement through DEC's legal office.

Certification and Training

Competent and credentialed operators serve as frontline defenders of public health in their own communities. Since 1937 New York State requires certification of municipal wastewater treatment plant operators. Part 650[40] of Title 6 of New York Codes, Rules and Regulations details the requirements of the wastewater operator certification program. Prior to receiving this certificate an individual must complete DEC-approved training, possess hands-on operational experience at a treatment facility, and pass a certification exam. Additionally, every five years an operator must re-certify by completing a specific amount of DEC-approved training. Over 3100 individuals currently possess DEC-issued certificates.

Every five years DEC conducts a training needs survey using input from DEC staff and wastewater treatment facility personnel from across the state. The response to this survey determines training that DEC and partnering organizations will deliver in the ensuing five-year period. In addition to providing training which meets DEC's recertification requirements these

[40] http://www.dec.ny.gov/regs/4624.html

events allow for an operator to remain knowledgeable with changes in the management and operation of a treatment facility. Of significance is DOW's effort to provide training to municipal elected officials, including mayors, supervisors, and board members. This training recognizes the community-wide commitment necessary to effectively provide sewage collection and treatment to over 15 million state residents. Due to resource constraints, DEC is reducing the training it provides to treatment plant operators. DEC is collaborating with the New York Water Environment Association to provide additional training opportunities for treatment plant operators.

During 2008/09, a total of 27 seminars and workshops were delivered by DEC across the state focusing on various topics, including:

- operations and maintenance
- process control
- nutrient removal
- sample collection and laboratory analysis
- wet weather operational strategies
- energy consumption efficiency
- troubleshooting and problem solving

Several of these events specifically targeted elected local officials, covering strategies to efficiently finance and operate their communities' wastewater infrastructure while maintaining compliance with their SPDES permits. Overall, these outreach events were attended by approximately 1000 operational, administrative, and managerial local officials.

SPDES Enforcement

When violations of a SPDES permit are detected, staff respond by using the appropriate and available tools, including formal enforcement actions, to expedite a return to compliance. Generally staff will initiate an informal enforcement action, such as sending a warning letter, holding a compliance conference with the permittee, or issuing an NOV, to promote voluntary compliance with the regulations and permit requirements.

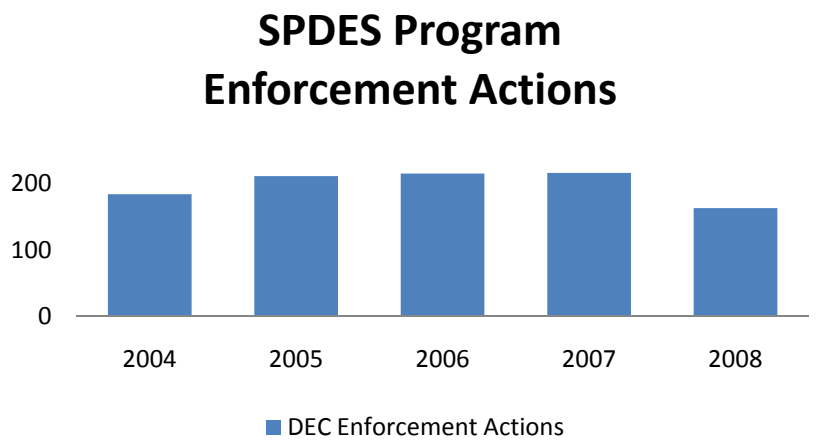
Formal enforcement becomes necessary when compliance is not achieved through informal enforcement or the discharge results in a negative impact to the environment or public health. Many formal enforcement tools are at DEC's disposal. The most commonly used are tickets issued by an ECO and the Order on Consent. An ECO-issued ticket for a discharge violation requires payment of a penalty by the respondent. An Order on Consent is a legally binding document issued by DEC and agreed to by the respondent (i.e. SPDES permittee).

An Order on Consent commonly includes some or all of the following:

- payable penalty
- suspended and/or stipulated penalties
- interim SPDES permit effluent limits
- compliance schedule for corrective action

When violations cannot be settled through an Order on Consent, DEC may initiate an Administrative Hearing Process. This may result in the issuance of a Commissioner's Order to compel compliance. Also, DEC staff can revoke permit coverage for the permittee based on current SNC status, past enforcement history, or the level of impact to the environment and public health caused by the violations. Refer to Figure 7 for a summary of SPDES enforcement actions over the past five years (consisting of ECO tickets and Orders on Consent).

Figure 8



How Enforcement Improves Water Quality

SPDES permits are issued with stringent discharge limits designed to protect public health and water quality. Periodically it is necessary to issue a SPDES permit with more stringent limits than were previously in place. When this happens DEC typically will also establish a schedule of compliance which allows the permitted facility to meet these new discharge limits by a future date and not immediately.

This schedule of compliance may include specific deadlines for the facility to design and install equipment or features necessary to comply with these new limits. In the event the facility fails to meet elements of the schedule of compliance, DEC may initiate an enforcement action through an Order on Consent. The Order on Consent may impose a financial penalty, extend the date of future compliance, or adjust the discharge limits that the facility must adhere to under the revised SPDES permit.

Contingencies for Slow or Incomplete Implementation

Chesapeake Bay Watershed Program Compliance Assurance

For those implementation items that are part of any of DEC's permits, the DEC follows its enforcement guidance:

- Enforcement TOGS: 1.4.1 Integrated Compliance Strategy System
- June 1996 Edition, and 1.4.2 Compliance/Enforcement of SPDES Permits June 2010 Edition

DEC will use the adaptive management framework provided by the two milestones to help correct for slow or incomplete implementation.

Department Guidance

DEC has developed a number of guidance documents to provide staff with a consistent plan and approach on compliance and enforcement activities for all of the State Pollutant Discharge Elimination System (SPDES) programs. Division of Water (DOW) staff use Technical and Operational Guidance Series (TOGS) 1.4.1 - Water Integrated Compliance Strategy System (WICSS), to determine if violations have occurred at wastewater treatment facilities. This guidance establishes the criteria for identifying priority violations against the State's water resources and establishes the procedures to assure integrated compliance responses to these violations in a timely manner. Once the priority violations have been identified, DOW staff use TOGS 1.4.2 to determine the appropriate compliance response.

In 2010, DEC issued the *Division of Water Technical and Operational Guidance Series* (TOGS) *(1.4.2):* Compliance and Enforcement of SPDES Permits[41]. This guidance provides for consistent statewide understanding and implementation of the SPDES compliance and enforcement program in order to protect public health and the environment. It provides DOW staff with enforcement options and operating guidelines to implement the compliance component of the program. The goal of TOGS 1.4.2 is to ensure consistent statewide understanding and implementation of the SPDES compliance and enforcement program in order to protect public health and the intended best use of the waters of the state.

The Compliance and Enforcement response guide contained in TOGS 1.4.2 specifies what actions need to be taken and in what timeframes for violations of reporting requirements, failure to meet permit requirements and water quality standards violations. DEC used EPA's "Interim Wet Weather SNC Policy" (dated 10/23/07), as a guide when determining the appropriate permit violations to include in DEC guidance for the stormwater programs. Additionally, this document provides DEC staff with the enforcement options and guidance to implement the compliance component of the SPDES programs across New York. Significantly, this guidance addresses the needs of the newer General SPDES Permit programs, such as stormwater and CAFO that have been added since the previous version of this TOGS was released in 1988.

The DOW also has separate Compliance Assurance Strategies for many of the SPDES programs. These provide additional details on implementation of the program and the appropriate compliance and enforcement response. Such strategies exist for the CAFO, MS4 and construction storm water programs. They provide the basic framework for compliance assurance by staff with respect to inspections, response to citizen complaints, and review of Storm Water Pollution Prevention Plans (SWPPPs). Included in the strategies, as well as in TOGS 1.4.2, is the compliance and enforcement response to violations of permit requirements and violations of water quality standards.

[41] *http://www.dec.ny.gov/chemical/62557.html*

Division of Law Enforcement Initiative
In July of 2010, the DOW worked with DEC's Division of Law Enforcement (DLE) to perform a statewide compliance check of construction sites to determine whether they were properly permitted and see if they had their permit authorization and Storm Water Pollution Prevention Plan (SWPPP) on-site. The DLE also checked to see if there were obvious water quality standard violations in the receiving water.

As result of this initiative, DLE conducted 806 site visits and issued 32 warnings, 19 notices of violation and 22 tickets. Initiatives like this help increase DEC field presence at construction sites outside of the routine inspections the DOW conducts on an annual basis.

EPA Cooperation
Compliance data obtained from the Integrated Compliance Information System (ICIS) for the wastewater treatment plants in the Chesapeake Bay Watershed shows that there is a 97% compliance rate with permit limits. Included in these treatment plants are 35 EPA majors which we monitor with EPA Region II through the Significant Noncompliance Action Program (SNAP). SNAP is outlined in a 1983 Memorandum of Understanding (MOU) between DEC and EPA Region II and is a process which provides for EPA oversight of the New York State NPDES enforcement activities. In quarterly meetings, DEC and EPA review a docket of facilities which includes: EPA majors with Significant Non-compliance (SNC) violations, citizen concerns, Sanitary Sewer Overflows (SSOs) and bypasses. The MOU sets forth an expectation that timely and appropriate enforcement is taken for noncompliance. SNAP has been working very successfully for DEC and EPA Region II for 27 years.

DEC Central Office and the nine regional offices work together to create the DEC inspection work plan each fiscal year. Inspection targets are identified for each inspection type by DEC and these numbers are distributed to EPA Region II to be used in their Compliance Monitoring Strategy (CMS) for New York State. DEC also works with EPA Region II when they are setting their annual inspection work plan. EPA Region II is able to provide additional inspection resources and a regulatory presence in New York State which aids in compliance. The current EPA Region II inspection work plan includes a focus on the Chesapeake Bay watershed.

Inspection Statistics
Due to the way the DEC database systems were developed, it is not easy for staff to obtain inspection statistics specifically on the Chesapeake Bay Watershed at the current time. Staff is working on creating a Chesapeake Bay Watershed specific data code to be used in the database to make generating statistics and lists of inspection much easier in the next Fiscal Year.
The following table of inspections in the Chesapeake Bay was generated from a review of DEC databases:

Permit Type	Number of Inspections 2007 - 2009
EPA Major	**96**
EPA Minor	**148**
CAFO	**38**
Construction Stormwater	**135**

On average in the last three years we are performing 40% more inspections at construction facilities in the Chesapeake Bay watershed than is called for in the inspection work plan and are meeting the DEC inspection targets for the other programs.

Enforcement Highlights

Below are examples of recent enforcement actions undertaken by NYSDEC.
SPDES Category: Municipal Wastewater Treatment Facility (POTW)

NYCDEP – Newtown Creek WWTP

Final clarifier at Newtown Creek WWTP

On August 3, 2009 a Consent Judgment between DEC and New York City Department of Environmental Protection (DEP) was entered in state court to audit compliance at all 14 of the city's wastewater treatment plants (WWTPs) and to ensure timely completion of specific upgrades at the city's Newtown Creek WWTP. The upgrades to the Newtown Creek WWTP, the largest wastewater treatment plant in the state, will continue under a strict set of construction completion milestones. This action by DEC was taken to address project delays beyond the compliance dates required under the original state court judgment. Regarding the August 2009 action, the city must:

- Hire an independent auditor to conduct a comprehensive environmental regulatory audit to ensure compliance with environmental laws at its 14 wastewater treatment plants and four combined sewer overflow (CSO) retention facilities, and to identify and correct any violations discovered during this audit. This is the **first time** such a protocol has been established between the city and the state for these wastewater treatment facilities.
- Comply with a schedule to complete the construction upgrade promptly. To ensure this compliance, the city has put into escrow proceeds from a $27.4 million judgment against the city for violations at the Newtown Creek WWTP. The penalty will be returned if the city meets certain construction milestones for the plant upgrade.
- Submit various construction management standard operating procedures, guidelines, and policies to the state for review and comment under the Capital Program Management Improvement Program (CPMIP). The city could face an additional $16 million in penalties as

outlined in the judgment if these submittals are not made in accordance with the compliance schedule.

- Provide $10 million in local environmental benefit projects to be administered by New York State Energy Research and Development Authority, New York City Parks Foundation and the Hudson River Foundation. This is **the largest** Environmental Benefit Project (EBP) in the state's history.

SPDES Category: Municipal Wastewater Collection System

NYCDEP –Combined Sewer Overflow Abatement

In April 2008 New York City agreed to pay a $1 million penalty and fund $4 million worth of EBPs to settle violations for missing construction milestone dates required by a 2005 Order on Consent between the city and the state to abate CSOs.

Under the 2008 settlement, the city agreed to a new timeline for completing certain construction projects that are already underway.

CSO on the Hutchinson River

This settlement will significantly improve the quality of New York City's waters and marine environment. Additionally, the EBPs contained in the settlement pave the way for the city to make progress in reducing the impacts of stormwater runoff on local water resources. By utilizing 'green' infrastructure techniques the city will reduce CSO events and enhance the quality of life for many of its citizens.

SPDES Category: CAFO Facility

Questionable manure management practices and a failure to implement a Comprehensive Nutrient Management Plan (CNMP) led DEC to take enforcement action against Boxler Dairy Farm, a large Concentrated Animal Feeding Operation in Wyoming County. Investigations and sampling by DEC, state and local departments of health, and the state Department of Agriculture and Markets revealed questionable manure spreading activities at a satellite manure land-spreading site in Genesee County. The site is in the vicinity of several homes served by private water supply wells. Additionally, site investigators discovered a direct discharge of process

wastewater to a Class A tributary of Tonawanda Creek in the vicinity of the farmstead in Wyoming County.

Improper manure spreading leading to well contamination

Boxler Dairy Farm and DEC entered into an Order on Consent, requiring the farm to pay a penalty of $40,000, fully implement the site CNMP, correct deficiencies noted during agency inspections, and cease manure application on the fields where the water well problems occurred. Prior to entering into this agreement with DEC, Boxler Dairy Farm provided bottled water, and then water treatment systems, to address the immediate needs of several residents who had contaminated water wells.

Follow-up inspections revealed that Boxler Dairy Farm was in compliance with the Order on Consent, had eliminated the cited deficiencies, and had fully implemented their CNMP. The residents with contaminated water wells are now served by a public water supply.

SPDES Category: Industrial Facility

Mirant, Inc. agreed to a $300,000 settlement to resolve alleged air and water violations at its Bowline and Lovett properties located in Rockland County. The settlement calls for the company to pay a $50,000 penalty and fund a $250,000 EBP to promote research on fish and aquatic life in the Hudson River. In addition, it requires Mirant Bowline to make immediate repairs, hire an outside consultant to audit the plant, and make any changes recommended by the consultant.

Mirant Bowline viewed from above

This settlement addresses various monitoring equipment failures occurring between June 1999 and November 2007 that negatively impacted receiving water quality.

SPDES Category: Private Wastewater Treatment Facility

Carteret Group, Inc. (Rushmore Wastewater Treatment Plant / Brigadoon Estates)

On September 14, 2009, DEC issued a Summary Abatement Order mandating that the owners of the Rushmore Wastewater Treatment Plant (Orange County) immediately comply with the state Environmental Conservation Law. This action was in response to a history of SPDES permit violations and discharge of insufficiently treated sewage into the Woodbury Creek watershed.

Discharge from Rushmore/Brigadoon Estates WWTP

The Summary Abatement Order demands immediate corrective actions, including replacement and repair of failed treatment system components and greatly improves system oversight.

Planned Program Improvement

Information Management System Assessment

The current data management infrastructure used by DEC staff hinders the SPDES program in many ways, requiring duplication of data entry and making common access to data cumbersome. In 2009, DEC conducted an assessment of the existing data management systems and business processes used to support the SPDES program. The objective of the assessment was to develop a plan for future information management investments that will streamline the SPDES data management process, meet the future business needs of the program, and complement the ongoing use of EPA's national system.

During this assessment DEC first developed a comprehensive outline of the SPDES program business workflow and the limitations in the existing information management system. Given consideration next were alternative actions that could be undertaken to streamline the data management process and effectively respond to future business needs. Finally, DEC defined a vision for future information management and developed a specific implementation plan consisting of a series of phased actions designed to achieve that vision. This plan focuses on an integrated program repository, centralized data capture, automated data collection and support tools, public access to information, and electronic document management. Currently DEC is seeking funding to begin the modernization of these information management systems.

Chesapeake Bay Regulatory and Accountability Grant

The New York State Department of Environmental Conservation is applying for an EPA FY 2010 Chesapeake Bay Regulatory and Accountability Program grant primarily for increased staff resources to accomplish these activities listed as eligible activities in EPA's March 2010 Addendum to its October 2009 Grant Guidance:

- Develop permits and ensure consistency with water quality needs, including TMDL wasteload allocations
- Compliance monitoring, enforcement follow-up, reviews, reporting, inspections, investigations, audits, corrective actions and assistance visits
- TMDL watershed implementation plan development
- Improved tracking and accountability

NYSDEC expects these activities will contribute to the "Protect and Restore Water Quality" goals of the Chesapeake Bay Program, including reduced nutrient (and sediment where appropriate) from:

- Municipal and industrial wastewater facilities
- Agricultural lands and animal operations

- Developed lands
- Streamside riparian areas

NYSDEC is the agency responsible for compliance assurance, permit development and issuance, and TMDL development and TMDL implementation planning. Responsibilities rest with both regional field offices and the central office in Albany. NYSDEC will be targeting actions at facilities/entities/activities within the Susquehanna and Chemung River Basins in New York which contribute nutrient and sediment to Chesapeake Bay.

In principal part, NYSDEC will focus its work on the facilities/entities/activities it regulates, including wastewater treatment plants, concentrated animal feeding operations and municipal separate storm sewer systems. In addition, although not directly regulated, NYSDEC will also augment its work, under contract with FEMA, to audit/assist local government administration of floodplain development regulations enacted for participation in the National Flood Insurance Program. All of this work will be located within the Susquehanna and Chemung River basins in New York[42] and will emphasize nutrient and sediment reduction.

This will result in improved performance through enhanced oversight of facilities/activities/entities in the Susquehanna and Chemung River Basins regulated by DEC State Pollutant Discharge Elimination System permits. Such permits include wastewater discharges, concentrated animal feeding operations, municipal separate storm sewer systems and construction sites.

A primary objective of DEC Division of Water field staff is to ensure compliance with the terms and conditions of SPDES permits through data and plan review, site inspections, and a range of compliance assurance activities including technical assistance and formal enforcement actions. A primary objective under this grant is to conduct these activities with a targeted focus on the control of significant sources of nutrient and sediment.

NYSDEC expects to meet the following objectives as stated in the CBRAP workplan:

Compliance and Enforcement of SPDES Permits. Improved performance through enhanced oversight of facilities/activities/entities in the Susquehanna and Chemung River Basins regulated by NYSDEC State Pollutant Discharge Elimination System permits. Such permits include wastewater discharges, concentrated animal feeding operations, municipal separate storm sewer systems and construction sites. A primary objective of NYSDEC Division of Water field staff is to ensure compliance with the terms and conditions of SPDES permits through data and plan review, site inspections, and a range of compliance assurance activities including technical assistance and formal enforcement actions. A primary objective under this grant is to conduct these activities with a targeted focus on the control of significant sources of nutrient and sediment.

[42] For point of reference, whereas the Chesapeake Bay Program describes the New York portion of the Chesapeake Bay watershed as "Susquehanna–New York", NYSDEC describes it as two separate drainage basins, the Susquehanna and Chemung River Basins.

Water Quality Protection in Floodplains. In New York State, local governments oversee development in floodplains. Most New York municipalities have enacted Flood Damage Prevention Laws as a prerequisite for participation in the National Flood Insurance Program. These laws govern not only encroachment and construction standards, they include requirements for the storage of materials and the placement of disposal systems, like septic systems. Under contract with the Federal Emergency Management Agency, the New York State Department of Environmental Conservation conducts audits of local government administration of its floodplain development regulations and provides technical assistance. Effective administration of these laws will help to improve and protect nutrient and sediment water quality. There are about 262 municipalities in Susquehanna and Chemung River Basins in New York. Floodplains play an important hydraulic function in river systems. Undisturbed floodplains dissipate flood water energy and allow flood waters to infiltrate native soils. These functions reduce erosion potential and facilitate natural processes to attenuate nutrients. In addition, disturbance of structures and fill materials during a flood inevitably lead to deposition of large quantities of sediment and other debris that contribute to violations of the state narrative water quality standard for deposition (none in amounts that will impair the best usage of the water body.) Further, such sediments will carry nutrients and other contaminates that have the reasonable potential to cause or contribute to violations of water quality standards. The goal of this objective is to improve local government administration of its floodplain development regulations and thereby reduce nutrients and sediments transported downstream during flood events. This will be accomplished by enhancing the current FEMA/State program, whereby the New York State Department of Environmental Conservation conducts Community Assessment Visits and Community Assistance Contacts, works with municipalities to take corrective actions and reports resulting findings to FEMA.

Individual Permitting, MS4, Construction and CAFO Permitting and Non-Point Source Technology. The New York State Tributary Strategy for Chesapeake Bay Restoration calls for NYSDEC to modify Bay-significant wastewater discharge permits. This is largely a centralized function under the Division of Water's Bureau of Water Permits. These modifications contain a schedule of compliance that requires the submission of engineering plans to NYSDEC for approval that describe how nutrient removal optimization will be implemented. Additional permit modifications are likely to result from the Chesapeake Bay TMDL. This bureau also develops the general permits issued for MS4s, Construction stormwater and CAFOs. Due to the traditional non-point source nature of these general permits, this bureau houses the NYSDEC's technical work group for non-point source controls. The goal of this objective is to issue individual discharge permits in accordance with New York State Tributary Strategy and EPA's expectations for watershed implementation plans associated with the Chesapeake Bay TMDL and to improve the technical and administrative provisions of the general permits. The latter will be targeted to nutrient and sediment control technologies and the tracking and reporting of resulting management practice implementation.

Watershed Planning and Implementation. A principal element of accountability in the Chesapeake Bay Program is the development and achievement of 2-year implementation milestones. The NYSDEC Bureau of Water Resource Management has coordinated the development of the New York State Tributary Strategy and its initial 2009-2011 milestones. This Bureau will also be coordinating the development of the Chesapeake Bay TMDL

Watershed Implementation Plan and subsequent 2-year milestones and overseeing implementation efforts. These efforts are underway, but are not expected to be completed during the term of this grant. With extensive stakeholder input, the NYSDEC, with its key partner the Upper Susquehanna Coalition (County Soil and Water Conservation Districts), developed in 2006 the New York State Tributary Strategy for Chesapeake Bay Restoration. With the results of EPA's revised watershed and Bay models and its reallocation of jurisdictional nutrient and sediment caps for the Chesapeake Bay TMDL, the New York Tributary Strategy needs to be refined and segregated into two year implementation increments leading to 60% of total implementation by 2017.

Data Management. Because a large fraction of pollutant loading to Chesapeake Bay is from non-point sources, it is important to maintain a high degree of confidence in the accounting of management practice implementation and the processing of available water quality measurements. The goal of this project is to facilitate the collection of management practice implementation through improved management of data found in the plans and reports submitted to the Department from permittees covered by SPDES general permits, especially construction stormwater and municipal separate storm sewer systems. Improvements to permit data management systems will be evaluated to make collection of information within the Susquehanna-Chemung River Basin more readily available for submission to EPA. In addition, various sources of water quality data need to be effectively amassed to facilitate appropriate technical assessments.

Tracking and Reporting Protocols

Through the work plan under CBP State Implementation Grant and through New York State Agricultural Environmental Management, the Upper Susquehanna Coalition has developed and implemented a model program to document and submit agricultural management practice implementation data. This is expected to continue.

The DEC collects data on a statewide basis from the Notices of Intent it receives from applicants seeking coverage under the states' general permits for construction stormwater, MS4s and CAFOs. The DEC also receives monthly Discharge Monitoring Reports from wastewater treatment facilities. The CBRAP inspection/verification grant will assist DEC to compile this data at the watershed scale and to field verify management practice implementation data.

E. Remaining Source Categories and Other Key Program Areas

Septic Systems

USEPA R3 estimates that about half of the residential population in this area of New York, or about 300,000 people, are served by about 120,000 Septic systems or on-site wastewater treatment systems (OWTS).

According to US Census data compiled by the USEPA R3, from 1980 to 2008 the population in New York has decreased from 654,499 to 629,767. This essentially static population is not

expected to change and is reflected in USEAP R3 estimates of the future number of septic systems.

Because studies show that most of the nitrogen from OWTS is removed by natural processes in soil, the Bay Watershed Model attributes only about 10 pounds of nitrogen per year to streams for each system.

Residential OWTS are regulated by the New York State Department of Health (DOH), or are delegated to county health departments. DOH construction standards for new and replacement systems were updated in 1996. Larger OWTS, including private, commercial and institutional systems, are regulated by the DEC. Construction standards for these systems are found in the DEC's 1988 Design Standards.

The DEC and DOH have worked together to identify and prioritize resolution of rural areas with clusters of sub-standard systems and/or direct discharges. The Susquehanna and Chemung Watershed and Restoration and Protection Action Strategy (WRAPS, 2002) was based on such a process and identified six municipalities that applied for or received funding to correct the OWTS problems. Several of these sites have since been corrected. The WRAPS also recommended that 12 areas should begin studies and obtain funding to develop centralized wastewater treatment facilities and/or OWTS management districts. Remaining sites are a priority. The State Revolving Fund, Environmental Protection Fund and County Water Quality Committee Mini-Grants are available to communities to help resolve OWTS problems.

In addition, the DEC has identified sub-standard OWTS as a significant contributor to pollutants in urban stormwater runoff. Municipal separate storm sewer system operators are required to implement a process to identify and eliminate such illicit connections. This requirement is expected to reduce the number of sub-standard systems in urban areas.

While New York State does not routinely inspect residential OWTS, several watershed based programs have developed. In some areas, such as Lamoka - Waneta Lakes and Otsego Lake local inspection and enforcement programs exist. The Otsego Lake watershed is also the site of a demonstration project intended to increase the knowledge and understanding of advanced OWTS, including increased phosphorus removal capability.

As a means to protect water resources in a cost-effective manner, municipal management of OWTS is encouraged. The DEC encourages municipalities to conduct OWTS inspections and to develop OWTS management strategies. Nine such projects were awarded state grants in 2005. A local initiative in Schuyler County has used funding from various sources to cost-share replacement of failing or antiquated septic system components.

To further assist municipalities, the DEC is involved in the development of a statewide training program for OWTS professionals. A largely volunteer industry group called the Onsite Wastewater Treatment Training Network (OTN) has been formed. The Department has provided financial and staff support to the OTN.

A GIS-based inventory and tracking software now includes a module that local officials, watershed professionals and consultants can use to inventory and map septic systems. In addition to attributes such as tank size and material, the module allows linking photographs, plans and inspection records to each system. An inspection form has been developed by the OTN and is available for use in this system.

Because OWTSs make up a minor fraction of the total nitrogen load and because de-nitrifying systems are expensive (about $10,000/system), DEC does not consider it practical to expect major nitrogen reductions from OWTS. Although there could be isolated instances where additional nitrogen removal systems may be needed to meet local groundwater quality standards (codified at Title 6, Subpart 703 of the Codes, Rules and Regulations of the State of New York, found at http://www.dec.ny.gov/regs/4590.html), de-nitrifying systems are not included in this plan.

Program highlights:

- New residential systems less than 1,000 gpd are required to achieve specific design criteria in New York State Department of Health regulations (Part 75-A)

- **DEC requires all subsurface discharges greater than 1,000 gpd to obtain State Pollutant Discharge Elimination System permits and to adhere with New York State groundwater water quality standards**
    - **For sanitary subsurface systems greater than 30,000gpd, compliance with groundwater effluent standards for nitrate is required**

- Proposed Enhancement: Seek aggressive pursuit of eliminating direct discharges or inadequate systems with emphasis on areas identified in the 2002 Susquehanna and Chemung River Basin Watershed Restoration and Protection Action Strategy.

Forest

Harvesting

The New York Chesapeake Bay Watershed is about 75% forested. About 1% is harvested annually and about 23% of that has forest harvest water and soil resource protection BMPs installed as part of the harvesting activity.

The DEC BMP Field Guide, found at http://www.dec.ny.gov/lands/5240.html, is a practical tool for loggers, foresters and landowners. It presents suggestions, guidelines and technical references on a variety of timber harvesting practices, including skid trails, haul roads and landings. The guide is to be used as a menu of options to protect soil (and phosphorus), water and timber resources from loss or degradation.

Such BMPs are installed due in part to recommendations of a forest management plan (Forest Stewardship Program & Other Plans), or are required per Section 480a of the Real Property Tax Law on Certified tracts or required in Sales Agreements for timber harvests on DEC managed Multiple Use, Reforestation and Unique Areas collectively known as State Forests.

The installation of forestry BMPs are identified as a means to reduce the emission of nutrient and sediment that might otherwise be introduced into waters within the watershed during timber harvesting activities.

Estimates of management plans acres, Forest Tax Law tract acreage and actual State Forest timber sale acreage were used to generate an estimate of the number of acres on which timber was harvested pursuant to a management plan or statutory requirement that resulted in the installation of forestry BMPs.

Although there will be some annual fluctuation, the above annual estimate of managed forest harvest acres is expected to be constant. Yet, this figure may be underestimated. For instance, some Chemung County municipalities require the use forest harvest BMPs on all harvesting and not all of this may be captured in the state's data.

Atmospheric Deposition

In excess of 34% of the Chesapeake Bay's nitrogen loading is estimated to be from air deposition[43]. Atmospheric deposition is a significant load to all land use categories. Because approximately half of New York's allocation of nitrogen is attributed to forest (including small amount of non-tidal water deposition) and the impracticality of reducing nitrogen runoff from such extensive forestlands, it is necessary to heighten the focus on the Chesapeake "air-shed" which is significantly different than the watershed.

New York is a national leader in air quality controls and has already undertaken significant actions, including the following:

- Adoption of strict year-round NO_x controls at power plants and other stationary sources. Because nitrogen deposition during cold weather months is most likely to result in nitrogen losses to runoff, for reasons described above, this control will likely have the most significant effect.

- Adoption of the low-emission-vehicle (LEV) standards for nitrogen oxides.

- The Regional Greenhouse Gas Initiative (RGGI), under which seven northeast states, including New York and Delaware, have agreed to implement a cap-and-trade program to lower CO_2 emissions. This is the first such mandatory program in United States history. The RGGI allows carbon offsets, including sequestration of carbon due to afforestation and avoided methane emissions from agricultural manure management operations. Thus, the RGGI may provide resources through offset mechanisms to increase practices that support implementation of this strategy.

- Renewable Energy Portfolio Standard, which targets renewable energy as 25 percent of the electrical energy sold at retail in New York State by 2013. A Public Service Commission order authorized funds collected by utilities be used to help renewable energy projects get financing. Examples of projects under review within the Susquehanna/Chemung basins include more than 300 MW of wind power. The

[43] Executive Order 13508 202a report, September 2009

Renewable Portfolio Standard may also financially support farm digester production of methane and electrical generation.

- In 2005, the New York State Environmental Board approved state regulations that require significant reductions in greenhouse gas emissions from motor vehicles (LEV for carbon dioxide).

It is difficult to directly quantify the indirect nitrogen reduction benefits of the last three initiatives, but they are likely to reduce nitrogen emissions by reducing fossil fuel consumption.

New York's nitrogen allocation in 2003 accounted for atmospheric deposition reductions that were projected from the EPA Clear Skies Initiative. Since then, EPA promulgated the Clean Air Interstate Rule (CAIR) to require substantial reductions in nitrogen oxides from power plants. The EPA estimates that CAIR will result in significantly less nitrogen being delivered to Chesapeake Bay.

New York has regulatory and other air program initiatives that likely will result in more reductions, as will some of the agricultural practices outlined in this plan. Although model quantification of these reductions is not available at this time, when coupled with a better understanding of actual atmospheric deposition of nitrogen and its fate and transport in forested watersheds, a high level of nitrogen reduction is expected.

Other Key Program Areas

Floodplains

Floodplains play an important hydraulic function in river systems. Undisturbed floodplains dissipate flood water energy and allow flood waters to infiltrate native soils. These functions reduce erosion potential and facilitate natural processes to attenuate nutrients. In addition, disturbance of structures and fill materials during a flood inevitably lead to deposition of large quantities of sediment and other debris that contribute to violations of the state narrative water quality standard for deposition (which is none in amounts that will impair the best usage of the water body.) Further, such sediments will carry nutrients and other contaminates that have the reasonable potential to cause or contribute to violations of water quality standards. Improved local government administration of its floodplain development regulations will reduce nutrient and sediment transported downstream during flood events. This will be accomplished by enhancing the current FEMA/State program, whereby the New York State Department of Environmental Conservation conducts Community Assessment Visits and Community Assistance Contacts, works with municipalities to take corrective actions and reports resulting findings to FEMA.

Although not directly regulated, under pending CBRAP grant DEC will augment its work, under contract with FEMA, to audit/assist local government administration of floodplain development regulations enacted for participation in the National Flood Insurance Program. DEC will also assist municipalities with implementation of flood damage reduction programs that exceed federal standards and protect floodplain functions.

A focus will be restoration of the hydraulic function of floodplains, especially regarding smaller headwater streams that have often been isolated due to historic human alterations of stream beds and banks in an effort to limit out of bank flooding and resulting field scour or other perceived and/or real damages, and to retain the function of undeveloped floodplains.

- ***Stream Processes: A Guide to Living in Harmony with Streams (2007)***
  Developed by the Southern Tier Central Regional Planning and Development Board and Chemung County, this innovative guide describes how streams work and why functioning floodplains are integral parts of stream systems. The guide contains dramatic photographs that help promote the need for sound management practices. It already has had a positive effect on decisions made by Chemung County landowners and local highway departments. It can be found at the Chemung County Soil and Water Conservation District website, http://www.chemungcountyswcd.com/homepage.html.

Ecosystem-based watershed planning

Through an American Reinvestment and Recovery Act water quality planning grant from DEC, the Southern Tier Regional Planning and Development Board is developing a Susquehanna-Chemung Action Plan based on an ecosystem approach to watershed planning. The Action Plan is to be completed by the end of 2011. This plan will be a concise, highly accessible public document that provides a unified vision for the region and promotes funding for water resource projects that benefit the Basin's residents.

Its draft goals include:

- Capitalizing on water resources as economic assets
- Maintaining clean and abundant water supplies
- Living in harmony with streams
- Being prepared for floods
- Preserving the rich diversity of plant and animal life
- Slowing rainwater down, spread it out and soak it in
- Supporting sustainable agriculture and forestry
- Navigating toward better roadway drainage
- Connecting people to nature
- Cultivating a watershed ethic

While not readily translatable into USEPA Bay Watershed Model inputs, this project is expected to yield demonstrable water quality and water quantity related benefits.

Marcellus Shale

Current uncertainty regarding the details of how this vast natural gas reserve will be developed in New York and its impact on the landscape makes nutrient and sediment related watershed implementation planning uncertain. The uncertainty and potential results are significant enough to warrant USEPA R3 to consider this Draft Phase I Watershed Implementation Plan to be an interim plan pending completion of New York's regulatory framework for high volume hydraulic fracturing.

The issuance of drilling permits for high volume hydraulic fracturing is currently suspended pending completion of New York State's comprehensive review of the potential environmental

impacts of oil and gas drilling and production and how they are mitigated prior to permitting high volume hydraulic fracturing. (ref: http://www.dec.ny.gov/energy/46288.html)

New York expects a full suite of environmental controls to apply (the federal government has "de-regulated" these sites), including:

- Sites to obtain coverage under the Multi-Sector State Pollutant Discharge Elimination System General Permit for stormwater discharges
- Erosion and sediment control and post-construction stormwater management on all facets, including well pads, access roads and pipelines
- Spill prevention, control and countermeasures, including secondary containment for process liquids
- Wastewater disposal plans

Chesapeake Bay Executive Order 13508

Several natural resource objectives that stem from the issuance of this Order in May 2009 and the subsequent release of a Basin Protection and Restoration Strategy in May 2010 will contribute to sediment and nutrient reduction in New York. These principally include land conservation, brook trout and black duck habitat restoration and wetland restoration objectives. New York State looks forward to learning of the details of how various federal agencies will be supporting the attainment of these basin goals in New York.

The United States Forest Service and United States Fish and Wildlife Service are already working closely with New York in pursuit of these goals. USFWS held a kick off meeting with multiple local, state and other stakeholder in June 2010. The USFS is presently conducting work planning with DEC Division of Lands and Forests to effect a comprehensive forest conservation strategy for the Susquehanna/ Chemung region focused on maintaining and enhancing water quality. DEC also expects to work closely with the United States Army Corps of Engineers and others to locate and develop watershed restoration project implementation opportunities.

Local Roads

Streams and roads are closely related in the upper Susquehanna region. It is generally hilly terrain with many roads and a long history of settlement along its valley streams. There are about 13,800 miles of streams and 17,000 miles of roadways

Stabilizing road ditches and banks is a local priority, not only to minimize stream pollution, but also to improve highway safety and reduce ditch maintenance. Changes in how water flows along and across roads also can reduce erosion and flooding problems. Stream road crossings frequently contribute to stream instability due to channel alterations and floodplain encroachments that may occur. Dredging and other maintenance activities intended to protect this infrastructure may also contribute to stream destabilization.

Several roadway practices are beneficial, including hydro-seeding, grade breaks (check dams), under-drains, French mattresses (allowing water under the road through course stone), crown reshaping, profile and cross slope modification, high-water bypass techniques and the use of different surface aggregates. In-stream design structures, such as cross vanes, also protect bridges and culverts. Wetlands and other buffers also can be specifically designed and constructed or restored to capture road ditch runoff to reduce energy, capture sediments and

provide opportunity to denitrify atmospheric and automobile exhaust sources of nitrogen. Incorporating these concepts into planning, implementation and training efforts is essential.

The Cornell Local Roads Program LTAP Center (http://www.clrp.cornell.edu/) provides training, technical assistance, and information to municipal officials and employees responsible for the maintenance, construction, and management of local highways and bridges in New York State. It is one of 58 Centers established under the Local Technical Assistance Program (LTAP) of the Federal Highway Administration. Soil and Water Conservation Districts also provide technical assistance with road bank stabilization and erosion prevention associated with road systems.

The Waterbody Inventory/Priority Waterbody List

The DEC Division of Water (DOW) maintains an extensive inventory of the state's water resources. This inventory, the Waterbody Inventory/Priority Waterbodies List also provides summaries of general water quality conditions, tracks the degree to which the waterbodies support a range of uses and monitors progress toward the identification and resolution of water quality problems, pollutants and sources.

This PWL supplements the 303 (d) list and serves as an early warning system to protect good water quality and address problems before they reach the level of impairment of best usage of the waters. It serves as the basis for New York State Environmental Protection Fund funding programs such as Ag-nonpoint source. All of the Susquehanna and Chemung Basins (Chesapeake Bay watershed in New York) are listed as threatened for nutrient to make them eligible for funding improvements for Chesapeake Bay. This is despite the fact that only a few ponded waters are listed as impaired by phosphorus (none are impaired for nitrogen) on the 303 (d) list. Some streams are listed in the PWL as stressed or threatened, but not listed as impaired as would be found on the 303(d) lists.

Susquehanna at http://www.dec.ny.gov/chemical/36734.html
Chemung at http://www.dec.ny.gov/chemical/36746.html

Susquehanna Comprehensive Wildlife Conservation Strategy (SCWCS)

President Bush signed the Department of the Interior and Related Agencies Appropriations Act, 2002, into law on November 5, 2001. This bill included $80 million for wildlife conservation grants to states. The Fish and Wildlife Service is apportioning funds to New York under the State Wildlife Grants portion of Public Law 107 63. New York's strategy is based on major watersheds. The SCWCS was developed by the DEC and other interested organizations and individuals, including the USC. It describes actions that will protect, support and enhance species of greatest conservation need. To the extent possible, goals of the SCWCS are integrated into the Tributary Strategy. The SCWCS can be viewed at http://www.dec.ny.gov/animals/30483.html

2009 Open Space Conservation

The 2009 Open Space Conservation Plan (http://www.dec.ny.gov/lands/47990.html) takes a fresh approach to conserving our vital natural and recreational areas. Small or large areas; urban, suburban, rural or wilderness; can be protected with a combination of public land protection and thoughtful use of our own land. It incorporates the example of riparian areas; lands that line waterways, when protected and managed properly, can filter runoff, absorb stormwater and reduce catastrophic flooding downstream.

New York State Climate Action Plan Interim Report - November 9, 2010

New York has shown leadership in clean energy policy, and is taking actions to reduce emissions of the greenhouse gases (GHGs) that cause human-induced climate change. Governor Paterson's issuance of Executive Order 24 in August 2009 formally established a State goal of reducing GHG emissions 80 percent below 1990 levels by 2050 (or 80 by 50), and named the Climate Action Council to determine how to meet the goal. The Council was also tasked with developing a plan to increase New York's resiliency to a rapidly changing climate.

The public comment period for this report will extend for ninety days, beginning on November 9, 2010 and ending on February 7, 2011.