Agricultural Stewardship Plan

Suffolk County – March 2016

The purpose of the Suffolk County Agricultural Stewardship Plan is to provide a framework, series of recommendations, and an associated budget to promote the long-term responsible management of farmland in Suffolk County, consistent with Suffolk County's Comprehensive Water Resources Management Plan and the County Executive's Reclaim Our Water initiative.

Contents

Acknowledgments

This report would like to thank the following agencies, organizations, and individuals who gave tireless hours to the development and production of this comprehensive report including:

American Farmland Trust
David Haight – New York State Director
Jeff Ten Eyck - New York Agricultural Stewardship Specialist
Cornell Cooperative Extension of Suffolk County
Dale Moyer – Agriculture Program Director and Associate Executive Director
Rebecca Wiseman – Coordinator of the Agricultural Stewardship Program
Farmers
Frank Beyrodt – DeLea Sod Farm
Robert Nolan – Deer Run Farms
Karen Rivara – Aeros Cultured Oyster Company
Charles Scheer – Half Hollow Nursery (Retired)
Long Island Farm Bureau
Jessica Anson – Policy Director
Robert Carpenter – Administrative Director
New York State Department of Environmental Conservation
Anthony Leung – Region 1 Water Engineer
Joyce Rodler – Pesticide Control Specialist
Peconic Estuary Program
Alison Branco – Program Director
Suffolk County Department of Economic Development & Planning
Sarah Lansdale – Director of Planning
August Ruckdeschel – Farmlands Administrator
Suffolk County Department of Health Services
Walter Dawydiak - Director, Division of Environmental Quality
Ronald Paulsen – Hydrogeologist
Suffolk County Legislator Al Krupski – District #1
Suffolk County Performance Management Team
Richard Lanna - Senior Industrial Engineer
Suffolk County Soil & Water Conservation District
Paul TeNyenhuis – District Manager (Retired)
Polly Weigand - Technician
Suffolk County Water Authority
Steve Colabufo - Water Resources Manager
United State Department of Agriculture – Natural Resources Conservation Service
Liz Camps - District Conservationist
Allan Connell - Conservation Specialist

Executive Summary

Comprehensive agricultural stewardship requires the responsible planning and management of natural resources including water, plants, soils and wildlife on Suffolk County farmland. The agriculture industry in Suffolk County sees an opportunity to decrease nitrogen and pesticide levels found in Suffolk County ground and surface waters further by strengthening existing Agricultural Stewardship programs, supporting new research and pilot projects, and expanding on-going monitoring efforts.

The purpose of the Suffolk County Agricultural Stewardship Plan is to provide a framework, series of recommendations, and an associated budget to promote the long-term responsible management of farmland in Suffolk County, consistent with Suffolk County's Comprehensive Water Resources Management Plan and the County Executive's Reclaim Our Water initiative.

Development and Successes of the Agricultural Stewardship Program
In 2003 a task force of stakeholders was convened to develop an Agricultural Stewardship Program for Suffolk County and recommendations and a report were issued in 2004. The current Agricultural Stewardship program at Cooperative Extension of Suffolk County (CCE) is a result of that Task Force. This program has already shown meaningful decreases in nitrogen and pesticide inputs as it relates to agricultural practices. Approximately half of Suffolk County farmers are involved at some level with the New York State AEM program developed by the Suffolk County Soil and Water Conservation District (SCSWCD) and CCE. However, despite the great strides that have already been made through the efforts of this program, the lack of funding to complete the original vision of the Task Force has left the industry short of its goal.

Environmental Concerns
The agricultural industry in Suffolk County is dependent on the use of nitrogen fertilizers and pesticides. Nitrogen management is a major concern for the estuaries as excess nitrogen can contribute to adverse environmental effects including low oxygen areas (hypoxia), harmful algal blooms and loss of coastal vegetation. Pesticides and high nitrate concentrations in groundwater also present a public health concern where private drinking water wells are in use and increase treatment costs for public water suppliers.

Goals
The mission of the Agricultural Stewardship Program is to cooperatively develop a strategy to lower nutrient and pesticide loading associated with farming to the groundwater and surface waters of Suffolk County while maintaining a strong, viable agricultural industry.

Challenges
Challenges that limit the adoption of agricultural stewardship practices in Suffolk County include crop diversity, lack of funding, resource limitations, lack of trained and certified professionals and need for additional monitoring and evaluation techniques. The variety of crops grown by Long Island farmers drives up the expense of conservation actions. There is a lack of funding dedicated to local agencies that coordinate implementing stewardship initiatives and educate farmers as to their benefits. Adopting conservation practices can be both costly and risky to the individual farmer and funding is often necessary to alleviate these challenges. Access to trained and certified Technical Service Providers is extremely limited. There is a lack of an advisory body for coordinating evaluation efforts and programmatic effectiveness.

Recommendations
This report outlines a series of recommendations to improve the effectiveness of agricultural stewardship programs and initiatives.

Advisory Committee - To oversee these efforts the Task Force recommends that an Agricultural Stewardship Advisory Committee (ASAC) be created and appointed by the Suffolk County Legislature. The committee will evaluate the progress and effectiveness of stewardship efforts and review an annual budget and work plan to meet the goals of the stewardship plan.

Research and on Farm Demonstration Initiatives - There have been significant developments of best management practices for nutrient and pest management over the past 30 years. To continue development of new technology, local research is imperative in addressing the stewardship issue due to the diversity of crops in Suffolk County. It is not uncommon for a single farmer to grow twenty or more fruits and vegetables in their operation. Each crop requires different levels of pesticide applications and, different levels of fertilizer applications, therefore every nutrient management plan will need to be customized to fit each farm operation.

Education Outreach to Farmers - Research and on-farm trials are the first step in evaluating BMP effectiveness however it is crucial that these suggestions are successfully communicated to farmers. This includes workshops, newsletters and communication between farmers to increase participation in stewardship programs. This step is essential as education and outreach to the farm community is vital to success of the plan. Additionally to connect with next generation farmers nontraditional communications such as social media can be beneficial.

Funding for Staffing and the Implementation of Best Management Practices - Cost-share dollars for implementation of agricultural best management practices is fundamental in generating stewardship practices. Suffolk County Soil and Water Conservation District is recognized as the public agency authorized to draft and certify Nutrient Management Plans and associated practices. To accomplish this, Soil and Water technicians need specialized training and course work, accreditation as Certified Crop Advisors and demonstrated competency as well as continuing education training for technicians.

Increased Monitoring - The use of test wells to monitor groundwater is the best method to evaluate the impact of agricultural practices on groundwater quality. Cornell Cooperative Extension, New York Department of Environmental Conservation, Suffolk County Health Department and farmers have collaborated to establish a network of test wells at main crop commodities grown on Long Island. This network can be expanded and utilized to evaluate the effectiveness of best management practices and determine their effectiveness in reducing impacts to groundwater.

Public Outreach - Since the 2004 Agricultural Stewardship recommendations there has been clear and obvious progress. However, there is a need for an organized and comprehensive strategy to communicate the progress of agricultural stewardship efforts to the public-at large, local stakeholders and public policymakers.

Budget

In order to increase involvement in local agricultural stewardship efforts, additional funding from County, State, Federal and other sources will be required. The following budget recommendations are suggested over the next ten years:

- $4.1 million to provide on-site expertise and to write nutrient and pest management plans and to enhance existing monitoring and oversight;
- $16.8 million to offset farmer expenses associated with implementing best management practices;
- $5.7 million to fund research/pilot projects, educational outreach, and on-farm demonstration trials to develop Suffolk-specific best management practices including, but not limited to, the use of controlled release fertilizers, cover crops and bio-fumigants, pesticide-use minimization, integrated pest management strategies. It is expected that funding priorities within these pilot projects will change as new technologies and better management strategies are identified through the years.

The Development and Successes of the Agricultural Stewardship Program

Since its very beginning, agriculture has been a significant contributor to Suffolk County's (SC) quality of life. It has driven Long Island's economic productivity and land-use policy for generations of SC residents. While agriculture remains a critical generator of economic productivity, increased development pressures and continued suburbanization have substantially reduced the number of farms and farmers. At the time of SC's previous Agricultural and Farmland Protection Plan in 1996, the future of SC farming seemed in question. Growing in tandem with concerns about development pressures were concerns about Long Island's groundwater and estuarine waters, which were subject to inputs from the use of agricultural pesticides and fertilizers. With these economic and environmental concerns in mind the 1999 Agricultural and Farmland Protection Board created a subcommittee with wide representation, entitled the LI Agricultural Stewardship Committee.

In 2003 the SC Legislature passed a resolution to establish a Task Force to develop an Agricultural Environment Management Policy and Program for SC designed to promote the county's agricultural industry while protecting groundwater and surface waters. In 2004 the Task Force for Nitrogen and Pesticide Load Reduction submitted their final report to SC Legislature: *A Strategy to Develop and Implement the SC Agricultural Stewardship Program*. Legislation was then adopted in 2004 for Cornell Cooperative Extension to develop and coordinate the SC Agricultural Stewardship Program with funding made available through SC's Water Quality Protection and Restoration Program.

The 2004 Strategy to Develop and Implement the SC Agricultural Stewardship Program called on the supporting staff from Cornell Cooperative Extension (CCE), SC Soil and Water Conservation District (SCSWCD) and USDA-Natural Resources Conservation Service (NRCS) to provide professional guidance in the development of worksheets, comprehensive sustainable programs, best management practices (BMP's) and the implementation of Agricultural Environmental Management (AEM), conservation practices and on-farm demonstration projects. Additionally they were to serve as a liaison to growers and experts in the understanding of the economics and viability of new technology and precision agricultural management practices.

In the past ten years, the cooperative strategy developed by the Task Force to reduce nutrient and pesticide loading into ground and surface waters has provided research and guidance to SC farmers. Farmers have voluntarily adapted conservation efforts related to a reduction in nutrients and pesticides as a proactive approach to growing environmental concerns relating to estuarine health, water quality and public health in SC. The programs developed have delivered appropriate management and stewardship techniques and practices for Long Island that allow for a strong and viable agricultural industry. Sustaining a supportive, useful and successful program requires periodic evaluation of progress made, identification and prioritization of new goals, and recommendations for next step; all of which are captured within this updated report.

Steps Taken Since 2004

In May 2004, "*A Strategy to Develop and Implement the Suffolk County Agricultural Stewardship Program*" was released. In the ten years since the strategy was introduced, partnering organizations have taken many steps to increase agricultural stewardship efforts across the County.

Cornell Cooperative Extension

In 2004, funding was made available through Suffolk County's Water Quality Protection and Restoration Program (also known as Fund 477) to finance an Agricultural Stewardship Program through Cornell Cooperative Extension of Suffolk County (CCE). The Program was expanded though the same funding mechanism in 2005. Since its inception, Suffolk County has spent $3,037,136 on the Agricultural Stewardship Program.

CCE staff has made great gains reaching SC farmers across commodity groups. According to CCE, 90% of farmers participate, in some capacity, in programs offered by the Agricultural Stewardship Program including educational workshops and conferences, grower meetings and on-farm demonstration projects. Approximately 75% of farms receive CCE's educational programming regarding methods to improve pest and nutrient management practices to greatly reduce agriculture's impact on water quality. See **Appendix - Progress Since 2004** for additional information about Program outreach and adaptation within SC and specifically within the Peconic Estuary Watershed.

CCE, Cornell University, SCSWCD and NRCS, developed local Agricultural Environmental Management (AEM) worksheets to address unique crops and environmental concerns in place of the state-wide AEM program worksheets, which were primarily focused on dairy. A total of 14 worksheets addressing Nutrient and Pest management for orchards, vineyards, greenhouse, vegetables as well as Irrigation, Petroleum, Waste and Soil Management were drafted under this cooperative effort which strengthened these agencies abilities to conduct agricultural environmental planning locally. NYS Soil and Water Committee reviewed the sheets and approved their use for SCSWCD and NRCS. In order to help streamline the planning, the Ag Stewardship Program printed AEM sheets and developed best management practice fact sheets for grower reference.

Suffolk County Soil & Water Conservation District and Natural Resources Conservation Service

The SCSWCD and the NRCS have a well-established and effective partnership in which they advance on-farm conservation planning and practice design and implementation for the protection and enhancement of soil, water, air, plant and animal resources. Since 2004, on-farm conservation planning has occurred with 294 farmers in SC, with 60% of these growers moving forward with the implementation of best management practices. In terms of acreage, 78% of all Suffolk farmland has been planned or implemented best management practices on 46,336 agricultural acres[1]. Collectively, these agencies secured and allocated over $7.3 million dollars in conservation practice implementation assistance. Of this total, nearly $2 million was secured through the District (**Appendix – Grant Funding Secured by Suffolk County Soil & Water Conservation District**) and $5.6 million was allocated by the NRCS which encouraged the implementation of 40 different best management practices including nutrient and pest management, conservation cover, cover cropping, and irrigation water management. A programmatic highlight was the Fuel Tank Replacement Program, which facilitated the replacement of 207 fuel tanks (82,690 gallons) on 126 farms in SC with $955 thousand on cost share funding from New York State and the NRCS. Both agencies also were successful in conducting education and outreach programming to further engage and educate the County's growers on the conservation planning practices

[1] The acreage sum accounts for multiple practices on the same acres. For example, a farmer conducting nutrient management and pest management on the same 25-acre orchard would sum total 50 acres.

and funding available to protect the region's natural resources.

New York State Department of Environmental Conservation (DEC)

The DEC regulates the registration, commercial use, purchase and custom application of pesticides. The Environmental Conservation Law (ECL) sets forth the state's policy regarding pesticide usage. According to the ECL, pesticides, when properly used, are "valuable, important and necessary to the welfare, health, economic well-being and productive and industrial capabilities of the people of this state" (ECL 33-0301). However, pesticides also present potential dangers to health, property and the environment if improperly used. The DEC is committed to the reduced use of high-risk pesticides and the increased use of integrated pest management (IPM) techniques, including cultural, physical and biological pest control systems. As such, the DEC released the Long Island Pesticide Pollution Prevention Strategy (Strategy) in July 2014. The Strategy was developed in response to concerns related to the detection of pesticide-related constituents in the groundwater over time at various locations on Long Island and in recognition of the importance of protecting the environment while meeting critical pest management needs.

The State of Agriculture

According to the USDA's 2012 Agricultural Census, the total market value of agricultural products sold in SC was $239.8 million and SC continues to be a leading agricultural producer in New York State, with unparalleled levels of agricultural diversity. With nearby affluent markets, productive soils, and plentiful water resources, it is positioned for continued economic success. SC farmers average $6,666 in market production per farmed acre while New York state farmers in general only average $753 per farmed acre – a nearly nine fold advantage. This advantage reflects the unique nature of SC agriculture. Nursery and greenhouse products represent 70% of the total value of all SC agricultural products sold in 2012, with sales totaling $168.4 million. Suffolk's production of nursery and greenhouse products was more than five times greater than the next highest county in New York State and accounted for 40.8% of New York State nursery and greenhouse production. SC ranked number one in the state in the market value of poultry & poultry products sold in 2012, $24.1 million. SC also ranked number one in the state in the market value of aquaculture products sold in 2012, $9.3 million, which represented 52% of the entire New York State total and was a 22% increase since 2007. The revival of the SC shellfish industry itself brings a renewed dedication to protecting SC water bodies as a means of driving continuing economic development. For more information on changes to SC agricultural land use and market production, see **Appendix - Change of SC Farming in Past 30 Years**.

Agricultural diversity and changes in the composition of SC's farmland acreage are important to note because different types of agriculture require different levels of pesticide and fertilizer applications. It is not uncommon for a single farm to produce a variety of crops all requiring differing levels of pesticides and fertilizers (see **Appendix – Change of SC Farming in Past 30 Years – Table 2. Nitrogen Requirement by Land Use**). Multi-crop farming on Long Island requires specific planning and technicians to accurately address stewardship concerns.

Environmental Concerns

Crop production at any scale is fertilizer dependent and typically relies on pesticides to ensure a productive yield. Nitrogen management is a major concern for estuaries around Long Island. Nitrogen contributed from fertilizers (along with wastewater, atmospheric deposition and other sources) has already resulted in adverse environmental impacts such as low oxygen areas (hypoxia), harmful and toxic algae blooms, and loss of coastal vegetation that provides critical habitat and protects shorelines from storm impacts.

As underscored in The Nature Conservancy's report titled *Nitrogen Load Modeling to 43 Subwatersheds of the Peconic Estuary*[2] specific to East End of Long Island, "while some nitrogen is a natural and necessary nutrient in estuarine ecosystems, excessive quantities of nitrogen have been shown to cause eutrophication, leading to fish kills, harmful algal blooms, loss of seagrass and salt marsh habitat, low dissolved oxygen conditions, and over-sedimentation (Cloern 2001, Deegan et al. 2012, Latimer and Charpentier 2010), and acidification (Gobler et al 2014)". Nitrogen in surface waters has been directly linked to the frequency, duration, severity, and toxicity of algal blooms in Long Island waterbodies (Gobler et al, 2012, O'Neil et al, 2012).

Progress has been made in the control of point-source nitrogen loading to our estuaries, through regulatory tools like Total Maximum Daily Load (TMDL) limits placed on sewage treatment plants. But non-point sources, like on-site wastewater disposal systems (septic systems) and fertilizers, influence the Peconic Estuary watershed and the eastern coast of Long Island Sound. The nature of nonpoint source management is complex and challenging, as it deals with extremely pervasive contributions that are diffuse and not easily regulated with traditional regulatory tools like TMDL.

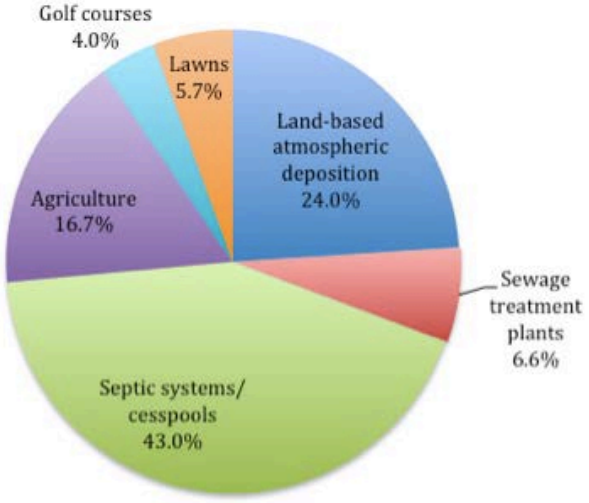
The Nature Conservancy's May 2014 report, evaluated only land-based sources of nitrogen, found wastewater "to be the largest single contributor of nitrogen for the Peconic Estuary as a whole (49.6%), with fertilizer (26.4%) and atmospheric deposition (24.0%) following" (Lloyd 2014). As noted on the following table, the significant source of atmospheric deposition to the open water surface was not calculated. The fertilizer category is comprised of agriculture (16.7%), lawns (5.7%) and golf courses (4.0%) within the watershed of eastern Long Island. On-site wastewater treatment contributed greater than 50% of the nitrogen load in 19 of the subwatersheds, with four sub-watersheds showing a contribution of over 75% (see Figure 1). Agriculture was typically an important source in the larger subwatersheds of the North Fork, with three sub-watersheds having contributions of greater than 50% from agricultural fertilizer.

[2] The Nature Conservancy report is based on a Nitrogen Loading Model (NLM) utilizing current information about atmospheric deposition rates, on-site wastewater systems, sewage treatment plant outputs, fertilizer application rates, and spatial data on population, land use, and land cover.

Figure 1 – Source: The Nature Conservancy

Total Nitrogen Loading to the Peconic Estuary

	kg N yr⁻¹
Land-based atmospheric deposition	**64,233**
Wastewater	**132,453**
Septic systems/cesspools	114,737
Sewage treatment plants	17,717
Fertilizer	**70,415**
Lawns	15,350
Golf courses	10,590
Agriculture	44,475
TOTAL	**267,101**
Subwatershed area (ha)	44,083
Yield	6.1



Nitrogen loading has impacts on estuarine health causing hypoxia and algal blooms (**Appendix – Environmental Concerns: Estuarine Health**). Hypoxia is a condition in which dissolved oxygen levels are low enough to be detrimental to aquatic organisms living in the ecosystem. Algal blooms are the rapid production and accumulation of microscopic algae caused by nutrient enrichment. The algal blooms decrease water clarity and diminish the amount of light received by rooted aquatic plants, such as eelgrass, that are essential to aquatic environments. There are also public health concerns associated with high nitrate levels in drinking water (**Appendix – Environmental Concerns: Public Health**). Nitrate is one of the most common groundwater contaminants in drinking water and excess levels can cause methemoglobinemia in infants. Fortunately, nitrogen levels in SC waters have never neared limits associated with this blood disorder. Impacts to public drinking water resources in terms of both quality and quantity are a growing concern as the demand for water resources increases (**Appendix – Impacts to Public Drinking Water Resources**). To ensure the ample availability of drinkable groundwater it is imperative to avoid negative water quality effects.

Goals for Suffolk County Agricultural Stewardship Program

Mission: Cooperatively develop a strategy to lower nutrient and pesticide loading associated with farming to the groundwater and surface waters of SC while maintaining a strong, viable agricultural industry.

1. At least 85% of the farmers[3] in Suffolk County should enroll in Tiers III-V in the **AEM** program and adopt best management practices (BMPs) to prevent or minimize non-point or point contamination from agricultural inputs. BMPs will include methods of reducing pesticide and nitrogen use and/or maximizing the efficiency of these agricultural inputs by improved timing, formulations, new products, new technologies, water and soil management and use of new crops/varieties, to limit leaching and run-off.

2. Secure approximately $10.2 million in cost-share funding needed to write and implement 90 Nutrient Management Plans over the next ten years. When appropriate, funding sources should prioritize parcels impacting the Long Island Sound and Peconic Estuary.

3. Secure approximately $6.6 million in cost-share funding needed to write and implement 90 Integrated Pest Management Plans over the next ten years. When appropriate, funding sources should prioritize parcels impacting the Long Island Sound and Peconic Estuary.

4. Provide technical support staff, educational and cost-sharing opportunities to improve agricultural stewardship specifically oriented to Suffolk County's agricultural and environmental concerns.

5. Fund research to develop best management practices that reduce nitrogen and pesticide impacts on the environment.

6. Provide educational programs that encourage the adoption of best management practices that prevent or reduce non-point or point contamination from agricultural inputs.

7. Provide long-term sufficient funding to continually improve best management practices to prevent or reduce non-point and point contamination from agricultural inputs.

8. Provide technical support, educational and cost-sharing opportunities to more effectively utilize groundwater for irrigation and to integrate water withdrawal information into an overall resource management strategy.

9. Establish an active Agricultural Stewardship Advisory Council that will guide stewardship efforts and assist in consumer outreach, marketing, obtaining funding, and evaluation of the program.

10. Provide an on-going evaluation of the stewardship program, which will target pesticide and nitrogen use and the development and adoption of best management practices. Produce an annual report which shall summarize on-going stewardship efforts and evaluate programmatic effectiveness. Evaluation of this program will require long-term, targeted groundwater monitoring.

[3] For purposes of this report, the farms targeted shall be those commercial agricultural operations with less than seven acres who average over $50,000 in annual sales and farms of more than seven acres who average $10,000 or more in annual sales.

Challenges

Following is a list of Suffolk County-specific challenges that limit the adoption of Best Management Practices in local agriculture:

- **Crop Diversity:** Most SC farmers do not grow a single crop, or raise a single type of animal. They grow multiple crops or raise several kinds of animals. It is not uncommon for a single farmer to grow twenty or more fruits and vegetables in a single operation. This can complicate and drive up the expense of conservation actions such as Nutrient and Pest Management Plans.

- **Improve New York State Technical and Financial Support:** New York State, which is generally supportive of its agricultural industry, needs to do more to address the unique environmental challenges facing Suffolk County agriculture. New York State policies and funding sources traditionally prioritize dairy farming and single crop agriculture.

- **Increase Funding and Resources:** Funding for applied research is essential for the development of nutrient and pest management practices due to the diversity of crops grown in SC. On-farm demonstrations are critical strategies to help encourage farmers to adopt new practices, as these programs allow farmers to gain first-hand experience with specific management practices. Cost-share programs advance stewardship efforts by offsetting the expense of adopting a new conservation practice and/or the purchase a new piece of equipment. It can also minimize economic risk.

- **Mission Alignment:** Federal, State, and County governments all offer programs that have benefited farmers and improve conservation efforts through a wide variety of programs and funding mechanisms. Different agencies, such as CCE, SCSWCD and NRCS, have slightly different missions, with different priorities, at different points in time. Maintaining agricultural viability and preserving water quality are enduring SC government priorities. To effectively advance successful stewardship and collaboration, some measure of coordination must be maintained in order to serve these priorities across government agencies and through supporting research and educational institutions.

- **Participation**: Best Management Practices are voluntary and not required to be implemented. Adopting conservation practices can be both costly and risky to the individual farmer and funding is often necessary to alleviate these challenges and concerns. For example, the NYC Watershed Advisory Council provides 100% cost share to farms. This approach has been instrumental in programmatic success and has led to more than 90% of the large farms within the Catskill/Delaware and Croton Watersheds adapting Whole Farm Plans and Best Management Practices.

- **Training/Certification Needs:** Suffolk County must secure and provide access to the expertise needed to handle the workload created by targeted nutrient and pest management plan and practice implementation. Plans will have to be developed and practices designed and installed according to specific standards which will require a significant staffing increase, an increase in staff training and certification and/or access to third-party experts such as Technical Service Providers. As of this report, agencies are significantly understaffed to meet challenges and no local staffers or agencies are certified nutrient or pest management planners.

- **Monitoring:** The monitoring of pesticides and agriculture-based nitrogen loading is on-going and difficult because there are multiple sources over large areas leaching into a complicated groundwater system. SC must develop and implement an effective strategy to monitor the direct and long-term effects of agronomic conservation practices installed to reduce nitrogen and pesticide leaching including continued ground water monitoring. This program will require the successful coordination between the following government agencies that are all involved with groundwater monitoring on Long Island: Suffolk County Department of Health Services (SCDHS), CCE, DEC, public water suppliers and the United States Geological Survey (USGS).

- **Evaluation:** Information about farmers' adoption of conservation practices in Suffolk County is fragmented and supported by multiple agencies. There is a lack of an advisory body for coordinating evaluation efforts and programmatic effectiveness, as well as a need for a more comprehensive assessment of current conditions and adapted practices in order for governments, non-profits, educational institutions and for-profit organizations to work effectively together as partners.

Recommendations

1.) Agricultural Stewardship Advisory Committee

The Task Force recommends that the Suffolk County Legislature create and appoint an Agricultural Stewardship Advisory Committee (ASAC) to oversee the Suffolk County Agricultural Stewardship Program. The principle function of the ASAC shall be to develop and advise the implementation of the annual workplan relating to nitrogen and pesticide loading reduction strategies pursuant to this report. The Committee will use the Key Performance Indicators as guidance. In addition, the Committee shall advise the Suffolk County Legislature on the progress and implementation of reducing nitrogen and pesticide leaching. Tasks shall include but not be limited to:

1) Report to the Legislature on the progress of meeting the nitrogen and pesticide reduction goals;
2) Evaluate and advise the Suffolk County Legislature on the progress and effectiveness of programs underway and recommend additional reduction strategies;
3) Propose an annual budget and recommended workplan to the Suffolk County Legislature that will allow agriculture to meet the stated goals.

This committee shall meet three times per year, additionally if necessary, and shall produce an annual report which shall summarize on-going stewardship efforts and evaluate programmatic effectiveness. The impacts of budgetary shortfalls on participating organizations and their abilities to meet goals shall be recognized when evaluating programming.

The Agricultural Stewardship Committee shall be comprised of the following fourteen members:

1) The Director of Planning from the Suffolk County Department of Economic Development & Planning or designee who shall serve as Chair;
2) The Commissioner of the Suffolk County Department of Health Services or designee;
3) The Chair of the Suffolk County Legislature Environment, Planning & Agriculture Committee or designee;
4) The Director of the Peconic Estuary Program or designee;
5) A representative from Cornell Cooperative Extension of Suffolk County;
6) A representative from Suffolk County Soil & Water Conservation District;
7) A representative from Natural Resources Conservation Service of the United States Department of Agriculture;
8) A representative from The New York State Department of Environmental Conservation;
9) A representative from the Suffolk County Water Authority;
10) A Farmer to be recommended by the fruit/vegetable industry;
11) A Farmer to be recommended by the horticultural industry;
12) A Farmer to be recommended by the livestock industry;
13) A Farmer to be recommended by the viticulture industry.
14) An Agribusiness representative to be recommended by the agriculture industry.

2.) Research and On-Farm Demonstration Initiatives

Significant developments of best management practices for nutrient and pest management have occurred over the past 30 years. However with the diversity of crops in SC (noted in the Challenges section) and the continued development of new technology, local research is of utmost importance to address the stewardship issue. It is estimated that an average of eight research projects for each of the five major commodity groups (vegetable, fruit, sod, greenhouse and nursery) will be conducted during a five-year period to meet these research needs. Each project will be conducted for a two- to three-year period to confirm the results of the study.

The local research conducted would result in the development of new Best Management Practices or changes to BMPs to reduce and minimize the impact on the groundwater and surface waters while maintaining the economic viability of agriculture. Nutrient management trials will focus on formulations, rates and timing of nitrogen. Pest management trials will include evaluations of alternative pest controls, biological controls, pest-resistant crops and organic strategies. Other research must focus on providing economic data to local farmers to help them remain economically competitive and financially able to implement BMPs. Promising practices should advance from small-scale research projects to large-scale on-farm demonstrations. Once demonstrated to be a viable practice on a large scale, these BMPs will be incorporated into Nutrient and Pest Management Plans and adopted by producers.

The following are examples of research that need to be conducted:

- Evaluation of various formulations of nitrogen, especially controlled release forms for vegetable and fruit crops, sod and nursery to determine if nitrogen contamination to groundwater and surface water is reduced and economically viable yields are maintained.
- Evaluate and support new cultivars which will use less nitrogen and/or demonstrate higher disease resistance compared to standard varieties.
- Develop alternative pest management practices to replace pesticides which have the potential to impact the environment.
- Conduct research on new pesticides and encourage the registration of newer, environmentally safer products.
- Develop irrigation management practices, including the evaluation of the most effective equipment such as precision irrigation for greenhouses and other commodities.
- Develop thresholds for pests and scouting and monitoring procedures
- Develop web-based pest forecasting and modeling programs using the weather station network.
- Use of treatment technologies to remove pollutants from groundwater as a remedial measure in areas where groundwater is contaminated.

Brief descriptions of example projects to minimize the impact of nitrogen and pesticides due to agricultural inputs are attached in **Appendix – Research and Pilot Projects**.

3.) Education and Outreach

Research and on-farm trials are the first step in evaluating BMP effectiveness. However, once BMPs are identified, those suggestions must be successfully communicated to SC farmers. While some farmers may actively seek out new technologies, environmentally friendly practices, and cost-minimizing strategies, some farmers may not. Word-of-mouth has always been a strong communication medium within the agricultural community. Farmers are willing to adopt beneficial insect controls, or mating disruption technology, or slow release fertilizers, when they see neighboring farmers have success with those methods. But first adopters are essential in this process. CCE, SCSWCD, and NRCS must continue to use traditional and non-traditional means to communicate with the agricultural community. This means traditional communications like CCE's Agricultural News and Long Island Fruit & Vegetable Update, but also the use of social media and the sharing of user-created content such as you-tube mediums. It means that SCSWCD and NRCS must continue to hold Soil Health Education workshops, but it must work hard to increase participation and attendance rates through old and new mediums. Subscribers to USDA e-newsletters will notice a new use of video-based communications and user-friendly websites. Next generation farmers will seek out new information through traditional outlets, and through in-person visits to the Riverhead offices, but they increasingly expect to come across information organically through new media. State and County agencies must help advertise the education and technical services offered through local programming.

4.) Funding for Staffing and the Implementation of Best Management Practices

The SC Soil & Water Conservation District 's Agricultural Environmental Management (AEM) program utilizes the NY State AEM process to support the County's diverse agricultural community in its effort to protect the quality of region's ground and surface water as well as its other natural resources, while maintaining a strong, viable agricultural industry. This goal will be achieved by completing AEM Tiers I-V with growers. Assistance to producers will be provided through conservation planning, design, installation and cost-share opportunities. The objective is to have 85% of farms acres enrolled in Tiers III-V in 2025. Cost share monies will be sought through programs such as New York State Department of Agriculture & Markets Agricultural Non-Point Source Abatement & Control Program (ANSACP) to encourage the planning and implementation of best management practices.

In NY State, Soil & Water Conservation Districts have an integral role in working with USDA - Natural Resources Conservation Service to set conservation goals, provide the maximum technical assistance to farmers and to leverage federal funding made available through the Farm Bill. Federal programs to support these programs include the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), Agricultural Management Assistance Program (AMA) and Agricultural Conservation Easement Program (ACEP). These federal programs may cover implementation costs for practices including, but not limited to, pest and nutrient management, conservation cover crops, critical area planting, tillage, filter strips, irrigation systems, micro-irrigation, water management and windbreaks.

5.) Increased Monitoring

The use of test wells to monitor groundwater is the best method to evaluate the impact, or the lack of impacts, of agricultural practices on groundwater. The Suffolk County Department of Health Services (SCDHS) has been monitoring test wells adjacent to agricultural fields and greenhouses for over 30 years. During that time approximately 200 test wells have been established to evaluate impacts from agricultural inputs. In the past three years, CCE, DEC, SCDHS and SC farmers have collaborated to establish a network of test wells at locations where main crop commodities are grown on Long Island. These wells have been established at greenhouse, sod, nursery, vineyard and vegetable operations. Groundwater samples are collected from the top of the water table in order to detect nutrients and pesticides applied on site and to minimize potential influences from up-gradient land uses. As part of this program, all growers participating in CCE's Agriculture Stewardship program share site-specific pesticide and nutrient use data along with agricultural practices with CCE staff so that this information can be compared with the groundwater quality data collected from the nearby monitoring wells. With additional funding, this network can be expanded as needed to evaluate the effectiveness of best management practices in reducing the impacts to groundwater.

CCE, SCSWCD and NRCS will continue to work with growers to document pesticide and nutrient use and agricultural management practices. SCDHS will monitor test wells semi-annually. As part of the trend analysis, CCE will collaborate with growers to evaluate the causes/reasons for detection and non-detection of various selected pesticides and nutrients and evaluate grower best management practices to determine their value in minimizing groundwater impacts.

6.) Public Outreach

There has been clear and obvious progress made since the 2004 recommendations in agricultural stewardship. This progress has been documented within the body and appendices of this report. However, no organized and comprehensive efforts have been made to communicate these successes to the public-at-large, to local stakeholders and to public policymakers. Part of the Agricultural Stewardship Advisory Committee mission is to evaluate programmatic effectiveness. But it must also serve as a clear and consistent communication medium. It should serve as an organization that speaks to legislative inquiries and concerns, that communicates in a uniform voice with local journalism outfits, and that guides interested citizenry to appropriate historical trends, performance measures, and success narratives. It must position itself as both a warehouse of historical and present day data, but also as an advocacy arm for a) mission realignment when needed and b) increasing funding when appropriate and c) extolling the effectiveness of agricultural stewardship practices (for example, the use of controlled release fertilizers).

Proposed Budget

In order to increase involvement in local agricultural stewardship efforts, offer additional on-site expertise, write NMPs and IPMs, and enhance monitoring and oversight, the following operational needs and costs have been identified by the authors of this report.

Educational, Technical, and Evaluation Services Ten Year Budget = $4,142,953

Budget							
Educational, Technical, and Evaluation Services							
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Years 6-10**	**Ten Year Total**
Cornell Cooperative Extension							
Salary Costs - Soil Fertility Specialist	$75,000	$77,415	$79,908	$82,481	$85,137	$468,613	$868,553
Department of Health Services							
Monitoring & Sampling Costs	$109,325	$112,845	$116,479	$120,230	$124,101	$683,082	$1,266,061
Salary Costs - Sanitarian/Engineering Aide/Chemist	$104,445	$107,808	$111,280	$114,863	$118,561	$652,591	$1,209,547
Suffolk County Soil & Water Conservation District							
Salary Costs - Specialist/Agronomist	$68,976	$71,197	$73,490	$75,856	$78,298	$430,974	$798,791
Total	**$357,746**	**$369,265**	**$381,156**	**$393,429**	**$406,097**	**$2,235,259**	**$4,142,953**
* Year-to-Year Budget Increases are estimated based on a 3.22% yearly inflation rate.							

In addition to operational costs and investments, money must be allocated directly to farmers in order to share the cost of writing and implementing recommended NMPs and IPMs. The following proposed cost-share Budget, to be funded primarily through NRCS, assumes 90 Nutrient Management Plans and 90 Integrated Pest Management Plans would be written and in various stages of implementation over the next ten years. The educational, technical, and evaluation services Budget recommended above will help provide the staffing needed to write, over see, and monitor the effectiveness of these implementation strategies. Please see **Appendix - Cost Share Budget Estimation** for the assumptions behind these budget estimates below.

Cost-Share Dollars Needed to Implement Recommended BMPs Ten Year Budget = $16,791,570

Cost-Share Dollars Needed for Farmers to Implement BMPs	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Years 6-10**	**Ten Year Total**
Nutrient Management Plans - Plans Written	3	5	7	9	11	55	90
Cost Share Dollars ($10,000/Plan)	$30,000	$50,000	$70,000	$90,000	$110,000	$550,000	$900,000
Nutrient Management Plans - Plans Being Implemented	0	3	8	15	24	55	79
Cost Share Dollars ($32,721/Farm/Year)	$0	$98,163	$261,768	$490,815	$785,304	$7,689,435	$9,325,485
Integrated Pest Management - Plans Written	3	5	7	9	11	55	90
Cost Share Dollars ($10,000/Plan)	$30,000	$50,000	$70,000	$90,000	$110,000	$550,000	$900,000
Integrated Pest Management - Plans Being Implemented	0	3	8	15	24	55	79
Cost Share Dollars ($19,881/Farm/Year)	$0	$59,643	$159,048	$298,215	$477,144	$4,672,035	$5,666,085
Total	**$60,000**	**$257,806**	**$560,816**	**$969,030**	**$1,482,448**	**$13,461,470**	**$16,791,570**

Lastly, the following projects have been identified by CCE educators and other industry leaders as the most promising agricultural programs to protect our ground and surface waters. There is no current expectation that revenue currently exists to fund all of these projects. Partners should work together to identify funding streams to prioritize certain projects on the list below, particularly those projects that can assist farmers within the Peconic Estuary. The recommended mix of research and pilot projects below is expected to change as better strategies emerge, alternate funding sources are identified, and newer technologies demonstrate their effectiveness.

Research and Pilot Projects Ten Year Budget = $5,748,141

Budgets for CCE Research and Pilot Projects							
Pilot Projects	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Years 6-10**	**Ten Year Total**
Development and Evaluation of BMPs for Controlled Release Fertilizers in Vegetable Crops	$58,000	$59,160	$60,343	$61,550	$62,781	$325,000	$626,834
Evaluating Mustard Cover Crops as a Biological Alternative to Fumigation	$55,000	$56,100	$57,222	$58,366	$59,534	$300,000	$586,222
Minimizing Pesticide Use in Vegetable and Potato Production with Resistant Variety Evaluations	$25,000	$25,500	$26,010	$26,530	$27,061	$150,000	$280,101
Development of Strategies to Reduce Fertilizer Leaching from Containerized Plants	$40,000	$40,800	$41,616	$42,448	$43,297	$225,000	$433,162
Development of Best Management Practices for Herbicides Detected in Groundwater	$24,000	$24,480	$24,970	$25,469	$25,978	$140,000	$264,897
Development of Programs That Minimize Use of Fungicides That Have the Potential to Leach	$28,000	$28,560	$29,131	$29,714	$30,308	$165,000	$310,713
Promoting Sustainable Practices in Vineyards	$30,000	$30,600	$31,212	$31,836	$32,473	$175,000	$331,121
Best Management Practices in Conjunction with Groundwater Monitoring	$25,000	$25,500	$26,010	$26,530	$27,061	$150,000	$280,101
Development of Alternative Practices to Insecticides That Have the Potential to Leach	$40,000	$40,800	$41,616	$42,448	$43,297	$225,000	$433,162
Engaging Suffolk County Growers to Implement a Comprehensive IPM Program	$85,000	$86,700	$88,434	$90,203	$92,007	$475,000	$917,343
Improving Nitrogen Fertilizer BMPs and Adoption CRNF	$120,000	$122,400	$124,848	$127,345	$129,892	$660,000	$1,284,485
Total	**$530,000**	**$540,600**	**$551,412**	**$562,440**	**$573,689**	**$2,990,000**	**$5,748,141**

Potential Funding Sources

Federal

- Environmental Quality Incentives Program – USDA-NRCS
- Conservation Stewardship Program – USDA-NRCS
- Agricultural Management Assistance Program – USDA-NRCS
- Agricultural Conservation Easement Program – USDA-NRCS
- Regional Conservation Partnership Program – USDA-NRCS
- Specialty Crop Research Initiative – USDA-NIFA
- The Northeastern IPM Center – USDA-NIFA
- Farm Service Agency – USDA
- Small Business Innovation Research Program – USDA
- Long Island Sound Futures Fund

State

- Agricultural Nonpoint Source Abatement & Control Program – NY State Agriculture & Markets
- Climate Resilient Farming Pilot Grant Program – NY State Agriculture & Markets
- Farmland Protection Implementation Grant – NY State Agriculture & Markets
- New Farmers Grant Fund – NY State Agriculture & Markets
- Environmental Protection Fund – New York State

County/Town

- Water Quality Protection Program (Fund 477) – Suffolk County
- Purchase of Development Rights Program – Suffolk County
- Community Preservation Funds (CPF) – Five East End Towns

Private/Non-Profit

- Farmers For The Future Agricultural Capital Equipment Grant Program – Peconic Land Trust and Empire State Development
- The Northeast Sustainable Agriculture Research & Education
- New York Farm Viability Institute

Key Performance Indicators

Performance indicators are an important barometer of strategy implementation success. To measure a program's effectiveness, setting goals and consistently evaluating if those goals are being met is imperative. However, performance metrics will never be perfect. Water quality is going to be impacted by residential land usage and fertilization, atmospheric deposition, wastewater treatment, urban development, changes in weather patterns (including global warming), the adaptation of new and unpredictable technologies, social and cultural changes that affect water usage, etc. Input-based performance indicators, such as the number of nutrient management plans written and implemented, will help speak to the reach of these programs and to the effectiveness of these strategies in protecting ground and surface water qualities. It is important to note that many farmers are adopting BMPs such as composting, cover cropping, reduce tilling, etc. that are not captured in formal key performance indicators such as AEM enrollment because these practices are adopted independent of formal AEM enlistment. It is equally important to note that the current lack of access to Technical Services Providers may constrain the agriculture industry's ability to reach certain targets.

While this report does not set a specific nitrate concentration target for groundwater, the Long Island Nitrogen Action Plan, currently being spearheaded by the Long Island Regional Planning Council and the NYSDEC, should help inform nitrogen level targets as that plan is written and developed with environmental and agriculture industry input.

Suitable goals and performance indicators regarding pesticide usage, trends in groundwater concentrations, detections and frequency, and the adaptation of best management strategies within the industry regarding the appropriate usage of pesticides shall be established by the NYSDEC *Long Island Pesticide Pollution Prevention Strategy* currently in progress.

*** 2025 Goals are dependent upon the sufficient acquisition of technical and cost-share implementation funding.**

Key Performance Indicators	Unit of Measurement	Data Source	2004	2015	2025 Goal*
Farms in Tier III	# of Farms	SCSWCD	67	113	159
	% of Farms		11%	19%	26%
	# of Acres		7,675	12,224	9,000
	% of Acres		22%	34%	25%
Farms in Tier IV	# of Farms	SCSWCD	33	121	201
	% of Farms		6%	20%	33%
	# of Acres		2,790	10,589	16,000
	% of Acres		8%	29%	44%
Farms in Tier V	# of Farms	SCSWCD	10	60	160
	% of Farms		2%	10%	26%
	# of Acres		1,314	5,248	9,000
	% of Acres		4%	15%	25%
Total Farms in Tier III-V	# of Farms	SCSWCD	110	294	520
	% of Farms		19%	49%	86%
	# of Acres		11,778	28,061	34,000
	% of Acres		34%	78%	95%

Key Performance Indicators	Unit of Measurement	Data Source	2004	2015	2025 Goal*
Nutrient Management Plans Written	# of Farms	SCSWCD	1	40	119
	% of Farms		0%	7%	20%
	# of Acres		496	8,468	13,868
	% of Acres		1%	24%	39%
Nutrient Management Plans Being Implemented	# of Farms	SCSWCD	1	23	79
	% of Farms		0%	4%	13%
	# of Acres		496	8,264	13,004
	% of Acres		1%	23%	36%
Integrated Pest Management Plans Written	# of Farms	SCSWCD	1	34	96
	% of Farms		0%	6%	16%
	# of Acres		122	6,864	12,264
	% of Acres		0%	19%	34%
Integrated Pest Management Plans Being Implemented	# of Farms	SCSWCD	1	22	101
	% of Farms		0%	4%	17%
	# of Acres		122	5,938	11,152
	% of Acres		0%	17%	31%
Controlled Release Fertilizer Usage	# of Farms	CCE	0	31	50
	# of Acres		0	2,172	3,000
# Research/Demonstration Projects	# of Projects	CCE	36	64	65
# Attendees to Education Presentations	# of Attendees	CCE	550	700	700
Number of Monitoring Wells	#	DHS/CCE	5	52	125
Number of Monitoring Samples	#	DHS/CCE	20	104	150
Groundwater Quality	Nitrate Concentration	DHS/CCE	10.3	8.5 (2013)	**

** Groundwater Quality Nitrate Concentrations are drawn from down gradient monitoring wells on five farms that have been monitored from 1998 through 2013. See **Appendix - Environmental Concerns Figure 1: Long Term Nitrogen Monitoring for Mixed Use Agriculture**. As a 2025 Goal, there is a continued expectation that Nitrate concentrations measured at these agricultural test wells *will continue to decline*.

Conclusions

Even in the face of environmental pressures agriculture remains a significant contributor to SC's local economy and culture. Concerns about Long Island's groundwater and estuarine waters continue to grow and be a constant subject of interest in the media and government. Professional guidance and leadership from local agencies and organizations can ensure that waterways will be protected and feasible solutions are generated for Long Island farmers to implement.

In order to continue and build upon the progress of agricultural stewardship on Long Island, the implementation of best management practices with a focus on nutrient and pest management planning by qualified agency staff is crucial. This report represents the joint collaboration of various local agencies and organizations invested in ensuring the sustainability of agriculture and environmental health in the region. These organizations and agencies are best suited to advance agricultural stewardship while protecting the viability of the agricultural industry. However, local collaboration, technically appropriate support, and progressive management can only be implemented, monitored and evaluated by trained technicians with sustained and enhanced access to adequate resources. Through this proactive and collaborative approach farmers can address the growing environmental concerns surrounding the topic of groundwater and surface water protection and have resources readily available to adjust agricultural practices in a manner that will not disrupt production efforts.

As the largest threats to our ground and surface waters continue to be residential in nature and in cause, an agricultural stewardship strategy must work in concert with a comprehensive County-wide strategy to address *all* sources of nitrogen and pollution to our waterways. Just as all sources of residential nitrogen loading will not be eliminated over ten years, we cannot expect all agricultural sources to be remediated in ten years. However, with sufficient funding and continued government cooperation, the agricultural community and its partners are committed in playing their part to protect Long Island's sole source aquifer and the surrounding water bodies which fundamentally drive SC quality of life.

Appendix – Change of SC Farming in Past 30 Years

In SC in 2012, the total market value of agricultural products sold was $239.8 million and SC continues to be a leading agricultural producer in New York State, with unparalleled levels of agricultural diversity. With nearby affluent markets, productive soils, and plentiful water resources, it is positioned for continued economic success. SC farmers average $6,666 in market production per farmed acre while New York state farmers in general only average $753 per farmed acre – a nearly nine fold advantage. This advantage reflects the unique nature of SC agriculture. Nursery and greenhouse products represent 70% of the total value of all SC agricultural products sold in 2012, with sales totaling $168.4 million. Suffolk's production of nursery and greenhouse products was more than five times greater than the next highest county in New York State and accounted for 40.8% of the total New York State nursery and greenhouse production. SC ranked number one in the state in the market value of poultry & poultry products sold in 2012, $24.1 million, including ranking number one in New York State in the number of ducks sold (1.9 million). SC also ranked number one in the state in the market value of aquaculture products sold in 2012, $9.3 million, which represented 52% of the entire New York State total and was a 22% increase since 2007. The revival of the SC shellfish industry itself brings a renewed dedication to protecting SC surface waters as a means of driving continuing economic development.

SC farming has truly changed in the past 30 years. There have been noticeable changes in the composition of SC's farmland acreage. Selected larger crops are displayed in Table 1.

Table 1. Acreage of Farms by Selected Crop, Suffolk County, 1982-2012

Crop	***1982***	***1987***	***1992***	***1997***	***2002***	***2007***	***2012***
All Vegetables	7,492	6,912	6,250	5,868	4,762	6,679	**6,177**
Nursery Stock[1]	2,693	2,960	3,740	3,902	NA	3,317	**3,393**
Sod	995	NA	1,179	2,502	3,043	3,785	**2,781**
Potatoes	18,998	10,358	7,032	5,906	3,248	2,805	**2,605**
Grains[2]	4,062	3,929	3,167	4,037	2,526	2,560	**2,373**
Grapes	NA	1,245	987	1,971	2,282	2,593	**2,193**
Hay	900	1,000	1100	600	834	452	**874**
Orchards	NA	617	734	617	902	568	**617**
Berries	291	301	NA	NA	129	163	**161**

[1]Grown in the open, not under glass. In 1997 and previous censuses, called "Nursery Crops". NA – Not Available.
[2]Grains = Oats, Rye, Wheat, Corn-grain
Source: U. S. Census of Agriculture

All vegetables comprised 6,177 acres of farmland in the County in 2012, 17% of all farmland acreage, down 1% since 1992. Nursery stock comprised 3,393 acres in 2012, but this figure decreased by 9% since 1992, perhaps as a result of more nursery stock shifting to greenhouse operations under glass.
Sod farms have increased in acreage in the past 20 years, with acreage rising by 136% between 1992 and 2012, to 2,781 acres. Potatoes were the dominant crop in the County for decades. In 1982, they comprised 38% of the farmland in SC, but that figure decreased to 2,605 acres in 2012, 7% of all farmland. The acreage devoted to grapes increase significantly between 1992 and 2012 in SC. In 1992, grapes covered 987 acres, and that figure increased by 122% by 2012 to 2,193 acres.

Greenhouses account for a significant portion of production in SC. As of 2012, more than 12 million square feet of greenhouse space was situated in the County. This figure was a 9% increase over the 2007

figure, which increased 7% over the 2002 figure. Since 1997, greenhouse space has increased in SC by 2.8 million square feet or 30%.

Animal production has traditionally been an important component of farming in SC, particularly duck and poultry farming. However, as a result of heightened water quality concerns and increased regulation, only one duck farm remains on Long Island. It should be noted that this single duck farm contributes ~4.5% of all national duck production. As previously indicated, SC is still #1 in New York State in duck and poultry production, but the number of duck and poultry farmers, and its corresponding acreage and nitrogen contribution to SC waterways, have decreased substantially. Trends in other animal production operations is mixed, and the number of farms devoted to cows, sheep, pigs, and goats has fluctuated marginally, with no clear trends emerging. Even the number of equine farms has fluctuated without a clear trend emerging. Equine operations have increased 20% since 2007 (from 108 to 130) but that is still a 14% decrease since 2002, when there were 152 operations. According to the 2012 Census, there are 291 animal producing farms in SC. Unfortunately, the Census does not measure acreage associated with animal production operations. So it is difficult to estimate the impact of animal production on water quality stewardship. The Suffolk County Soil & Water District estimates that there are approximately 1,800 acres in equine and livestock production in SC. Alternatively, the 2012 Census estimates there are 2,735 acres of "permanent pasture and rangeland" in SC.

The change in crop type and production is important to note because different types of agriculture require different levels of pesticide applications and, notably, different levels of fertilizer applications. Potato farming, which is nitrogen-intensive, has decreased significantly in SC. Even nursery stock and sod farming, which can also be nitrogen-intensive, have decreased on Long Island.

Table 2. Nitrogen Requirement by Land Use

Land Use	Acreage	Nitrogen Application Rates (lb/acre)	Comments
Mixed Vegetables	6,177	80 - 160	Split Applications
Potatoes	2,605	150 - 200	Split Applications
Nurseries	3,393	50 – 300[1]	Multiple Applications
Orchards	617	60 - 80	Split Applications
Vineyards	2,193	5 - 40 (10-20)	Foliar &/or Ground Applications
Sod	2,781	200 - 300 (260)[2]	Multiple Applications (5-7)
Berries	161	30 - 120	Split Applications
Greenhouse	~750	60 – 350[1]	Multiple Applications
Small Grains	937	0 - 30	
Field Corn	1,436	120 - 200	Split Applications
Pasture/Hay	874	0 - 40	
Golf Courses	9,850	65[3]	Multiple applications (2-6)
Residential lawns	100,000[4]	35	Multiple applications (2-3)

[1]Area does not include aisles and/or roadways
[2]Amount over an 18 month cropping period
[3]Average over entire land area
[4]Total land area in lawns, though not all lawns are fertilized

Appendix - Progress Since 2004

The staff from CCE's Agriculture Program, SCSWCD, and NRCS is essential in fulfilling the goals of the SC's Agricultural Stewardship Program. These agencies and their associated programs provide the applied research and professional guidance in the development of comprehensive sustainable programs for pest and nutrient best management practices, implement on-farm demonstration projects, secure cost-share funding and conduct AEM conservation evaluations, develop conservation plans and provide the technical assistance necessary for the adoption of agricultural best management practices.

CCE's Agricultural Stewardship Program

The Agricultural Stewardship Program works with SC's commercial agricultural industry to encourage adoption of pest and fertilizer management practices recommended by CCE's research specialists. The program establishes side-by-side on-farm demonstration projects to allow the grower to evaluate and compare the costs/benefits of adopting a crop specific pest and/or nutrient management practice into their standard practice. While research has shown the new practice will not negatively impact crop yield or quality, growers must experience the pest and nutrient sustainable practice first hand before making long-term decisions on adoption. See the tables for complete Agricultural Stewardship programmatic reach.

Sweet Corn: Controlled Release Nitrogen Fertilizer (CRNF): Sweet Corn CRNF recommendations have been established in SC with upwards of 50% of sweet corn growers adopting CCE's recommendations for CRNF use following four years of applied research and five years of on-farm demonstrations. All corn producers calibrate fertilizer equipment with support of CCE's Ag Stewardship Program to help ensure precision application. Growers using CRNF save $711/acre and reduce the nitrogen applications at a rate of 29% per/acre.

Potato: Controlled Release Nitrogen Fertilizer (CRNF): Potato CRNF recommendations have been established by CCE for Long Island following four years of applied research and an additional four years of on-farm demonstration projects. 12% of potato producers have adopted CCE's recommendations for CRNF on a part of their fields. All potato producers calibrate fertilizer equipment with CCE's Ag Stewardship Program for precision application. Growers using CRNF save $221 per/acre and reduce amount of nitrogen applied by 14% per/acre.

Tree Fruit: Integrated Pest Management Program (IPM): A total of 73% of tree fruit/orchards have adopted an IPM program into their production activities, using scouting, trapping and pheromone disruption. Being largely a pollinator dependent crop and recognizing the impact of pesticides, 75% of insecticide applications now utilize soft pollinator free pesticides.

Field Nursery: Nitrogen Management: Four nursery producers are participating in pilot projects to reduce total nitrogen application by using CRNF and by reduction in total application of nitrogen.

Greenhouse: Biological Control: As a result of working with 9 greenhouse operators to reduce the use of Imidacloprid and other pesticides by introducing bio-controls, an estimated 50% of greenhouse growers now use bio-control measures.

RainWise Weather Stations: A total of 20 weather stations connected to Cornell University's Network for Environment & Weather Application's (NEWA) have been installed in specific microclimates across Long Island to provide farmers' with real time weather access and pest and disease-forecasting models. The information enables growers to make more informed decisions concerning timing of pest

management activities (timing of insect and disease controls, placement of pheromone traps and mating disruption lures, planning scouting trips, etc.) and enhance adoption of IPM in specialty crop production.

Educational Programs: An estimated 90% of SC farmers participate in CCE's agricultural educational programs, conferences and publications: including the annual Long Island Agricultural Forum, the Nursery and Landscape Conference, Floriculture Conference, group educational programs on: pesticide spray management, composting, pest-forecasting with RainWise weather stations, and the use of mating disruption tactics in orchards. In addition, growers receive the monthly Long Island Agricultural News, Greenhouse Notes, and the seasonal Fruit and Vegetable Update weekly newsletter documenting growing degree-days, disease and pest field reports and trap information, critical news on pests and product changes, educational programs, and other timely information.

Table 1. Suffolk County

Suffolk County	Farms	Acres	Ag Stewardship on-farm Demonstrations	Adopted CRNF	Adopted AG Stewardship Programs Precision Calibration	Impact
Farms 10 Acres or greater (as established by Ag & Markets)	347	18,107	80	x	x	x
Vegetable Farms	140	7,000	45	As of 2014, CRNF for use on sweet corn & potatoes according to CCE, Suffolk's recommendations CCE research underway for CRNF use in shorter season crops		12% practice Biological Control, 70% use IPM, monitoring & scouting, 80% use reduced risk pesticide, 65% use irrigation management to reduce leaching of nitrates and pesticides, 42% farms use some organic methods
Sweet Corn growers	35	1,500	22 (CRNF)	11 (50%) CRNF	22	Reduction of N applied: 13lbs/Acre
Potato growers	25	2,805	16 (CRNF)	3 (12%) CRNF	16	Reduction of N applied: 10lbs/Acre
Organic crops	28	504	x	x	x	x
Vinifera Grapes	56	3,000	6 (IPM)	Use very little Nitrogen Fertilizer	14 Vineyards are in the Sustainable Wine Growing Program 75% have used biological control, 50% use biological control periodically 25% use it annually, 100% use some organic methods, 95% take tissue samples and soil tests to measure nitrogen levels, 100% use alternative pest management strategies, 100% use reduced risk pesticides, and great percentage use drip irrigation to reduce leaching potential	
Greenhouse	59	249	(5) IPM	Estimated 50% greenhouse growers use bio-control measures to reduce applications of Imidacloprid & other pesticides because of the demonstration projects and educational programs, 25% use biological control of pests, 85% scout and monitor for pest and disease, 75% follow recommended fertilizer rates, 25% adopted CRNF, 90% use at least 1 reduced risk product and 75% use drip irrigation		
Sod	7	3,785	3	Estimated 80% sod is grown using controlled release nitrogen fertilizer		
Nursery	114	3,319	7 (IPM & N-Best Management)	75% use controlled release nitrogen fertilizers, 95% use IPM monitoring and Scouting, 5% use biological controls, 50% use alternative pest management strategies		
Tree Fruit	15	500	14 (IPM & N-Best Management)	93% adoption of IPM and use of reduced risk alternatives to organophosphates used for all insecticide applications, 40% adoption of non-insecticidal mating disruption for pest management		
Ducks	1	200	x	200 acres with sewage treatment facility		

Table 2. Peconic Estuary Watershed

Peconic Estuary Farms within Meetinghouse Creek, Terry Creek Reeves Creek bordering Peconic Bay	Farms	Acres	Ag Stewardship on-farm Demonstrations	Adopted CRNF	Adopted AG Stewardship Programs Precision Calibration	Impact
Farms (10 Acres or greater as established by NYS Ag & Markets)	74	9,261	x	x	x	x
Vegetable Farms	26	2,500	18	As of 2014, only sweet corn and potatoes have been approved by CCE Potato/Vegetable Specialist for use on LI. Research is now being conducted on shorter season crops (Tomatoes, Cauliflower and Cabbage)		
Sweet Corn growers	21	1,000	13 (CRNF)	11	13	52% of sweet corn growers in Peconic Estuary Watershed have adopted CRNF and 100% have adopted precision calibration
Potato growers	3	550	3 (CRNF)	1	3	33% of Potato growers in Peconic Estuary Watershed have adopted CRNF and 100% have adopted precision calibration
Vinifera Grapes	26	1,846	x	7 Vineyards are in the Sustainable Wine Growing Program 75% have used biological control, 50% use biological control periodically 25% use it annually, 100% use some organic methods, 95% take tissue samples and soil tests to measure nitrogen levels, 100% use alternative pest management strategies, 100% use reduced risk pesticides, and great percentage use drip irrigation to reduce leaching potential		
Greenhouse	5	25	x	Estimated 50% greenhouse growers use bio-control measures to reduce applications of Imidacloprid & other pesticides because of the demonstration projects and educational programs, 25% use biological control of pests, 85% scout and monitor for pest and disease, 75% follow recommended fertilizer rates, 25% adopted CRNF, 90% use at least 1 reduced risk product and 75% use drip irrigation		
Sod	4	1,000	x	Estimated 80% sod is grown using controlled release nitrogen fertilizer		
Nursery	9	2,000	2 (IPM & Nutrient Management)	75% use controlled release nitrogen fertilizers, 95% use IPM monitoring and Scouting, 5% use biological controls, 50% use alternative pest management strategies		
Tree Fruit	15	500	14 (IPM & Nutrient Management)	93% adoption of IPM and use of reduced risk alternatives to organophosphates used for all insecticide applications, 40% adoption of non-insecticidal mating disruption for pest management		
Ducks	1	200	1 duck farm: 200 acres with sewage treatment facility			

Agricultural Environmental Management (AEM): In a collaboration between CCE, Cornell University, SCSWCD and NRCS, local Agricultural Environmental Management Worksheets, were drafted to specifically address the region's unique crops and environmental concerns in place of the state-wide AEM program worksheets which were primarily focused on dairy. A total of 14 worksheets addressing Nutrient and Pest management for orchards, vineyards, greenhouse, vegetables as well as Irrigation, Petroleum, Waste and Soil Management were drafted under this cooperative effort which strengthened these agencies abilities to conduct agricultural environmental planning locally. NYS Soil and Water Committee reviewed the sheets and approved their use for SCSWCD and USDA-NRCS. In order to help streamline the planning, the Ag Stewardship Program printed AEM sheets and developed best management practice fact sheets for grower reference. See **Appendix - Agricultural Environmental Management**.

The New York State Department of Environmental Conservation (DEC)

The DEC is committed to the reduced use of high-risk pesticides and the increased use of integrated pest management (IPM) techniques, such as cultural, physical and biological pest control systems and other sustainable pest management agricultural practices.

The DEC regulates the registration, commercial use, purchase and custom application of pesticides. The Environmental Conservation Law (ECL) sets forth the state's policy regarding pesticide usage. According to the ECL, pesticides, when properly used, are "valuable, important and necessary to the welfare, health, economic well-being and productive and industrial capabilities of the people of this state." (ECL 33-0301). However, pesticides also present potential dangers to health, property and the environment if improperly used.

DEC exercises its broad regulatory responsibilities in consultation with the Departments of Health (DOH) and New York Agriculture and Markets in order to protect public health and the environment while ensuring that pesticides proposed for use in New York State are properly registered and applied for the benefit of agricultural and other economic enterprises that rely on pesticide usage. In the interests of providing further protection to Long Island's precious groundwater resources, DEC engaged the public, municipalities, agricultural and other regulated communities in a discussion on how to further protect Long Island's groundwater resources. As a result, the DEC has developed the Long Island Pesticide Pollution Prevention Strategy (Strategy) in response to concerns over detection of pesticide-related constituents in the groundwater over time at various locations on Long Island and recognition of the importance of protecting the environment while meeting critical pest management needs. The strategy presents a blueprint for DEC, in consultation with stakeholders, to evaluate pesticide usage on Long Island, identify pesticides that have the greatest potential to cause adverse impacts and work with partners to reduce or eliminate such usage or find alternatives that do not present such impacts. This approach will both protect Long Island's water resources from pesticide impacts and encourage effective methods of pest management. The Strategy is initially focusing on 3 commonly used pesticide active ingredients: imidacloprid (insecticide), atrazine (herbicide), and metalaxyl/mefenoxam (fungicide).

The DEC has created a Technical Review and Advisory Committee (TRAC) to pool expertise amongst State and local government agencies, academic agencies, and public service organizations to advise the DEC regarding potential response actions to prevent further pesticide-related impacts to the Long Island aquifer while recognizing pest management needs. TRAC meetings are currently being held and stakeholder outreach is also underway. The Strategy's scope is to address 47 pesticide active ingredients that have been detected in Long Island groundwater and that are currently registered for use on Long Island. As progress is made with the first three (atrazine, imidacloprid, and metalaxyl/mefenoxam), the DEC expects to begin to identify the next group of active ingredients to be evaluated.

Suffolk County Soil and Water Conservation District (SCSWCD) and USDA-Natural Resources Conservation Service (NRCS)

The Suffolk County Soil and Water Conservation District (SCSWCD) and the USDA-Natural Resources Conservation Service (NRCS) have a well-established and effective partnership in which they advance on-farm conservation planning and practice design and implementation for the protection and enhancement of soil, water, air, plant and animal resources.

On-farm conservation planning and implementation occurs through New York State's Agricultural Environmental Management program (AEM) and the NRCS planning processes. Since 2004, approximately 268 farms have benefited from conservation planning (Tiers I & II) with the development of 184 farm specific conservation plans (Tier III). Of the cooperating growers, over 75% have advanced to the implementation and evaluation stage (Tiers IV and V respectively), by incorporating crop, grazing, waste, nutrient, pest, energy, soil, and habitat resource management systems for the benefit of water quality protection and improvement into their operations. This included the adoption of 51 different conservation practices and the implementation of 2,000 cumulative conservation practices. The total number of utilized practices and their installations is a testament to the District's and NRCS' working relationship and technical expertise, as both Agencies' staff designed and supervised the implementation of 99% of the 2,000 engineering and agronomic practices.

The development and adoption of these progressive conservation plans and practices requires the purchase or retrofit of farm equipment and/or the installation of infrastructure, and always involves training on the operation and management. Due to these high financial and/or time investments, the cost of trying a new practice is a risky investment. To help mitigate the risk and financial burden, planning and design are conducted by the agency staff at no financial cost to the grower, helping to encourage practice implementation and adoption. To off-set material and installation costs, both agencies also readily support

the agricultural community in applying for Farm Bill sponsored USDA cost share funding opportunities. Additionally, the SCSWCD also applies on behalf of the agricultural community, for additional Federal, State and Local funding to help secure alternate cost-share funds to further encourage the installation of conservation practices.

Both agencies' diligence and efforts have been highly effective, with over $7,375,650 in cost-share funds secured from multiple funding sources between 2004 and 2015. USDA-NRCS' total appropriated funding of $5,605,993 was provided by the Farm Bill through the Environmental Quality Incentive Program (EQIP), the Agricultural Environmental Management Program (AMA), the Conservation Stewardship Program (CSP), the Wildlife Habitat Incentives Program (WHIP), and the Federal Emergency Watershed Protection Fund (EWP). The SCSWCD secured and addition $1,769,658 in funding through the New York State Agricultural Nonpoint Source Abatement and Control Program (AGNPS), the Ag Community Recovery Fund (ACR) and the NYS DEC Environment Benefit Project (EBP).

With this funding, 340 contracts consisting of 40 different conservation practices were successfully implemented by SC growers, resulting in the installation of over 1,956 practices, benefiting an estimated 16,283 acres of agricultural lands. It is also important to highlight that a total of 75% of the practices installed in the last decade received some form of cost-share funding. Funding to implement these practices is imperative. A list of the conservation practices installed using cost-share funding from 2004 through 2015 are noted in Table 3 on the following page.

Table 3. Conservation Practices Funded by NRCS

USDA- NRCS Conservation Practice	Units	Total Installed Units	Cost Share Units	% Receiving NRCS Cost Share
Access Road	ft.	4,733	2,754	58%
Ag Fuel Storage Facility	#	126	126	100%
Agrichemical Handling Facility	#	10	10	100%
Brush Management	ac.	103	4	4%
Coastal Dike	ft.	3,335	3,335	100%
Combustion System Improvement	#	105	105	NA
Compost Facility	#	1	Not Eligible	NA
Conservation Cover	ac.	928	184	20%
Conservation Crop Rotation	ac.	684	Not Eligible	NA
Conservation Tillage	ac.	1,456	Not Eligible	NA
Cover Crop*	ac.	7,791	6,298	81%
Critical Area Seeding	ac.	34	12	35%
Deep Tillage	ac.	5,993	5,993	100%
Diversion	ac.	1,445	1,145	79%
Energy Audit	#	3	Not Eligible	NA
Fence - Grazing	ft.	138,598	76,413	55%
Field Border	ft.	322	322	100%
Filter Strip	ac.	3	3	100%
Forest Management Plan	ac.	100	Not Eligible	NA
Grassed Waterways	ft.	11,151	11,151	100%
Grazing Land Mechanical Treatment	ac.	33	33	100%
Heavy Equipment Protection Area	#	20		0%
Herbaceous Wind Barrier	ft.	24,940	24,940	100%
Irrigation System - Micro Irrigation	ac.	130	130	100%
Irrigation Water Conveyance	ft.	31,532	6,331	20%
Irrigation Water Management	ac.	3,954	3,706	94%
Land Clearing	ac.	2	Not Eligible	NA
Lined Waterway	ft.	2,050	730	36%
Irrigation - Micro	ac.	3,419	Not Eligible	NA
Mulching	ac.	730	210	29%
Nutrient Management*	ac.	12,796	7,767	61%
Obstruction Removal	ac.	24	24	100%
Pasture and Hayland Planting	ac.	1,602	113	7%
Pathogen Management	ac.	25	Not Eligible	NA
Pest Management*	ac.	6,560	5,279	80%
Pipeline	ft.	9,025	1,975	22%
Prescribed Grazing	ac.	137	127	93%
Pumping Plant	#	4	Not Eligible	NA
Restoration of Wildlife Habitats	ac.	200	Not Eligible	NA
Roof Runoff Management	ft.	360	360	100%
Seasonal High Tunnel System (798)	sq.ft.	17,424	17,424	100%
Soil Management	ac	645	Not Eligible	NA
Streamline/Shoreline Protect.	Ft	1,200	Not Eligible	NA
Subsurface Drain	ft	50	Not Eligible	NA
Terrace	ft	1,200	1,200	100%
Upland Wildlife Habitat Management	ac.	95	76	80%
Vertical Drain	#	9	Not Eligible	NA
Waste Storage Facility	#	1	Not Eligible	NA
Waste Management Ag Plastic Baling	lbs.	180,000	180,000	100%
Water & Sediment Control Basin	#	2	Not Eligible	NA
Water Test	#	10	Not Eligible	NA
Water Well	#	9	Not Eligible	NA
Watering Facility	#	14	Not Eligible	NA
Windbreak/Shelterbelt Establishment	ft.	22,910	22,910	100%

Programmatic highlights include the replacement of 207 single-walled fuel tanks with double- walled tanks on 126 SC farms, containing and securing an estimated 82,690 gallons of petroleum. A total of $955,522 in cost- share funding from New York State and the USDA-NRCS was secured for this program. Funding provided through NYSDEC's EBP provided integral financial assistance for the installation of Agrichemical Handling Facilities (AHF). An AHF is an impermeable surface/that helps reduce ground and surface water contamination by providing containment of pesticides and fertilizers during mixing and loading, in the event of an accidental spill, or equipment failure. A total of 10 AHFs have been installed with an additional 13 AHFs approved for funding and pending installation.

Education and outreach programming has also been a prominent programmatic focus of the SCSWCD and NRCS, serving to introduce new conservation practices as well as provide training on adaptive management, and operation and maintenance activities. Presentations and educational events widely ranged from general programs and funding opportunities to soil health, livestock and composting management systems, pesticide sprayer retro-fits, pollinator protection, habitat restoration and on-farm energy conservation. A comprehensive list of informational sessions and workshops conducted to assist the agricultural industry in their attempts to preserve water quality and protect soil health are listed below.

Soil and Water Conservation District and USDA-NRCS Agricultural Education Outreach and Workshops: 2006 – 2015

2006

- **Soil and Water Presentation**: 25 attendees / Basic description of programs and technical assistance offered to farmers for the purpose of aquifer protection and the improvement of soil health.

2007

- **East End Livestock Association**: 50 attendees / This presentation highlighted livestock management conservation practices supported by the District and NRCS including prescribed grazing and manure management. It included a discussion of federal funding opportunities and the technical assistance available
- **Wildlife Habitat Incentives Program (WHIP) Presentation**: 25 attendees / The practices, cost share incentives, and benefits associated with enhancing wildlife habitat through the NRCS WHIP.
- **Ag Forum / Renewable Energy Series**: 45 – 50 attendees / This series informed growers on the benefits of alternative energy for the purposes of water pumping and other on farm uses. Alternative energy reduces the need for the burning and storing fossil fuels on site and contributes to cost efficiencies and greater protection of water quality.

2008

- **Ag Forum / Equine Management:** 15 attendees / Plant morphology and physiology, as well as prescribed grazing and fencing systems were the highlighted topic of this inaugural livestock management session. The three presentations given by NRCS staff comprehensively identified the critical components of establishing an effective prescribed grazing program for equine.

- **Suffolk County Conservation Activities Presentation:** 15 attendees / Conservation practices and cost share programs available for equine management were highlighted in conjunction with Equine Management discussions. As horse pastures are commonly over-grazed due to high stocking rates and animal grazing habit, the goal of this presentation was to help ensure the adaptation of conservation practices through cost share incentives for the improvement of livestock health and natural resources.

2009

- **Agriculture and Energy Series**: 30 attendees/ This series, like the previous energy workshop series, presented information to growers on the benefits of alternative energy sources for water pumping and other on-farm uses. These workshops explored smaller scale alternatives including biofuels and oil seed crops, small wind energy and on-farm energy efficiency. Alternative energy reduces the need for burning and storing fossil fuels on site and therefore contributing to efficiency and water quality.

2010

- **On-Farm Wind Workshop**: 40 attendees/ The District hosted this workshop to highlight new and advancing wind turbine systems to improve energy efficiency.

2011

- **Long Island Native Plant Symposium:** 265 attendees / This full-day educational event focused on highlighting the importance of incorporating genetically native plant materials into the landscape. The commercial propagation and establishment of ecotypic plant materials in Long Island's landscape ensure the highest degree of native plant adaptation, ensures synchronized plant phenology and faunal food sources, reduces the dependence on chemical amendments, and protects against the unintentional introduction of invasive species. Accordingly, this event focused on providing the nursery and landscaping industry will necessary information as to the importance of these plant materials and the need to provide these plant materials. Informing the public on this overlooked component of plant selection and management helps stimulate demand and improves ecological and environmental resilience in the Long Island landscape.
- **Pesticide Sprayer Retrofit Workshop:** 40 attendees/ Introduced growers to new retrofits for pesticide sprayers that will improve application efficiencies by reducing overspray, drips, and drift, which in turn reduces pesticide leaching and off-field travel. Upon completing this workshop, SCSWCD secured a nonpoint source grant from Ag & Markets to aid farmers in updating and retrofitting old and inefficient sprayers.
- **Ag Forum / Livetsock Management Session: 30 attendees**/ This year's focus in livestock management highlighted policy requirements for the effective handling and slaughtering of livestock. This is critical to maintain a thriving livestock industry on Long Island. The permitting as well as the proper disposal of offal was discussed as well as the available funding opportunities to advance local slaughtering. Implementation of local slaughtering facilities would help ensure waste disposal occurs in concert with to state regulations thereby reducing nutrient and pathogen loading into ground and

surface waters as well as regional reduce contributions to air pollution associated by eliminating the off-island transport of animal's for slaughter.

2014

- **Soil Health Workshop:** 70 attendees/ This progressive workshop provided demonstrations and presentations on soil properties and best management practices to improve soil health and productivity and limit the regional soil liabilities. SCSWCD and NRCS, in cooperation with CCE, demonstrated different cover crops and seed mixtures and how these different mixes provide functions to reduce erosion and soil loss, reduce compaction and increase organic matter. This progressive education on soil health education is an integral component in pest and nutrient management in order to protect ground and surface waters from agrichemical contamination.
- **Long Island On-Farm Compost Workshop:** 30 attendees/ A two-day workshop providing foundational concepts and technical information on large and small scale on-farm composting was presented in classroom and through site visits. This included soil interactions, natural rendering, compost quality, regulations, and troubleshooting to ensure the production of high quality, biologically active organic materials for future commercial and agricultural application.
- **Xerces Pollinator Workshops:** 140 total attendees (roughly 70 at each offering) / this workshop delivered advancing research on the importance of pollinators for crop production on Long Island, with a focus on native bees and their habitat needs. Farm management practices can better support both native bee and honey bee populations when ensuring a diversity of flowering plants through the growing season, providing nesting sites, reducing negative impacts of pesticide use, and, for native ground-nesting bees, reducing tillage.
- **Invasive Species Awareness Training**: 30 attendees/ The awareness of invasive species and their management is integral to preventing their spread and ensuring its control. In this presentation conducted for the nursery and landscape industry, garden clubs, plant enthusiasts and general public, plant morphology, physiology and the unique traits that lend to invasiveness were highlighted. The various commercially sold plant materials and naturalizing species banned from sale in SC due to invasiveness were also discussed as well as alternatives to help protect to SC's natural areas, citizens, and wildlife from further degradation by invasive species.
- **Ag Forum / Livestock Session:** 30 attendees/ This year's livestock management topic was soil health. Protecting and maintaining soil health is the most important management techniques that can be employed to ensure high quality forage, infiltration and percolation, and nutrient retention and cycling. The physical, chemical and biological properties of soils collectively result in holistic ecological soil management which is integral to building resiliency in turn protect against nutrient and pathogen loading into ground and surface waters in any agricultural management system.
- **Ag Forum / Diversifying Cover Crops and Forage Species as a Means to Promote Soil Health:** 30 attendees/ The livestock and environmental benefits of foraging summer and winter cover crops were presented during this Ag Forum talk. A diverse array of suitable cover crops and varieties were highlighted as examples of plant materials which could be adapted into livestock management system. The benefits and challenges of using and diversifying perennial grazing species were also covered to ensure the availability of high quality forage for livestock and to limit natural resource concerns.

Appendix – Grant Funding Secured by Suffolk County Soil & Water Conservation District

Grant Funding Secured												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grant Totals
Ag NPS - Beaver Dam Creek	$ 7,729		$ 6,972									$ 14,701
Ag NPS - Irrigation Wellhead Protection	$ 11,038		$ 8,000	$ 19,672								$ 38,710
Ag NPS Round 14 - Atlantic Nursery								$ 14,396				$ 14,396
Ag NPS Round 14 - Fuel Tank Replacement					$ 21,228	$ 58,410	$ 7,079		$ 10,640			$ 97,357
Ag NPS Round 17 - Fuel Tank Replacement									$ 99,943			$ 99,943
Ag NPS Round 18 - Fuel Tank Replacement										$ 131,367		$ 131,367
AG NPS Round 19 - Fuel Tank Replacement										$ 81,541		$ 81,541
Ag NPS Round 20 - Fuel Tank Replacement											$ 213,271	$ 213,271
Ag NPS Round 20 - Pesticide Retrofit											$ 227,731	$ 227,731
Animal Waste Systems - Corwin Duck Farm	$ 172	$ 84,294		$ 3,496								$ 87,963
DEC Environmental Benefit Program (AHF)		$ 5,000	$469,750	$ 74,850	$ 64,500	$ 6,000						$ 620,100
Deer Fence Grant						$864,000		$ 81,729	$ 9,944			$ 955,672
Jurgielewicz Duck Farm							$162,274					$ 162,274
LI Ag Stewardship Planning Project	$ 32,911											$ 32,911
NYS Ag & Markets CAFO	$ 5,304											$ 5,304
NYS Ag Community Recovery Fund								$ 22,500	$ 2,434			$ 24,934
SC NPS Technical Assistance Project	$ 22,260											$ 22,260
Wellhead Protection Demonstration Project	$ 20,880	$ 2,506										$ 23,386
Annual Totals	$100,294	$ 91,800	$484,722	$ 98,018	$ 85,728	$928,410	$169,353	$118,625	$ 122,961	$ 212,908	$ 441,002	$ 2,853,820

Appendix - Environmental Concerns

Estuarine Health

Excessive levels of nitrogen can be harmful to the estuary. When nutrients are introduced to the estuary at higher than normal rates, they can stimulate aquatic plant growth, including plankton and larger communities of macroalgae. Algae respiration, which occurs at night, consumes oxygen to a degree that can potentially deplete dissolved oxygen levels in the water column ("diurnal oxygen depression"). Also, when algae die, they can settle through the water column to the sediments, where the organic matter is decomposed by bacteria. Bacterial decomposition also utilized dissolved oxygen ("sediment oxygen demand"), as well as releases nitrogen back into the water column ("sediment nutrient flux"). Processes such as diurnal dissolved oxygen depression, sediment oxygen demand, and sediment nutrient flux can result in dissolved oxygen levels which are low enough to be harmful to marine life, a condition referred to as hypoxia.

Long Island Sound experiences widespread, persistent hypoxia during warm months. Currently, the Peconic Estuary is not experiencing widespread and persistent hypoxia, but the western estuary and embayments do exhibit intermittent hypoxia during summer, sometimes persisting for several days at a time. The western portion of the system (Peconic River and Flanders Bay) has a legacy of nutrient over enrichment and periodic, short-term dissolved oxygen problems.

In addition to hypoxia, increased production of microscopic algae caused by increased nutrient enrichment decreases water clarity and diminishes the amount of light received by rooted aquatic plants, such as eelgrass (*Zostera marina*). Decreased light penetration shades the estuary's floor, reducing suitable habitat for productive eelgrass growth. Excessive nutrient loading can also increase the growth of epiphytes on eelgrass blades, again shading the plant itself and hindering production. Furthermore, species such as red or green macroalgae, which adsorb nutrients more quickly than eelgrass, may competitively exclude eelgrass plants inhabiting high nitrogen environments. Eelgrass beds are important components of estuary ecosystems because they serve as critical nursery habitat for juvenile fish and shellfish, improve water clarity by stabilizing sediments, and buffer against erosion by reducing wave energy.

High nitrogen loading fuels harmful algal blooms (HABs) (Heisler et al, 2008), and has even been shown to increase the toxicity of toxic algal blooms. Harmful algal blooms are increasing in their frequency and extent in the Peconic Estuary, and can include nuisance blooms that discolor the water but are not dangerous. Blooms like "brown tide" which kill shellfish and eelgrass, and species like the red tide producing *Alexandrium* can be toxic fin and shell fish, amphibians and even humans. Harmful algal blooms can have devastating consequences for aquatic plants and shellfish communities, like the brown tides of the 1980's did in the Peconic Estuary, and can impact the economy by decreasing tourism due to decreased water clarity, by killing commercially important finfish and shellfish, or their food sources, and by forcing shell fishing areas to be closed to harvest due to human health concerns over algal toxins.

It is also important to note that the lowering of the water table, which can occur when pumping for recreational, commercial, and agricultural use exceeds replenishment, can be harmful to estuary health by altering the salinity of estuarine waterbodies. Accordingly, estuarine health is both a water quality and water quantity issue.

Public Health

Many studies indicate that nitrogen from synthetic fertilizers is the most common source of nitrate in groundwater. There are some public health concerns associated with high nitrate levels in drinking water. For example, ingestion of water with high nitrate levels is known to cause methemoglobinemia in infants under one year of age, though no case has ever been documented in SC. Fortunately, nitrogen levels in SC waters have never neared limits associated with this blood disorder. In addition, a 1996 report issued by the Centers for Disease Control has reported the possible connection between three episodes of spontaneous miscarriages in LaGrange, Indiana and elevated nitrate concentrations in drinking water.[4] However this syndrome is suspected to be under reported and it is unclear what the total number of U.S. cases is. An important consideration when evaluating nitrate contamination is highlighted in a 2009 United States Geological Survey (USGS) report on the quality of water in domestic wells, the USGS found that contaminants such as nitrate (nutrients) co-occurred with other contaminants in 73% of wells tested in this national study.[5] Essentially, elevated nitrate levels often indicate a degraded groundwater condition and a high likelihood of the co-occurrence of other contaminants including pesticides. An additional health consideration from the prolonged intake of high levels of nitrate is linked to gastric problems due to the formations of nitrosamines. N-nitrosamine compounds have been shown to cause cancer in test animals and possibly humans.[6]

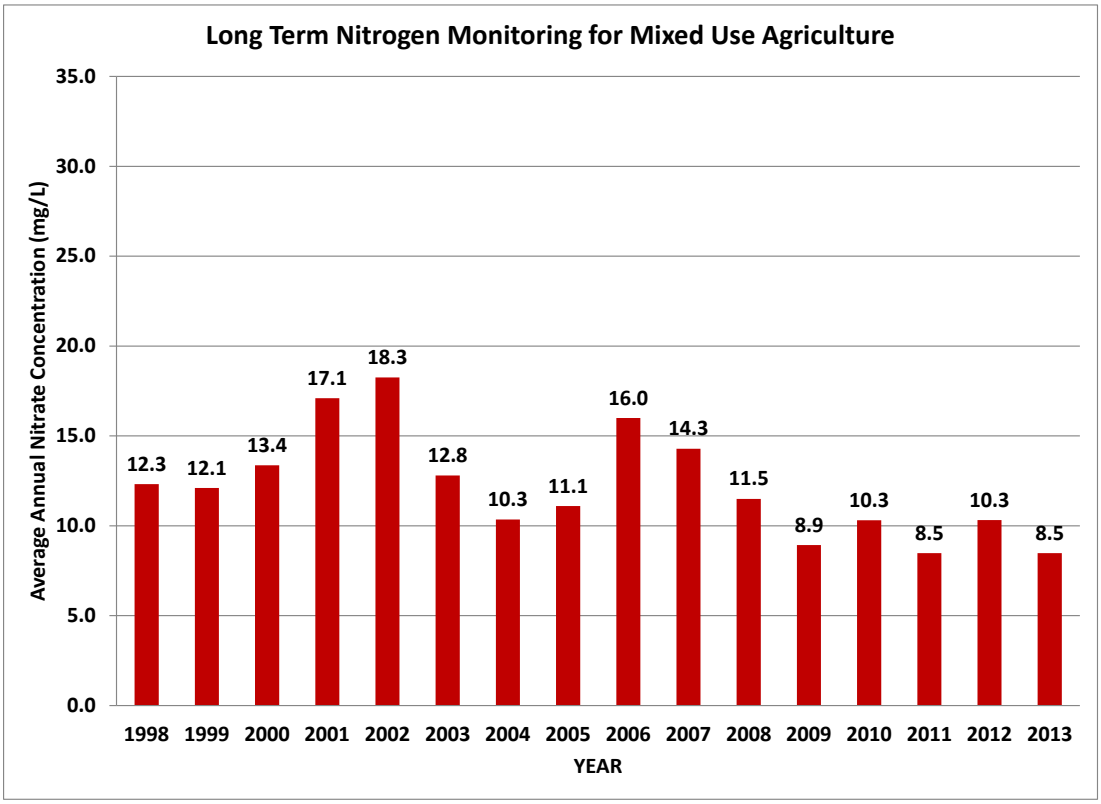
Historical groundwater data in SC revealed an average annual nitrate concentration of 11.3 mg/L. This data was collected by SCDHS from ten monitoring wells primarily down gradient from agricultural land over a 20-year period from 1975-1994. Beginning in 1998, the SCDHS in cooperation with land owners and pesticide manufacturers installed five monitoring wells either directly on farmland or immediately down gradient of an agricultural entity. The data from these wells show an average annual nitrate concentration of 12.5 mg/L during the 16-year sample period (1998-2013). Since 2006, nitrate levels have been decreasing from a high of 16.00 mg/L in 2006 to a low of 8.48 mg/L in 2011 and again in 2013 (Figure 1). The U.S. Environmental Protection Agency restricts nitrates in tap water to a maximum concentration level (MCL) of 10 parts per million. It is important to note that the agricultural land-use up gradient of these wells has changed over the years which has likely contributed to the reduction in nitrogen. For example, only two of the sites have been consistently in row crop production over the past 16 years, while the other monitoring sites have been row crops and nursery or sod production over that time period. This land use change does reflect the current changes occurring in the agricultural land use in SC. For additional trends in nitrogen fertilizer use across crop commodities, see **Appendix - Change in SC Farming in Past 30 Years**.

[4] CDC. Spontaneous Abortions Possibly Related to Ingestion of Nitrate-Contaminated Well Water -- LaGrange County, Indiana, 1991-1994. MMWR 45(26):569-572 (1996).

[5] USGS. The quality of our nation's waters—Quality of water from domestic wells in principal aquifers of the United States, 1991–2004—Overview of major findings: U.S. Geological Survey Circular 1332, 48 p. (2009)

[6] EPA. Ambient Water Quality Criteria for Nitrosamines. Cincinnati, Ohio: US EPA. Environmental Criteria and Assessment Office. EPA 440/5-80-064 (1980)

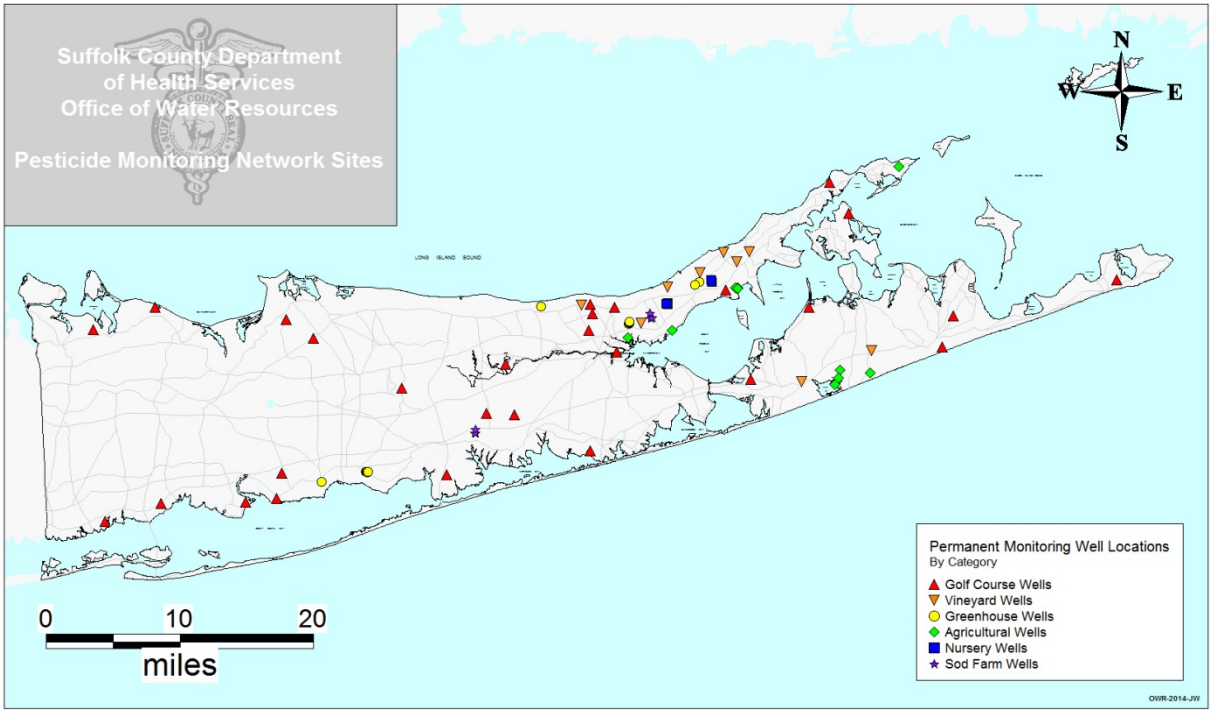
Figure 1: Long Term Nitrogen Monitoring for Mixed Use Agriculture. Five down gradient monitoring wells on five farms have been monitored from 1998 through 2013. The average nitrate concentrations (mg/L) over the 16 years was 12.2 mg/L. Variability is likely due to changes in crop types as well as the implementation of BMP's on two farms.



The contributions from agriculture on nitrate concentrations is also reflected in the results of private well testing by the SCDHS. Historical data shows that from 1972 to 1994, a total of 45,985 private wells were tested with 7.4% of those wells exceeding the nitrate MCL (SCDHS 1996). More recent private well data shows an increase in nitrate MCL exceedances. The SCDHS also tested approximately 10,000 private wells over a 17 year period (1997-2013). Those results showed that 8% of the wells tested exceeded the nitrate MCL. The percentage of private wells exceeding the nitrate MCL was significantly greater in the agricultural communities than the countywide average.

Agricultural pesticides have also found their way into SC's groundwater with initial detections of dating back to the late 1970's and were among the first detected in groundwater in the United States. Notably, SC was one of the first to develop various analytical detection methodologies and establish a monitoring and surveillance program in place to address these concerns. In 1997, the SCDHS entered into a partnership with the DEC to monitor pesticides in groundwater in Suffolk and Nassau Counties as part of the 1996 State Pesticide Reporting Law. As of 2015, this program is in its 17th year and has provided useful data on pesticide trends and impacts in groundwater. Wells were chosen for monitoring based upon a variety of criteria including land use, geographic coverage/location, and random selection. The current network of monitoring wells is provided in Figure 2 on the following page.

Figure 2: SCDHS permanent pesticide monitoring well locations by category



The banning and restriction on many pesticides has been based partially on the data collected from the monitoring program. Table 1 identifies the most often/commonly detected pesticides found to date and their current registration status. Most of the pesticides found in groundwater are legacy compounds that have since been taken off the market.

Table 1 – Most frequently detected pesticide compounds in SCDHS observation wells

Most Frequently Detected Compounds

Compounds	Use	Registration Status
Aldicarb	Insecticide used on potato farms	Withdrawn in 1980
Metolochlor	Agricultural herbicide	Withdrawn in 2002
Dacthal (TCPA)	Agricultural herbicide	Withdrawn in 1988
Dichloropropane	Insecticide / Soil fumigant	Withdrawn in 1987
Alachlor	Widely used herbicide	Withdrawn in 1999
Dinoseb	Agricultural herbicide	Withdrawn in 1986
Metalaxyl	Fungicide	Currently Registered
Imidacloprid	Insecticide	Restricted
Simazine	Herbicide	Restricted
Atrazine	Herbicide	Restricted

To date over 100 pesticides have been detected in Suffolk's groundwater, the most prevalent are presented in Table 3. It should be noted that many of the pesticides in Table 3 are legacy pesticides used during the 1960's through 1980 and are no longer registered for use in SC. Recent pesticide detections of

currently registered pesticides are typically detected in low concentrations and often found throughout the County, but still largely detected in agricultural areas. For example Metalaxyl and Imidacloprid have been detected throughout the County at concentrations well below the current MCL's. **No currently registered pesticide has been identified at concentrations exceeding MCL's in recent years.** However, the need remains for continued and expanded pesticide monitoring, as some currently used pesticides have been detected at significant concentrations, with some approaching 30 ppb. This includes the herbicide Dichlorobenil and its associated metabolite 2,6 Dichlorbenzamide. While these pesticides are not meeting or exceeding MCL's, they are still being found at significant measureable concentrations.

Concentrations of carbamate pesticides, most notably, Aldicarb (Temik), have been routinely detected in SC's monitoring wells but have steadily decreased since their ban in 1980's. The dacthal metabolite TCPA can be found in some areas despite its removal from the SC market in 1988. TCPA is still detected over MCL's in some areas.

Between 1997 and 2012, the SCDHS collected over 37,000 potable well samples (public and private) that were analyzed for pesticides. The results showed that at least one pesticide compound was detected in 22% of the public community supply wells, 25% of the public non-community supply wells had at least one pesticide compound detected and 23% of the private wells had at least one pesticide compound detected. Between 1997 and 2012, pesticide related contaminants were detected above the MCL in 17 community supply wells, 19 no-community supply wells and 213 private wells. The majority of these compounds include Alachlor, TCPA, EDB, Dichloropropane, and metabolites of Atrazine.

Impacts to Public Drinking Water Resources

In SC, the community water is provided by the Suffolk County Water Authority (SCWA), nineteen (19) municipal water districts, village owned water systems and fifty-six (56) individually owned water corporations. The SCWA and the Riverhead Water District (RWD) supply residents within the Suffolk's largest agricultural Towns, Riverhead and Southold, with public water from local wells. There are also an estimated 40,000 private wells supplying drinking water to homeowners throughout SC that do not have access to public water. The vast majority of these private wells are located in Eastern SC.

As demand for public water increases, the SCWA and RWD have had to construct numerous additional wells and treatment facilities, and install many miles of water main to convey the water from their well fields to the individual homes. The pumping of these public supply wells results in impacts to the aquifers beneath the North Fork as a result of the quantity of water that must be pumped. Though public supply wells on the North Fork are much lower in capacity than those on the main body of Suffolk (100 to 250 gpm vs. 1,000 to 1,500 gpm), the unique hydrogeologic setting of the North Fork leaves public supply wells more vulnerable to water quantity related problems. In order to insure the groundwater availability continues, we must account for all water use on the North Fork in order to avoid negative water quality and quantity effects.

Water Quantity-Related Issues for Public Water Suppliers

Since crop irrigation is a necessity for all of Long Island's farmers, and the mission of public water suppliers is to provide safe potable water to the residents of Suffolk County, a balance must be maintained in certain groundwater areas, particularly on the East End of Long Island. Larger community public water suppliers (SCWA and RWD) and its agricultural interests need to find a way to accommodate the growing demand for public water on the North Fork and South Forks and the interests of other users of water.

Pursuant to Environmental Conservation Law Article 15, and the Water Withdrawal Reporting Law of 2010, the DEC has been empowered to implement a permitting program for water withdrawal systems for agricultural, commercial, and industrial sources. All agricultural facilities that have withdrawn groundwater or surface water equal to or in excess of an average of 100,000 gallons per day in any thirty day consecutive period (3 million gallons during a 30 day period) must file an Agricultural Water Withdrawal Report with the New York State Department of Environmental Conservation on an annual basis. This will allow these potable suppliers to more effectively regulate pumping of their wells to better address water withdrawal issues and to maintain chloride levels far below drinking water standards.

Costs of Ensuring Water Quality - The costs associated with treating groundwater are important to consider because these costs are ultimately borne by rate payers. These costs also must be considered when we evaluate alternative strategies to mitigate pesticide use, manage nitrogen, and invest in agricultural best management practices. Removing pesticides and nitrogen from public drinking water requires the use of Granular Activated Carbon adsorption units (GAC) to remove contaminants. The total capital cost to date to install GAC systems for the removal of pesticides and herbicides from our drinking water is approximately $12,500,000 and the cost to construct a new enclosed GAC facility is $800,000. The costs incurred by the SCWA for pesticide contamination testing averages close to $500,000 annually. The cost to construct new nitrate removal facilities is approximately $2 million.

Legacy Contaminants
While it is critically important to focus on pesticide pollution prevention, there is still a need to address the remediation of legacy contaminants from agricultural production in SC. One possible solution is to work with farmers near public supply wells to install mobile GAC on their shallow irrigation wells during the winter months to help clean up prior agricultural pollution in our groundwater. The SCWA could help oversee the deployment of small GAC systems, such as a 4 foot diameter model, as well as piping and winterizing the systems. This is a potential best management practice is discussed in the **Appendix – Research and Pilot Projects.**

Soil Health

SC's prime agricultural soils, maritime climate and diverse markets support the wide regional diversity of agricultural production from vineyards, orchards, nursery stock, small-scale livestock production to traditional heritage row cropping commodities like potatoes and corn. In fact, SC is continuously recognized as one of the highest agricultural revenue generating Counties in New York State based on wholesale production values.

Maintaining the long-term viability, sustainability and success of this agricultural industry, as defined in the *1996 Suffolk County Agricultural and Farmland Protection Plan*, requires maintaining high levels of soil health within Long Island's prime agricultural soils in association with the implementation of nutrient and pest management planning.

Soil health management is the most critical agronomic conservation management system in the protection and improvement of water quality as the soil serves not only as the medium for crop production but also the medium which buffers against leaching while detoxifying, immobilizing, degrading, and filtering soil contaminates. Soils also regulate and partition water and solute flow; a soil with 1% higher organic matter can store 25,000 gallons of available soil water per acre, decreasing leaching, runoff and sedimentation of waterbodies. The more biologically diverse, chemically balanced and physically supportive the soil ecosystem, the higher the resource protections provided by this media, which can be achieved by increasing organic matter content in soils.

Unfortunately, the same edaphic factors and maritime proximity which support SC's thriving industry are also a liability to ground and surface water quality when under production. Agricultural crops are nutrient intensive and the supportive agronomic practices that disturb the soil through conventional tillage, readily degrade soil health by reducing organic matter content and its functional abilities to support production while buffering against leaching, erosion, disease, pests and weeds.

For example, organic matter increases soil's cation exchange capacity and water holding capacity, which in turn increases the soil's ability to retain compounds and minerals which have low soil adsorption and/or high levels of water solubility. This is critical in Long Island's coarse sandy loams which have a low buffering capacity due to low organic matter, high porosity and low cation exchange capacity (due to low levels of clays). Conventional tillage such as moldboard plowing and discing diminishes soil's functional ability to buffer against nutrient and pesticide leaching by aerating soils and accelerating the decomposition rate of organic matter, destroying soil aggregation and reducing soil biota. Additionally, the extensive shorelines and limited land area, coupled with urbanization and historical farm locations, creates high hydrologic connectivity which exponentially increases the risk of nutrient loading into surface waters and embayment's.

Soil health, also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. This definition speaks to the importance of managing soil's physical, chemical and biological components so they are sustainable for future generations.

Healthy soil supports clean air and water, bountiful crops and forests, productive grazing lands, diverse flora and fauna and beautiful landscapes. Soil is the medium which provides all these ecological services by performing five essential functions:

1. **Water Regulation and Retention:** Soil directs the flow and velocity of precipitation runoff, snowmelt, and irrigation water as well as dissolved solutes by its physical capacity to facilitate water infiltration into and percolation through the soil profile. Preserving the physical properties of the soil along with increasing organic matter facilitates water storage for future climatic and biological cycling.
2. **Habitat:** Soil provides shelter, food and access to water resources for a diverse array of flora and fauna, from micro-organisms inhabiting the soil profile to the flora and fauna which take root and emerge from the soil. The diversity, productivity and health of the soil directly reflect the diversity, health and productivity of the organisms which depend on this medium.
3. **Remediation:** The chemical composition and microbes inhabiting soils can aid in the remediation of soil contaminations by filtering, buffering, degrading, immobilizing, sequestering and detoxifying harmful organic and inorganic compounds including industrial and municipal by-products and atmospheric deposits.
4. **Nutrient Cycling:** Macro and micro nutrients such as carbon, nitrogen, phosphorus, potassium and sulfur are sequestered, transformed, and cycled within soil which helps reduce nutrient losses and provides a ready source of nutrition in a usable form. The rate of nutrient cycling depends on such factors as soil texture, biota, organic matter, cation exchange capacity, pH, and climate.
5. **Physical Stability and Support:** Soil structure provides pore spaces to store water and air for use by plant roots and soil biota. Strong soil structure is developed from the biological glues produced by the soil biota that give soil aggregates strength. The plant roots stabilize soils, buffering against off-field soil transport. As roots decompose they also enrich soils with organic matter, increasing soil's water holding capacity and providing the primary food source for soil biota. The soil biota produce biological glues, which aggregates soils, increases porosity and facilitates infiltration and percolation as well as supports continued high biological activity and soil health.

Soils also provide the foundation of support for human structures and the protection of cultural resources.

Historically, the industry has focused on amending the chemical and physical components of soils to ensure crop productivity, which has resulted in the installation of reactionary conservation measures to protect natural resources from degradation. The first goal in achieving high quality soil health is to recognize that soil is a functioning ecosystem and its chemical, physical and biological properties must be holistically managed and protected in order to receive the benefits and resource protections provided by this medium. Recognizing the benefits of soil health will require advancing agronomic activities which adhere as much as possible to the four guiding principles of soil health:

- Manage more by disturbing less
- Diversify soil biota with plant diversity
- Keep living roots growing throughout the year
- Keep the soil covered as much as possible

The incorporation of progressive cropping and tillage strategies, continued research on crop nutrient requirements, precision fertilizer application and timing as well as monitoring of soil and crop health in concert with productivity, costs and resource concerns is absolutely necessary. By monitoring changes in soils and plants, a farm manager can determine if a set of conservation practices is economically sustainable.

Additionally, there is no metric and monitoring program to track organic matter in soils. Developing and tracking the organic matter levels in soils over time is an important component needed to track the effectiveness of BMPs such as composting, cover cropping, erosion controls, no-till, crop rotations, and responsible nutrient and pest management applications.

Appendix - Success Stories and On-Going Efforts

Successful Partnerships – A Case Study

Beginning in 2012, American Farmland Trust (AFT) and private partner, Agflex, adapted the national *BMP Challenge* program to provide yield guarantees to SC farmers interested in participating in on-farm demonstrations of nutrient management practices, primarily application of Cornell University recommended rates for nutrients, fertilizer equipment calibration and use of Controlled Release Nitrogen Fertilizer (CRNF). These unique performance guarantees allow farmers to try conservation practices on their own land, observe performance in side-by-side comparisons with their traditional practices, and evaluate conservation practices without risk to income due to yield loss. The *BMP Challenge* program has been used nationally to encourage nutrient management, conservation tillage, irrigation and other practices with over 200 farmers in 19 states.

After this work by AFT and Cornell Cooperative Extension of Suffolk County (CCE) in 2012 and 2013, a majority of SC sweet corn farmers and potato farmers have experimented with use of these nutrient management practices. In 2013, potato farmers achieved a reduction in nitrogen applications of 13 pounds/acre while experiencing a net gain of $505/acre. By contrast, sweet corn farmers reduced their nitrogen use by 10 pounds/acre, while generating a net gain of $101/acre. These demonstration projects are not only encouraging larger numbers of SC farmers to try conservation practices, but are also prompting participating farmers to use the practices on more acres. For example, in 2009, only one SC vegetable farmer was using CRNF on a major portion of their total acreage. By 2014, fifteen vegetable farmers were planning to use CRNF on a major portion or all of their land. In total, the AFT/CCE demonstration projects and training programs have contributed to a 600% increase in vegetable farmers' use of CRNF in SC since 2009.

In the next 5 years, AFT and CCE aim to build on this successful record by working with farmers in SC to integrate advanced nutrient management practices with other soil health practices to further reduce nitrogen losses from farmland, while enhancing the economic viability of Long Island farms. AFT will adapt the BMP Challenge program to reduce financial risk for SC farmers interested in using this broader suite of nutrient management and soil health practices."

Next Steps Already in Progress

The Noank Aquaculture Cooperative was founded in 2000 by a group of small scale oyster farmers working in the Town of Groton, CT. They have since added members from Long Island, NY, all who share a common goal of responsibly growing great tasting shellfish. Currently, the Noank Aquaculture Cooperative is funding a groundwater monitoring program through proceeds from the sale of their "Peconic Pearls" oysters. Noank has collected money for a Nitrogen sampling study to look at the flow rate of groundwater and the concentration of nitrogen as it enters the Peconic Bay. The National Grid Foundation is matching Noank's contribution. The information collected will help track Nitrogen loading in subwatersheds and help pinpoint the sites most in need of mitigation practices. The study, to be conducted by Cornell Cooperative Extension, is titled "*Locating and Quantifying Groundwater Derived Nitrogen Seeping into Surface Waters at a Location in Peconic Bay, Suffolk County, NY: Demonstration of the Trident and UltraSeep Technologies*". The study intends to sample water from three sites; one site adjacent to undeveloped land, one site adjacent to a high-density coastal suburban setting, and the other adjacent to agricultural land.

Narrative - Wickham Farms

The Wickham's family has farmed on the North Fork of Long Island's East End since the 1600s. Their fruit farm is located on some of the oldest continually cultivated land in the country. Tom Wickham, a ninth generation farmer, and his wife Gekee have been farming in Cutchogue since 1970. Their 200-acre historic bicentennial farm and farm stand is a favorite destination for both visitors and locals.

Mr. Wickham has been extensively involved in many governmental and extension conservation programs since he began farming. He frequently partners with the Suffolk County Soil and Water Conservation District (SCSWCD) and was one of the first 50 farmers in the County to receive an Agricultural Environmental Management (AEM) comprehensive farm plan in 1999. AEM is a voluntary, incentive-based program that helps farmers make common-sense, cost-effective and science-based decisions to help meet business objectives while protecting and conserving natural resources. Farmers work with SCSWCD AEM resource professionals to develop the plans. Mr. Wickham's participation in NRCS cost-share programs has allowed him to offset the expense incurred by voluntarily implemented recommended Best Management Practices (BMP) on his farm.

In 1938 after the historical hurricane "The Long Island Express", the then USDA - Soil Conservation Service, assisted the Wickham family with the design of a 1½ mile dike system to protect their prime farmland, pristine tidal waters, and both public and private properties that surround the Wickham peninsula. When the SCSWCD was founded in 1964, the conservation professionals further assisted with the installation of weirs that supported the maintenance and operation of the dikes. In 2012, Superstorm Sandy caused extensive damage to the Wickham's dike system. Mr. Wickham received assistance from the USDA – Natural Resource Conservation Service's (NRCS) Emergency Watershed Protection fund to assist in designing and constructing repairs to the dike system.

The Wickhams have also utilized SCSWCD cost-share programs, including the Fuel Tank Replacement program. Tom replaced three fuel tanks with double-walled, environmentally sound tanks and with funding provided through the New York State Agricultural Nonpoint Source Pollution Abatement and Control Program. Mr. Wickham also participated in the installation of an Agrichemical Handling Facility (AHF). The AHF is a facility that provides farms with a safe environment for the storage, mixing, loading and cleanup of agrichemicals. This practice was funded in part by New York State Department of Environmental Conservation (DEC) Environmental Benefit Fund established in partnership with the DEC and the SCSWCD.

On the federal level, Wickham Farm has participated in the NRCS Environmental Quality Incentive Program (EQIP) and Agriculture Management Assistance (AMA) cost-share programs. These two programs partially funded the installation of a micro-irrigation system, which helps to conserve water use thereby reducing the potential for erosion, disease, and leaching throughout the farm. Additionally, the programs further assisted the Wickhams in offsetting the cost of establishing conservation cover in the orchard and cover crops which help prevent soil erosion and assist in absorbing excess nitrogen. Mr. Wickham has installed a Seasonal High Tunnel that is being used to grow cherry trees, and it is the first use of its kind in the area. A Seasonal High Tunnel is a polyethylene covered structure that is used to protect crops and extend their growing season in an environmentally safe manner. It helps protect the crop while reducing nutrient and pesticide losses into the groundwater.

Recognizing that the Wickham farm is located in a highly environmentally sensitive area, Mr. Wickham has worked closely throughout the years with Cornell Cooperative Extension of Suffolk County (CCE) to host and conduct many on-farm demonstrations and trials to reduce his use of pesticides and fertilizer to protect water quality. The Agriculture Stewardship programmatic researched resulted in the adoption of the Adapt-N program, controlled release nitrogen fertilizer, pheromone disruption, and a weather

station. The Adapt-N program is a management tool that helps precisely determine the nitrogen needs of grain crops including corn by considering field conditions, previous cropping history, weather, and soils before making fertilizer application decisions. Notably, this program assisted the Wickham farm in reducing fertilizer usage by at least 10 lbs. per acre while ensuring crop nutritional needs are met. The nitrogen needed for the crop is protected against potential leaching and runoff, ultimately safeguarding groundwater and reducing nitrogen infiltration into the surrounding surface water.

The similarly CCE-supported Pheromone Disruption program is a form of pest management used to control insect reproduction by releasing female insect scents attractants, which confuse male insects and reduces the need for traditional, regularly-scheduled pesticide applications and thus the need for pesticides. The Wickhams have installed a weather station on-site which they use to monitor the farm's micro-climate in order to assist in the fine-tuning of the farm's integrated pest management practices.

The US Environmental Protection Agency (EPA) recently published an article written by Mr. Wickham. In the article, "*Farmer Story: For Long Island Farmers, Fertilizer is Key to Saving Money, Reducing Work, and Protecting Community"*, Tom wrote, "What we have here is a unique opportunity to work with our land, improve our operations, and protect the health of our community. For me, these are rare opportunities that we shouldn't pass up". These programs teach farmers that by using slow release fertilizer and other best management practices, they will not only reduce nitrogen leaching into the groundwater but they can also save time and money. They also demonstrate the recognition that our farmers belong to a community, and they are willing to try new technologies and practices to enhance environmental and community stewardship.

Tom Wickham was recently awarded the Suffolk County Agricultural Environmental Management (AEM) Award in 2014. While his efforts are exceptional, they serve as a comprehensive and scalable model for future versions of best management practices implementation. Geographically, economically, and environmentally, the Wickham Farm is not so unique and special that these practices cannot readily be adopted on other SC farms. In fact, they serve as a model for future collaborative efforts, including District AEM conservation plan adaptation, CCE research trials, and NRCS cost-share programming on SC farms. It is a demonstration that farmers can protect the environment, improve their on-farm economics, and preserve natural resources with the appropriate degree of funding and inter-agency coordination.

Narrative – The Milk Pail Fresh Market & U-Pick

The Halsey family has lived and farmed on the South Fork of Long Island since the 1640's. The commodities they have produced may have changed over time, from potatoes and dairy to pumpkins, orchards and greenhouse, but their commitment to sound farming practices has remained constant. Today, Ms. Jennifer Halsey Dupree and Ms. Amy Halsey-Cohn are the 12th generation to manage the family's farm. They grow 26 different varieties of apples, a large diversity of squash and pumpkins, and a beautiful selection of flowering plants for the retail market and u-pick sales. The Halsey farm sells fruit to nearby schools and other farm stands, but most of its business is generated from "U-Pick" activities and direct sales at their The Milk Pail Country Store in Water Mill.

For the Halsey family, using conservation practices makes economic and environmental sense. They serve as a model for other SC farmers looking to avail themselves of the suite of agricultural stewardship programs offered on Long Island. One approach utilized by the Halseys to protect the environment is Integrated Pest Management (IPM). IPM requires careful monitoring of pests, disease and weather patterns to determine the most effective crop protectant and the proper timing of application. To ensure that crop protectants reach their intended targets and do not drift, Mr. John Halsey built an over-the-row sprayer with drift-reducing nozzles in the apple orchard. As a result, the Halsey farm was able to reduce the volume of pesticide use by 30 percent and almost eliminate off-target drift.

The Halseys store their crop protectants, fertilizer and equipment in a barn that is an agrichemical handling facility, having a floor that is specially designed to contain spills and to prevent leaching into the soil and water resources below. The Suffolk County Soil and Water Conservation District (SCSWCD) and the USDA Natural Resource Conservation Service (NRCS), with the partnership it established with the New York State Department of Environmental Conservation Environmental Benefit Program, assisted the Halseys with a cost sharing program for construction of this Mixing and Loading Facility.

Over the years the Halsey's have worked very closely with NRCS and the SWCD to develop and implement a comprehensive conservation plan on their farm. Conservation cover was installed between orchard rows to control erosion and improve soil health. NRCS staff provided cost share assistance for the design and installation of micro-irrigation on a small section of orchard a number of years ago. The demonstrated success of this incentive practices convinced the farm to install drip irrigation on their current 20 acres of apples, 4 acres of peaches, and 10 acres of pumpkins.

The farm also participated in the Conservation Security Program which funds the voluntary implementation and adoption of stewardship practices such as planting buffers around surface water bodies, installing field borders, and managing shallow water areas for wildlife. Nutrient management practices include banding fertilizer under the canopy line in the orchard, applying fertilizers through the drip irrigation system and regularly having soil, tissue and petiole analysis performed to determine specific nutrient needs. Pest management activities included canopy management to reduce fungicide use, precision spraying, and using reduced risk pesticides. Converting from conventional tilling to no-till has dramatically improved soil drainage, increased organic matter, reduced fuel consumption associated with pumpkin and squash production. The inclusion of an intensive cover crop program has also allowed for more natural nitrogen sequestration and cycling for the vine crops as well as building a resilient soil environment to improve plant health.

Keeping the land and water healthy is critical to Jennifer and Amy as they look to the future of the farm. Both women agree the next generation of farmers "are going to have so many opportunities. The technology itself is going to be amazing. And with all these new things, it'll just make it easier and safer. No one should be afraid to get into agriculture because it's a wonderful, wonderful way of life."

Appendix - Agricultural Environmental Management

New York State Agricultural Environmental Management program (AEM) consists of five steps or tiers of conservation planning. The tiers guide farmers through a progressive planning and implementation program in order to address associated environmental concerns farms while maintaining a healthy agricultural economy. The five tiers of conservation planning include:

- Tier I – A questionnaire designed to collect basic information, such as the type of commodities grown, agronomic practices, and current participation in conservation planning programs.

- Tier II – In this phase, on-farm resource concerns and stewardship activities are identified through the completion of a series of commodity specific agronomic operation worksheets by the farm manager and with the assistance of natural resources professional. The worksheets selected are based upon answers to the Tier I questionnaire. Additional commodity worksheets are continuously being drafted in local regions throughout the State in order to address additional and regionally unique resource concerns.

- Tier III –Comprehensive conservation plans are developed in this phase of planning to address each natural resource concern identified in Tiers I-II. The plan will highlight advancing stewardship, identify the recommended resource management system and associated best management practices (BMPs) as well as any suggested changes in agronomic operations. Since the use of nutrients and pesticides are a major environmental concern, it is important that these practices are an integral component of the plan.

- Tier IV – This is the implementation phase of AEM where the recommended resource management systems and/or individual practices are designed and installed. Tier IV may involve engineering and construction measures, or changes in farm practices and methods. Technical assistance is provided to the farmer for the design and implementation of the plan by staff from the Suffolk County Soil and Water Conservation District (SCSWCD), Cornell Cooperative Extension of Suffolk County (CCE) and the USDA – Natural Resources Conservation Service (NRCS). Financial incentives are a critical factor to help ensure implementation of the plan, resource management systems and/or individual practices.

- Tier V – In this final phase of planning, the natural resource benefits provided by the installation of BMP's are evaluated at a farm and watershed scale. This includes measuring the effectiveness, continued operation and maintenance, and satisfaction with the AEM initiatives.

Appendix – Cost Share Budget Estimations

The Suffolk County Soil & Water Conservation District (SCSWCD), the Suffolk County Department of Economic Development & Planning, and the USDA-NRCS worked together to develop the budget estimate to write and implement Nutrient Management Plans (NMP) and Integrated Pest Management Plans (IPM) on 90 farms over the next ten years. It is important to note that the pace of writing and implementing NMPs and IPMs is slower in earlier years as SCSWCD employees will need to gain technical certification and on-site experience before we can reasonably expect these plans to be written more quickly. In addition, successful development of these plans as well as programmatic delivery hinges on securing an agronomist or horticultural specialist as noted in the request for additional positions as well as the filling of vacant positions with experienced staff.

Based on internal research conducted by SCSWCD and NRCS and cost estimates provided by certified technical service providers, the expected cost of a written NMP is $16,000 per 60 acre farm. The cost is approximately the same for an IMP. A total of $2,000 of the cost is expected to be paid by the farmer and $4,000 of that cost is expected to be provided in-kind by SCWCD technicians. The remaining $10,000 will need to be cost-shared through state and or federal funding sources.

Based on SCSWCD expertise, and cost share rates provided by NRCS, the following “typical” NMP plan was developed for a traditional vegetable farm. A single farmer would need to receive $99,405 over five years, or $19,881/year, in cost assistance to fully implement this NMP.

Table 1. Estimated cost of implementing practices recommended by Nutrient Management Plan - Vegetable

Primary Benefit	Practice	No.	Units	Estimated Cost	Total over 5 Years
Nutrient	Compost Facility	1	Number	$10,000.00	$10,000.00
Nutrient	Critical Area Planting	0.25	Acre	$1,500.00	$375.00
Nutrient	Deep Tillage	36	Acre	$30.00	$1,080.00
Nutrient	Filter Strip	1	Acre	$700.00	$700.00
Nutrient/Pest	Conservation Cover	2	Acre	$850.00	$1,700.00
Nutrient/Pest	Conservation Crop Rotation	60	Acre	$60.00	$3,600.00
Nutrient/Pest	Contour Buffer Strips or Herbaceous Wind Barrier	5	Acre	$1,000.00	$5,000.00
Nutrient/Pest	Cover Crop	60	Acre	$100.00	$6,000.00
Nutrient/Pest	Diversion	250	Feet	$7.00	$1,750.00
Nutrient/Pest	Irrigation Water Management	60	Acre	$120.00	$7,200.00
Nutrient/Pest	Mulching	60	Acre	$550.00	$33,000.00
Nutrient/Pest	Residue Management	60	Acre	$400.00	$24,000.00
Nutrient/Pest	Vegetated Treatment Area	1	acre	$5,000.00	$5,000.00
					$99,405.00

A similar estimate was established for a “typical” IPM plan. A single farmer would need to receive $163,605 over five years, or $32,271/year, in cost assistance to fully implement this NMP. Note that there are overlapping practices between an NMP and an IPM. In practice, a farmer who did both an IPM and an NPM would not need to spend the full $263,010 to implement these BMPs.

Table 2. Estimated cost of implementing practices recommended by Integrated Pest Management Plan - Vegetable

Primary Benefit	Practice	No.	Units	Estimated Cost	Total over 5 Years
Nutrient	Deep Tillage	**36**	**Acre**	$30.00	$1,080.00
Nutrient	Filter Strip	**0.25**	**Acre**	$700.00	$175.00
Nutrient	Roof Runoff Structure	**300**	**Feet**	$40.00	$12,000.00
Nutrient/Pest	Ag Chemical Handling Facilities	**1**	**Number**	$45,000.00	$45,000.00
Nutrient/Pest	Conservation Cover	**1**	**Acre**	$850.00	$850.00
Nutrient/Pest	Conservation Crop Rotation	**60**	**Acre**	$60.00	$3,600.00
Nutrient/Pest	Cover Crop	**60**	**Acre**	$100.00	$6,000.00
Nutrient/Pest	Diversion	**200**	**Feet**	$7.00	$1,400.00
Nutrient/Pest	Contour Buffer Strips or Herbaceous Wind Barr	**15,000**	**Feet**	$0.30	$4,500.00
Nutrient/Pest	Irrigation Water Management	**100**	**Acre**	$120.00	$12,000.00
Nutrient/Pest	Mulching	**60**	**Acre**	$550.00	$33,000.00
Nutrient/Pest	Residue Management	**60**	**Acre**	$400.00	$24,000.00
Nutrient/Pest	Windbreak Shelterbelt	**5,000**	**Feet**	$4.00	$20,000.00
					$163,605.00

Finally, though not included in the Budget Estimates, a "typical" NMP was created for the livestock or equine industry. In this budget estimate below, a single farmer would need to receive $499,705 over five years, or $99,941/year, in cost assistance to fully implement a recommended NMP.

Table 3. Estimated cost of implementing practices recommended by Comprehensive Nutrient Management Plan – Livestock/Equine

Primary Benefit	Practice	No.	Units	Estimated Cost	Total over 5 Years
Nutrient	Compost Facility & Animal Mortality Compost	**1**	**Number**	$10,000.00	$10,000.00
Nutrient	Critical Area Planting	**0.25**	**Acre**	$1,500.00	$375.00
Nutrient	Deep Tillage	**36**	**Acre**	$30.00	$1,080.00
Nutrient	Fence	**5,000**	**Feet**	$8.00	$40,000.00
Nutrient	Filter Strip	**1**	**Acre**	$700.00	$700.00
Nutrient	Grazing Land Mechanical Treatment	**60**	**Acre**	$500.00	$30,000.00
Nutrient	Heavy Use Protection	**3,000**	**Sq Feet**	$25.00	$75,000.00
Nutrient	Pasture and Hayland Planting	**60**	**Acre**	$450.00	$27,000.00
Nutrient	Pipeline	**1,000**	**Feet**	$6.00	$6,000.00
Nutrient	Prescribed Grazing	**60**	**Acre**	$3,000.00	$180,000.00
Nutrient	Roof Runoff Structure	**200**	**Feet**	$40.00	$8,000.00
Nutrient	Waste Storage Facility	**25,000**	**Cubic Foot**	$4.00	$100,000.00
Nutrient	Water and Sediment Control Basin	**100**	**Feet**	$35.00	$3,500.00
Nutrient	Watering Facility	**3**	**Number**	$2,000.00	$6,000.00
Nutrient/Pest	Conservation Cover	**1**	**Acre**	$850.00	$850.00
Nutrient/Pest	Diversion	**200**	**Feet**	$7.00	$1,400.00
Nutrient/Pest	Irrigation Water Management	**40**	**Acre**	$120.00	$4,800.00
Nutrient/Pest	Vegetated Treatment Area	**1**	**acre**	$5,000.00	$5,000.00
					$499,705.00

Appendix - Cost To Treat Water

Pesticides

The use of Granular Activated Carbon (GAC) adsorption units to remove contaminants is considered standard procedure by the SCWA for wells located on the North Fork of Long Island. Most pesticides can be removed by Granular Activated Carbon (GAC) systems, but at a significant and ever-increasing cost to ratepayers. SCWA has 41 wells on treatment for pesticides and herbicides. The total capital cost to date to install GAC systems for the removal of pesticides and herbicides from our drinking water is approximately $12,500,000 and five additional wells with pesticide and herbicide detections are currently slated to be put on treatment this year, at an additional capital cost of over $1,000,000. The Authority has another 22 wells on treatment that include pesticides and herbicides as targeted contaminants for removal, and 6 wells in this category that will have treatment added this year.

The cost to construct a new enclosed GAC facility is $800,000. Operating costs for a GAC system typically add approximately 25 cents per 1,000 gallons treated. The SCWA operates over 100 GAC systems countywide and enjoys an economy of scale with GAC treatment which helps keeps costs affordable. The annual operating and maintenance costs associated with these treatment systems are just over $1,200,000. Additional operating and maintenance costs are incurred for the 22 wells on treatment for both pesticide-related compounds and volatile organic compounds (VOCs). In the adsorption process the pesticides and herbicides compete with the VOCs and therefore carbon usage and costs are increased, although it is difficult to quantify these additional costs.

SCWA samples for 113 pesticide related compounds. To analyze pesticide and herbicide samples, the SCWA Laboratory currently utilizes six gas chromatography-electron capture detector (GC/ECD) systems at an approximate cost of $30,000 each; four gas chromatography-mass spectrometry (GC/MS) systems at an approximate cost of $60,000 each; two liquid chromatography (LC) systems at an approximate cost of $50,000 each; and one liquid chromatography-tandem mass spectrometry (LC/MS/MS) system at an approximate cost of $300,000. The total capital cost for these thirteen instruments is approximately $820,000.

Just to meet the minimum general pesticide monitoring required by New York State and the Environmental Protection Agency, SCWA must sample every well in their system utilizing 11 different test methods, at least once a year, at an annual average cost of $407,000. There are additional testing costs associated with wells where pesticides and herbicides have been detected. This entails quarterly monitoring of both the influent and effluent at each well where the compounds have been detected, utilizing the appropriate test method for each compound detected, at an average annual cost of $67,000. The new wells being added to treatment will increase these costs by $10,000. Altogether, the cost of testing for pesticides amounts to close to $500,000 annually, on average, for the SCWA.

Nitrate

As the SCDHS has found, nitrate levels from fertilizers exceed the MCL in many sections of the aquifer. In agricultural areas such as the North Fork, nitrate levels in groundwater typically fluctuate seasonally. The peak nitrate levels are usually encountered in late summer and early fall, while the seasonal minima are usually encountered in late spring. The fluctuating nitrate levels make assessment of well fields for treatment strategies very difficult, since nitrates may only exceed drinking water standard in a given well for a small portion of the year.

Nitrates are difficult and expensive to treat. Blending two wells together at the same site is an option if one of the wells, usually constructed with a deeper screen setting, has much lower levels of nitrate in its water. On the North Fork, very few locations with those hydrogeologic conditions exist, largely due to the limited vertical extent of the fresh water aquifer in the area. Lacking the ability to blend with a lower nitrate source, nitrates are typically removed from raw well water by the operation of a nitrate removal plant, which uses regenerating ion exchange (IX) resins. These resins exchange chloride ions for nitrate ions. This generates a high nitrate brine waste which must be disposed of as hazardous waste. The cost to construct a new nitrate removal facility is approximately $2 million. The expenses associated with operation of a nitrate removal facility are quite high, so that the cost of producing nitrate free water from such a facility is more than double the rate charged to the consumer.

Because of the above mentioned expenses, most nitrate removal plants are operated in such a manner that they treat approximately 1/3 of the total flow to a level of zero mg/L of nitrate, and blend the resulting treated water with the remainder of the water produced by the wells at that well field. The resulting blended finished water typically has a nitrate level of approximately 7 mg/L, which is substantially below the drinking water standard. Therefore, a nitrate removal plant should be considered to be a blending facility.

Appendix - Research and Pilot Projects

Below are brief descriptions of projects proposed by Cornell Cooperative Extension of Suffolk County and the Suffolk County Water Authority to minimize the impact of nitrogen and pesticides due to agricultural inputs. The overall goal of these projects is to maintain the economic viability of the agriculture and horticulture industries on Long Island while protecting and preserving our sensitive environment. Producers adopt these best management practices (BMP) once their effectiveness has been demonstrated. Once developed, these BMPs can be incorporated into Nutrient and Pest Management Plans.

Research and Pilot Projects:

Evaluation and Development of Best Management Practices for Controlled Release Nitrogen Fertilizers in Vegetable Crops:

Major strides have been made to reduce the loading of nitrates in ground water by improved timing of nitrogen fertilizers and by reducing nitrogen rates. However, reports released by the Suffolk County Department of Health Services have shown detections of nitrates in the ground water continue to be above current health standards. Additional efforts are needed in this area to reduce nitrate loading in the ground water from agriculture. Previous research conducted by the Cornell Cooperative Extension Vegetable/Potato Program has shown that controlled release nitrogen fertilizer (CRNF) technology will minimize the potential of nitrate leaching into ground water by improving crop nitrogen-use efficiency and reducing nitrogen rates without compromising crop yield and quality. Results have led to best management practice guidelines in potato and sweet corn and grower adoption of CRNF in these crops. New advancements in the technology have led to the development of CRNF with a 45-day release profile allowing for implementation in numerous vegetable crops whereas before its use was limited to crops reaching maturity in 90+ days. However, in order to promote and implement the use of CRNF on more vegetable farms, growers need sound, scientific research that ensures minimal risk; yields be maintained or increased and the practice is economically sound. More scientific, replicated studies are necessary to determine best management practices for CRNF in short-season vegetable crops such as zucchini, lettuce, spinach, beets, cabbage, and broccoli and in long-season crops not previously researched such as tomatoes, peppers, pumpkins and winter squash before growers are comfortable adopting and implementing the practice.

The goal of these studies is to evaluate 45-day and 90-day release CRNF to determine if nitrogen contamination to groundwater is reduced and economically viable yields are maintained. The Vegetable/Potato program will achieve the goal by conducting small-plot, replicated research evaluating nitrogen rates, blends and yields on various vegetable crops as well as through on-farm demonstration projects working with the growers directly to implement the technology on their farm. Best management practices will be developed for each vegetable crop researched and published in a one-page handout. Results will be shared with growers at winter meetings, through one-on-one visits, and in Cooperative Extension publications**.**

Evaluating Mustard Cover Crops as a Biological Alternative to Fumigation in Vegetable and Small Fruit Production to Manage Soil-Borne Plant Pathogens:

Soil-borne plant pathogens cause significant economic loss each year in vegetable and small fruit production and for years growers have relied on chemical fumigation to manage them. The environmental impacts from traditional fumigants can be significant so alternatives need to be investigated that decrease runoff and leaching of pesticides into Long Island's ground and surface water.

Mustard cover crops offer a biological alternative to traditional fumigation while achieving similar results of improved crop health and reduced pathogen pressure. The mustard cover crop, when chopped and incorporated, releases a chemical similar to that found in the chemical fumigant Vapam. However, biological approaches are typically safer for the environment, the applicator, and the community as they pose less of a health risk, are less likely to leach, and do not persist for long in the environment. Research conducted by the Vegetable/Potato program demonstrated that a spring planted mustard cover crop grown and incorporated prior to winter squash will significantly reduce the incidence of *Phytophthora capsici* over the no mustard control resulting in increased yields and crop quality. Results were shared with growers at meetings and several factsheets and articles were published on the practice. Grower adoption of the practice has grown from zero acres in 2007 to over 500 acres in 2015 significantly reducing the amount of chemical fumigant (Vapam) used on Long Island fields. However, we have only researched one application of the mustard cover crop in one crop and on one particular pathogen. There is the potential to increase the acreage where mustard cover crops are used as a biological alternative to traditional chemical fumigants by expanding the research to evaluate the practice in different crops, for different pathogens and by evaluating spring vs. fall biofumigation as not every grower can plant a spring mustard crop.

The goal of this research is to minimize the use of Vapam chemical fumigation on Long Island vegetable, potato, and small fruit fields directly reducing pesticide use and leaching into ground water. Spring and fall biofumigation with mustard cover crops to control soil-borne plant pathogens will be evaluated in potato (scab, verticillium, fusarium, rhizoctonia), strawberry (verticillium, phytophthora, fusarium), eggplant (verticillium), pepper (phytophthora), and cucurbits (phytophthora, fusarium). Crop yield, quality, and disease incidence will be recorded and data analyzed in small plot replicated trials and in on-farm demonstrations. Reports, articles, and factsheets will be created and distributed amongst the grower community and results shared at grower meetings.

Minimizing Pesticide Use in Vegetable and Potato Production with Resistant Variety Evaluations:

Several common fungicides and insecticides used for pest management in vegetable and potato production have been detected in Long Island's groundwater. Although alternative materials that are less likely to leach or persist in the environment are effective options to keeping our ground water clean, the most effective way to minimize ground water contamination is by reducing overall pesticide use. In trials conducted on Long Island, resistant varieties have shown levels of disease suppression of 96% without the use of any chemical fungicides and the level of control achieved was similar to or better than any chemical spray program implemented. Growers also know and recognize the importance of resistant varieties as part of an integrated pest management program as resistant variety trialing is always identified as the number one priority by all three Advisory Committees the Vegetable/Potato program meets with annually; Vegetable, Potato and Organic. However, crop yield and quality plays a significant role whether or not resistant varieties are grown and adopted commercially. No matter the level of resistance, without the desired horticultural characteristics there is little to no chance for grower adoption. Plant breeders have included pest resistance as a major focus area of their breeding programs and "new" resistant varieties are constantly being developed and released. Growers need unbiased, scientific research on variety performance and disease suppression to stay up-to-date on the most recent advances and make informed decisions that improve their business and the environment. The goal of this project is to minimize fungicide and insecticide use in vegetable and potato production by evaluating resistant varieties for crop yield, quality, and level of resistance. Growers will receive information from the trials through newsletters, articles, and meetings. "New" resistant varieties that performed well will be highlighted on Cornell Cooperative Extension – Suffolk County Vegetable Program webpage.

Development of Strategies to Reduce Fertilizer Leaching from Containerized Plants in Greenhouses and Nurseries:

Due to interest in increasing fertilizer efficiency and in reducing nutrient leaching, this project seeks to gain further information on various practices that can reduce nutrient leaching. These practices include using controlled release fertilizers, precision irrigation (e.g., irrigation sensors, improved irrigation scheduling), and other cultural practices such as general irrigation and fertilization strategies, wetting agents, and types of growing media used. While most of the previously listed practices are not new in concept, there are barriers to their use or expanded use. Barriers include lack of grower experience, lack of crop specific usage information, and/or and research to validate, to identify best use practices, and to determine the cost effectiveness. This project seeks to gain more information on the various practices available for reducing nutrient leaching through conducting targeted research as well as on-farm demonstrations to validate their use in real-world production situations.

Development of Best Management Practices for Herbicides Detected in Groundwater:

Several currently labelled and commonly used herbicides have been detected in groundwater including atrazine, dichlobenil, diuron, metribuzin and simazine. These products are of critical importance to weed management in vegetable, nursery and fruit crops on Long Island. Development of cultural practices in conjunction with alternative herbicides or reduced rates of these leachable herbicides has shown potential to minimizing impacts to the groundwater and providing economical weed control. An example of this is the use of late summer rototilling of an infested field of mugwort will allow for better control of this weed with subsequent herbicide applications in the fall. Another example is the evaluation of the efficacy of the cultural practice known as ‘stale seedbed’ with alternatives to atrazine. Two to three years of applied research will be followed by two to three years of on-farm evaluation.

Development of Management Programs That Minimize Use of Fungicides That Have the Potential to Leach into Groundwater:

Some commonly-used fungicides have been detected in groundwater including metalaxyl, mefenoxam and propiconazole. These products are of critical importance to disease management in vegetable, nursery, greenhouse, sod and fruit crops on Long Island because of their proven efficacy for diseases that can be major constraints to production. It is anticipated that these diseases can be effectively and economically managed by using cultural practices in conjunction with alternative fungicides to minimize the need for these leachable fungicides at critical times. Growers understandably need documentation of the effectiveness of alternative products so that they can change their management programs and continue to produce high-quality products. Research will be conducted to evaluate alternative fungicides and cultural practices to minimize the use of these leachable fungicides for some key diseases of important Long Island crops, and to examine efficacy of low labeled rates as an additional approach to reduce the quantity of these materials used. Critical times in disease development when these fungicides are needed will be identified. The use of RainWise weather stations and NEWA's web-based pest forecasting and modeling programs will be incorporated into the research.

Promoting Sustainable Practices in Vineyards:

The viticulturist was co-author of VineBalance, the NY sustainable viticulture program and a major contributor to the Long Island Sustainable Winegrowing program (www.lisustainablewine.org). This is a significant, third party verified set of guidelines, the only such program in the eastern US. We propose research activities that further goals of sustainable viticulture – production of high quality winegrapes with methods that are environmentally sensitive as well as economically viable. Research will focus on managing grapevine viruses, ecological pest management techniques, cultural practices that mitigate

susceptibility to diseases and evaluation of disease tolerant varieties. Grapevine virus diseases such as leaf roll and red blotch are devastating local vineyards. Testing, evaluation of potential vectors and management strategies are critical. We also propose to plant and manage several varieties reported to be tolerant of fungal diseases, potentially reducing the need for fungicide maintenance sprays. These varieties are typically developed in climates with shorter growing seasons and lower humidity than that found in our maritime climate. Vines will be managed using LISW protocols. Screening of these varieties for both disease tolerance and fruit quality is critical. A variety may be disease tolerant but if fruit quality is mediocre to poor, that is a costly mistake given that vineyard planting costs are high (>$20,000/acre). We will also focus on vineyard management techniques that potentially reduce susceptibility to debilitating diseases such as summer fungal diseases and late season cluster rots. For example, alternating canopy density and cluster morphology may reduce inherent susceptibility to fungal diseases by promoting air flow, faster drying of leaves and fruit after a rainfall and reducing berry to berry spread.

Best Management Practices in Conjunction with Groundwater Monitoring:

Cornell Cooperative Extension of Suffolk County is collaborating with Suffolk Department of Health Services and the New York State Department of Environmental Conservation to evaluate the relationship between farm practices and the presence/absence of pesticides and nitrates in groundwater. To this end, monitoring test wells have been established in the following commodities: greenhouse, sod, nursery, vineyards, vegetable and tree fruit.

Cornell Cooperative Extension (CCE) will work with growers to document pesticide use and farm management practices. Special attention will be paid to materials currently found in groundwater or that are suspected to potentially leach when used according to the label. As part of the trend analysis, CCE will collaborate with growers to evaluate the causes/reasons for detection and non-detection of various selected pesticides and evaluate grower best management practices to determine their value in minimizing groundwater impacts. Using this information, staff will conduct research to further refine and develop new best management practices. Newly developed BMPs will be evaluated as they are implemented by the participating growers. This information will be used to develop comprehensive pesticide management plans, which would aid in minimizing the impact of pesticides on groundwater. If BMPs are determined to have the potential to reduce impacts to groundwater, they will be incorporated into Cornell recommendations.

Development of Alternative Management Practices to Insecticides That Have the Potential to Contaminate Groundwater or Surface Water:

Some important insect problems in Long Island agriculture and landscapes are often addressed with neonicotinoid and other insecticides that have been detected in or pose risks for ground- and surface water contamination. These include materials like trichlorfon (Dylox), imidacloprid (Merit, Marathon, Admire, etc.), dinotefuran (Safari) and methomyl (Lannate) used for grub control in ornamental plant nurseries, aphid and whitefly control in greenhouses, scale control in ornamental plants, cucumber beetle and Colorado potato beetle management in vegetable crops and worm control in sweet corn. Some insecticides used in vegetable and ornamental crops and landscapes also pose risks to surface waters and non-target species, such as pyrethroids, organophosphates and carbamates (e.g. bifenthrin, permethrin, acephate, carbaryl).

Cornell Cooperative Extension of Suffolk County's Entomology Program has a strong background in evaluating and implementing new products and technologies, including biological controls, biopesticides, insect mating disruption, and predictive tools like pheromone and other insect traps. Findings are now used in industry replacing the need for conventional insecticides, minimizing their use and improving business profitability through reduced losses from pests. Applied research on pests where alternatives are

needed to insecticides detected in groundwater or posing risks to surface water from drift or runoff will be conducted. Target pests and crops include white grubs in nursery plants, alternative treatments and/or baits for managing spottedwing drosophila in small fruit, cucumber beetles in vine crops, incorporating biological control for pests in greenhouse floriculture crops, using insect traps and field scouting to improve management of brown marmorated stinkbug and plum curculio in orchard fruit, and reduced-risk/biopesticide options for 'worm' pests in sweet corn.

Engaging Suffolk County Growers Within the Peconic Estuary Watershed to Implement a Comprehensive Program of Integrated Pest Management (IPM):

CCE's Agricultural Stewardship Program will engage farmers in adopting a comprehensive Integrated Pest Management (IPM) Program specific to the pest pressures of crops grown in the region's maritime climate. The project's objective is broader adoption of environmentally sustainable pest management practices to decrease runoff and leaching of pesticides into groundwater and surface waters.

For long-term sustainability, specialty crop producers must adopt environmentally sustainable pest management practices to protect groundwater, our sole source aquifer, surface waters and the Peconic Estuary. By adopting a comprehensive IPM Program specific to the specialty crops' pest pressures and by integrating the RainWise weather stations and NEWA's web-based pest forecasting and modeling programs, farmers will be economically viable and environmentally sustainable. In other regions of New York, NEWA's web-based resource has been reported to save on average $19,500/year in spray costs and prevent, on average, $264,000/year in crop loss as a direct result of using NEWA pest forecasting. We anticipate 90% adoption of IPM and Weather Station for long-term environmentally sustainable pest management practices.

On-Farm demonstration projects will bring together all the key components of IPM: On-farm evaluation of pest management history, recordkeeping, pest trapping, monitoring, establishing economic thresholds, biological/pheromone controls, chemical controls and pest forecasting through RainWise weather stations and their connection with Cornell University's Network for Environmental and Weather Applications (NEWA).

1. In cooperation with CCE Entomologists and Vegetable, Nursery, Tree Fruit, Greenhouse and Viticulture Specialists, the Ag Stewardship Program will develop IPM protocols and scouting guidelines specific to the pest pressures for mixed vegetables, greenhouse, vinifera grapes, nursery and tree fruit.
2. Establish Grower Cost-Share Program: To encourage grower investment in IPM program specific to each crop.
3. Enroll farms in comprehensive IPM demonstration projects. Establish farm-specific plans that consider pest pressures specific to each crop and microclimate.
4. IPM Farm Evaluation: Demonstration project will begin with a historical evaluation of the farm's pest management practices using AEM/Cornell University guidelines.
5. Conduct Grower Educational Program (topics include): Scouting Procedures, Pest Life Cycle Calendar, How To Use RainWise Weather Stations & NEWA Forecasting Models, Cultural Controls, Reduced-Risk Pesticides, Pheromone Disruption, Pest Identification & Trapping and other crop specific pest management techniques.
6. Scouting Program Includes: a) Agricultural Stewardship Technicians scouting fields, collecting and inputting data and providing weekly written reports to growers, CCE Entomologists and CCE Specialists. b) Oversight, consultation and grower-feedback will be provided by CCE Entomologists and CCE Specialists in Nursery, Greenhouse, Vegetable and Viticulture Programs.

7. End of Season Report & Evaluation: Grower, CCE Specialists, Entomologists and Technicians will review pest management practices and evaluate cost/benefits of the comprehensive pest management program.

Improving Nitrogen Fertilizer Best Management Practices and Grower Adoption of Nitrogen Use Efficiency and Controlled Release Nitrogen Fertilizer (CRNF): CCE'S Agricultural Stewardship

Program will engage farmers in adopting a nitrogen fertilizer best management program that includes: consideration of all nitrogen sources including (soil organic matter, legumes and cover crops), precision calibration, use of controlled release nitrogen fertilizer and Cornell University N-Fertilizer Recommends for the purpose of decreasing the amount of N-Fertilizer applied and improving nitrogen use efficiency. The project's objective is broader adoption of environmentally sustainable N-fertilizer management practices to decrease runoff and leaching of pesticides into groundwater and surface waters.

For long-term sustainability, specialty crop producers must adopt environmentally sustainable nitrogen-fertilizer best management practices to protect the groundwater, our sole source aquifer and surface waters. By adopting CRNF, Cornell University recommended rates of N-fertilizer and nitrogen use efficiency; farmers can be economically viable and environmentally sustainable. Results of past N-fertilizer demonstration projects have shown: Use of CRNF in sweet corn production can decrease Nitrogen applied by 10 lbs/acre, with a net gain of $101/acre based on yields and cost of CRNF. Likewise, potato results have shown a decrease in amount of nitrogen applied by 13-lbs/acre and $505/acre net gain based on yields and cost of CRNF. Continued research and on-farm projects need to be conducted to establish blends of CRNF and conventional fertilizer for application to mixed vegetables, nursery, tree fruit and sod.

On-Farm demonstration projects will involve implementation of in-field side-by-side projects to compare CRNF with conventional fertilizer. On-farm evaluation will include: appropriate planting and practices for use of CRNF, calibration of fertilizer equipment, soil health tests, tissue and soil nitrogen tests, and at-harvest yields will be taken from both fertilizer practices to determine if there has been a loss due to conservation practices adoption. CRNF will be provided at no cost to farmer.

1. In cooperation with CCE Specialists in Potato/Vegetable, Sod, Nursery and Tree Fruit, the Ag Stewardship Program will develop N-Fertilizer Best Management Recommendations specific to specialty crop.
2. Enroll growers in a Nitrogen Use Best Management on-farm demonstration project. (Projects may include one or more of the following: N-Fertilizer farm evaluation, side-by-side demonstration projects to compare CRNF with Conventional Fertilizer, side-side evaluation of reduced N-fertilizer rates, Equipment Calibration, End of Season harvest evaluation of crop's quality and quantity, soil health tests, soil and tissue Nitrogen tests, data collection and developing database, communicate with grower all results.
3. N-Fertilizer Farm Evaluation: Demonstration projects will begin with a historical evaluation of the farm's N-Fertilizer best management practices using AEM and Cornell University Guidelines.
4. Conduct Grower Education Programs (topics include): Basics of N-fertilizer BMP's, Determining Quantity of N-Fertilizer needed by crop, Nitrogen BMP's in Organic Production, How To Read & Interpret Soil Health and Plant Tissue Tests

Minimizing Nitrogen Use in Vegetable and Potato Production through Variety Trial Evaluations:

Nitrogen management in vegetable and potato crop production can be both an economic and environmental risk. In order to minimize these risks, the goal of any best management practice for nitrogen should be capable of minimizing contamination of groundwater while, at the same time, allowing

for profitable applications of nitrogen fertilizers. The CCE Vegetable and Potato Program has been researching and evaluating the use of controlled release nitrogen fertilizers as one method of achieving this goal but is not the silver bullet for every grower. Additional methods that are more widely adaptable by Long Island growers need to be researched and investigated in order to further reduce nitrogen loading from Agriculture into our ground and surface waters.

Plant breeders are constantly developing "new" varieties that are more efficient and perform better than older more traditional varieties. Information on how well these varieties perform in regard to yield and quality continues to be identified as a top research priority among local grower advisory committees. However, there has been limited research evaluating varieties for nitrogen-use efficiency. Varieties identified as having desired horticultural characteristics and high productivity at reduced nitrogen rates could easily be embraced by the industry. The goal of this project is to evaluate and then identify vegetable and potato varieties that use nitrogen more efficiently (e.g. yield and quality is maintained but at lower nitrogen rates) and encourage adoption by growers through demonstration projects, one-on-one consultations, written reports, factsheets, at winter meetings.
Cost

Portable GAC Units for Remediation of Pesticide Contamination:

Pesticides are ubiquitous in agricultural areas, and are known to contaminate groundwater in those areas. Granular Activated Carbon (GAC) adsorption systems are in widespread use in the potable water industry, and are known to be a cost effective remedial measure in areas where groundwater is contaminated by petroleum products or pesticide degradates. The Suffolk County Water Authority operates over 100 GAC units throughout its system, and closely monitors their performance to ensure that water emanating from these systems meets potable water standards. These GAC units range in size from 4-ft. diameter systems that can treat up to 100 gpm, to 12 ft. diameter vessels that can treat up to 1000 gpm.

The SCWA maintains contracts with different vendors for the installation, removal, and relocation of GAC vessels throughout SC, as well as for piping of these vessels and the emplacement and removal of the GAC filter media. Using existing contracts and vendors, GAC systems could be located on farm properties that are known to have pesticide contaminated groundwater beneath them. Water could be pumped to these systems in the off season either by utilizing an existing well located on the farm, or by the installation by SCWA contractors of an appropriately sized new well on the site. The farm property would need to be capable of accommodating the discharged water without flooding, unless a permit could be obtained to utilize nearby highway drainage structures, should they exist.

Initially, the focus would be on properties that are known to be within the capture zone of existing public supply wells. Assuming that the initial pilot proves successful, it can be expanded to include areas upgradient from residents on private wells, or upgradient from important ecosystems. The financial arrangements of these installations will vary, but could include the purchase by the SCWA of an easement on a farm property, or some other type of in-kind service.

Cover Crops for Nitrate Mitigation:

Groundwater over large portions of the North Fork is known to be contaminated with nitrates at concentrations close to or above the NYS drinking water standard of 10 mg/L. Given the generally thinner fresh water aquifer on the North Fork, blending with a deeper well pumping lower nitrate is not an option for public water suppliers over most of the area. One possible method to reduce nitrates in groundwater is to plant cover crops that remove nitrogen from the soil. This technique is widely practiced already, both on Long Island and throughout the agricultural regions of the U.S. It is believed that

targeted plantings of cover crops, either within the contributing areas of public supply wells, or upgradient of certain wetland ecosystems, can reduce nitrates in ground water. The SCWA has numerous parcels on the North Fork that have large enough undeveloped areas to facilitate the planting and harvesting of these crops, and also have elevated nitrates. The SCWA could allow a farmer free access to its land in order to cultivate and harvest these cover crops, while the SCWA could monitor the nitrate levels in nearby groundwater in order to validate the effectiveness of the planting in reducing nitrate concentrations.

Appendix - Agricultural Nonpoint Source Abatement and Control Program Grants

On-Farm nutrient management with a focus on nitrogen is a focal priority for the agricultural industry in SC due to the recognized contributions to and demonstrated impact of nitrogen loading on ground and surface waters. A potential for a state mandate regulating nitrogen applications on farmland further charges the agricultural community with voluntarily modifying and improving their agronomic stewardship in order to reduce nitrogen leaching through the implementation of progressive best management practices.

Nutrient management focuses on adjusting the rate (amount), timing, form, and method of nutrient application to ensure adequate soil fertility for plant production and to minimize the potential for environmental degradation, particularly air, soil, and water quality impairment as defined by the New York State Department of Agriculture and Market's Agricultural Environmental Management (AEM) program. Farm specific nutrient management plans (NMP) allow producers to understand many facets of their operation, including the nutrient cycles on their farms, environmental resources they may be degrading, and what Best Management Practices could be implemented to increase profitability and/or environmental protection.

The first phase of nutrient management is planning on a whole farm level. Baseline data on plant and soil health, nutrient use and loss, cropping systems as well as commodity type are collected and analyzed to document on farm stewardship as well as prescribe best management practices to address resource concerns.

The challenge in drafting NMPs locally has been the cost of developing the plan due to access to certified planners, geographic isolation, and local custom of growing multiple crops. NRCS' Technical Service provider funding remains available for nutrient management planning. However reimbursement rates are based on statewide rather than regional average costs and thereby do not provide an economic incentive to develop a NMP. Cost share funding therefore is imperative for the development of certified NMPs in SC to help offset the elevated expense of drafting a certified nutrient management plan.

Recently, the New York State Agricultural Nonpoint Source Abatement and Control Program approved SCSCD funding for $240,851 in order to provide cost share assistance for the development of NMP's. If awarded, cost share funding would facilitate the first phase of nutrient management through the development of 15 USDA-NRCS Nutrient Management (590) plans on five greenhouse, four vegetable and three nursery and livestock facilities as well as on one orchard and one vineyard. The successful implementation of this grant will not only benefit the agricultural entity and will provide access to additional cost share funding for the implementation of recommended best management practices but also help to engage other agricultural operations in nutrient management planning and implementation programs. Collectively, these activities will help advance the overarching regional goal in farmland management: the protection and enhancement of ground and surface water resources.

Appendix - Branding and the Third-Party Certification Model

In business, branding matters. Consumers have demonstrated a willingness to pay premiums for brands that signal an added degree of quality. Products that are promoted as "green," or "sustainable," or "eco-friendly," are good examples. A recent Nielsen study reviewed retail sales data for a cross-section of both consumable and non-consumable categories across 20 brands in nine countries.[7] These brands either included sustainability claims on packaging or actively promoted their sustainability actions through marketing efforts. The results from a March 2014 year-over-year analysis show an average annual sales increase of 2% for products with sustainability claims on the packaging and an increase of 5% for products that promoted sustainability actions through other marketing programs. "Grown locally" efforts have proven to be equally powerful. New York State Agriculture & Markets have a very successful "Pride of New York" brand and the Long Island Farm Bureau has an equally successful "Grown on Long Island" brand.

As evidence to the power of branding and certification standards, a recent study commissioned by the Economic Research Service of the United States Department of Agriculture used actual consumer purchase data to estimate a pricing model that measures consumers' willingness to pay for attributes and additional production costs associated with organic foods, such as organic certification and the lack of pesticides used during production. For vegetables, organic premiums varied from about 17% for tomatoes and carrots to 62% for potatoes.[8] Of the fruit that can be grown locally included in the study, the price premium ranged from 32% for apples to a 40% for strawberries.

While organic farming is a growing segment of Long Island farming, it still comprises a small percentage of SC farming practices. According to the 2012 Census of Agriculture, 15 Suffolk County farmers are certified organic, or approximately 504 acres.[9] However, tens of thousands of SC agricultural acres are involved, to some degree, in best management practices in consultation with our partners at Cornell Cooperative Extension (CCE), the Suffolk County Soil and Water Conservation District (SCSWCD), and the USDA-NRCS. We need a new mechanism to recognize these efforts and to signal to consumers which farmers are taking pro-active steps to protect SC soil health and water resources.

A third-party certification model, that is farmer-driven, could serve this function. While the USDA sets standards for "organic" certification, which is enforced through third-party agents, there is no equivalent for "best management practices". When standards are rigorously developed, and third-party enforced, they can prove to be a viable branding mechanism for local producers. These third-party certifications send signals to consumers that our local producers are taking extra, *voluntary* measures to protect our environment. As such, they can serve several important functions. Hopefully, they will allow local producers to charge premiums for their produce which will help reward producer investments in environmental sustainability. Two, they will help communicate to the press, to policymakers, and to the public-at-large that local farmers are taking important steps to protect our natural resources. Unfortunately, outside of specific industry and political circles, the public is not familiar with CCE, SCSWCD, and NRCS efforts, nor are they familiar with the high upfront costs and investments needed to purchase new equipment, develop and implement nutrient and pest management plans, perform field scouting, invest in weather monitoring equipment, etc. Third-party certification standards, which can be

[7] "Global Consumers Are Willing To Put Their Money Where Their Heart Is When It Comes To Goods And Services From Companies Committed To Social Responsibility" as accessed at http://www.nielsen.com/us/en/press-room/2014/global-consumers-are-willing-to-put-their-money-where-their-heart-is.html on 3/13/15.

[8] Organic Premiums of U.S. Fresh Produce, by Biing-Hwan Lin, Travis A. Smith, and Chung L. Huang, Renewable Agriculture and Food Systems, 2008, 23(3): 208-216.

[9] The acreage figures are from the 2007 Census as the 2012 Census does not include County-level acreage numbers.

communicated through branding labels applied directly onto produce, posted at farmstands, and integrated into marketing and promotional materials, can help achieve Agricultural Stewardship Committee goals, which include expanding awareness of on-going farmer sustainability efforts. It can also act as a motivator to engage "un-certified" farmers to act as industry "leaders" in setting high stewardship standards expectations for future generations of SC farmers. And as a grower driven effort, albeit motivated by increased profit margins, the effort is sure to drive local farmer involvement in the settings and achievability of certification standards.

A local, progressive, and commodity-driven "Branding and the Third-Party Certification Model" can be viewed within the following **Narrative – Long Island Sustainable Winegrowing**.

Narrative – Long Island Sustainable Winegrowing

For almost 40 years, Long Island vineyards have worked hard to develop unique and safe practices for producing quality wine grapes. East End vineyards and wineries have grown to create their own definition of sustainability that is based on their role as stewards of the rich agricultural heritage of the Long Island. According to the Long Island Sustainable Winegrowing (LISW), the viability of local vineyards is dependent on their ability to steward their land in a way that allows it to stay healthy and productive well into the future. They see their vineyards as a holistic ecological system and they strive to develop viticultural practices that produce the highest quality fruit possible while also being sensitive to the environment and financially viable over time.

LISW is a not-for-profit organization that provides education and certification for Long Island vineyards. Cornell Cooperative Extension Viticulture Specialist Alice Wise and former Viticulture Program Assistant Libby Tarleton created NY's first sustainable viticulture guidelines in 2004, the Long Island Sustainable Viticulture program. The LISV guidelines were then incorporated into VineBalance, the statewide guidelines that resulted from collaborations between a large group of Cornell faculty and staff. VineBalance is recognized and endorsed by AEM Program of NYS. It is "designed to provide grape growers of New York and other regions of the northeastern United States with guidance in evaluating and adopting best management practices that minimize environmental impacts, reduce economic risks and protect worker health and safety".

Using VineBalance as a template, a group of Long Island grape growers worked with Wise and Tarleton to create a set of sustainable viticulture guidelines that addressed Long Island's specific goals and challenges. First released in 2012, the Long Island Sustainable Winegrowing guidelines (http://www.lisustainablewine.org/) are a science-based approach that are annually reviewed and revised to reflect current best management practices. LISW and CCE together have hosted speakers that addressed both the technical merit and administration of LISW as well as vineyard management strategies for sustainable growers.

The LISW is a new way to look at sustainable agriculture that ensures that we have clean water and air, a healthy workforce, healthy soils and healthy vines. The program is committed to the following:

- To implement cultural practices and solve problems that reduces and minimizes the use of chemicals and fertilizers, with the goal of protecting the farmer, the environment, and society at large.
- To encourage practices that promote and maintain high biological diversity in the whole vineyard.
- To maintain and conserve healthy and fertile soils to produce grapes for years to come
- To encourage practices that protect our maritime ecosystem and estuaries from runoff and leaching

- To create and maintain viticulture that is economically viable over time.
- To maintain the highest level of quality in our fruit production.

To qualify for certification, participants must undergo an independent, third-party inspection. This involves an on-site visit and a review of all records—earning passing scores on all criteria, and creating an action plan for future improvements. The following year they must show progress on that plan. A vineyard has to be certified the first two consecutive years, and then subsequent inspections take place every third year.

Vineyards are scored on weed management, disease management and insect control. Some herbicides, fungicides and insecticides are prohibited altogether because of their tendency to leach into and persist in ground water. Others are limited to use once or twice per season. Reduced-risk, bio-pesticides or organic materials are allowed, and in the case of fungicides, must make up more than half of the applications each season. Since excessive nitrogen is a critical concern in ground water and the estuarine environment, growers are not allowed to exceed a total application of 20 lbs per acre of nitrogen fertilizer while encouraging the use of organic forms of nitrogen.

Former District Conservationist Allan Connell has been involved in not only helping to develop the criteria but also in providing guidance to growers on how to meet the requirements of the program. The NRCS and SWCD play a critical role in this process because the participants rely on them for conservation planning assistance to help them address these critical resource concerns. Participants must develop an action plan addressing how they are addressing soil erosion, runoff management and how they are providing habitat diversity in the form of ecological compensation areas on the farm. A current conservation plan satisfies these requirements.

One critical need that is being addressed is the need for an Agricultural Chemical Mixing Facility on each farm. The SWCD has designed a generic pad that can be used by all vineyards and NRCS is in the process of reviewing and approving this design. The NYS Department of Environmental Conservation is providing cost share assistance to the growers for the installation of these pads.

The program is in its fourth year and continues to grow. There are currently 18 vineyards and 800 acres enrolled in the program (36% of the Long Island wine grape acreage.) Many have gone through two years of inspections and all are now certified sustainable. A logo has been developed and can be used on wine labels to indicate that the vineyard is certified sustainable. Wine market research has shown that consumers will pay a premium for wine that originates from operations that take stewardship steps above and beyond the regulatory minimum. We already see the marketing advantages and price premium power of branding efforts such as “certified organic”. If SC grape growers can distinguish themselves in the marketplace and on store shelves with LISW certification, they will have proven to be a viable economic model for other agricultural commodities. It will not be long before other business-savvy and ecologically-conscious SC farmers create their own voluntary third-party certification programs in order to distinguish themselves from the competition.

Appendix - Managing Canadian Geese

The recent overpopulation of resident Canada Geese (*Branta canadensis*) has negatively impacted water quality in Suffolk County. When cover crops are planted in the early fall, vegetation growth is supported by warm soils and temperate days and slowed by cooling and snow cover. The cover crop, while growing, sequesters available nitrogen for the next growing season and prevents its leaching from the soil column. Both the above and below ground vegetation of the cover crop enhances soil health by enriching the soil with organic matter, encouraging infiltration by slowing velocity of precipitation and runoff and reducing wind and water erosion by stabilizing and buffering soil particles.

Unfortunately, geese are attracted to the young tender seedlings and flocks can easily de-vegetate a whole field in November before the hunting season begins. At this time of year, the soil and air temperature is too cold for the cover crop to recover exposing the soil to wind and water erosion through the whole winter. Cover cropping will remain an important component of any farmers' agricultural stewardship strategy. However, comprehensive strategies must be developed outside of the agricultural community that address the growing overpopulation of resident Canadian geese, as this species of fowl, pose a long-term threat to the effectiveness of increased local cover-cropping.

Canadian geese are protected as migratory birds. However, extending the hunting season from November 1st to the end of February would help protect cover crop growth. In the long-term, comprehensive strategies must be developed outside of the agricultural community to address the growing overpopulation of Canadian geese, as these animals pose a long-term threat to the effectiveness of local cover-cropping as well as surface water quality in ponds and stream.

Appendix - Agricultural Stewardship Monitoring Program Budget

Agricultural Stewardship Monitoring Program, which is the expansion of the SCDHS Department of Environmental Quality's on-farm well monitoring program, is proposed in order to determine the impacts to groundwater quality from pesticides, nitrates and other contaminants and monitor changes over time in association with agriculture.

To effectively implement and conduct the proposed expansion of Agricultural Stewardship Monitoring Program requires a minimum of three additional staffers. The combined salary for these additional three staff members is estimated to be $104,445 (net cost after Article 6 State Aide provided in Table 2).

In particular, the additional staff is required in order to conduct the expanded sampling, surveying, maintenance and monitoring of approximately 125 additional monitoring wells and with the collection and analysis of over 150 samples per year. Regular monitoring for pesticides and nitrogen in groundwater will occur at vineyards, row crops, golf courses, greenhouses, and nurseries and other agricultural commodities as well as residential uses. In addition, the potential impact of pesticides and nitrogen upon fresh and estuarine waters will also be evaluated.

This programmatic expansion well sampling program will require one additional public health sanitarian. The analysis of an additional 150 water samples collected each year requires securing a Chemist I to perform the additional work load within the Public Environmental Health Lab (PEHL). The installation of an additional 125 necessitates the hiring of an Engineering Aide, help survey in the newly added monitoring wells. In addition to surveying, the Engineering Aide will assist in data management, water levels monitoring and well sampling as needed. It should also be noted that without the additional staff members, the additional work for the Agricultural Stewardship Monitoring Program would not be feasible.

Table 1

STEWARDSHIP MONITORING COST OVER FIVE YEARS

	COST	2015	2016	2017	2018	2019	Total Cost
MONITORING NETWORK WELL INSTALLATION PER/YR *	$1,500	25	25	25	25	25	$187,500
SAMPLING MONITORING NETWORK WELLS (RUNNING TOTAL) **	$650	25	50	75	100	125	$243,750
SURFACE WATER SAMPLES	$650	25	25	25	25	25	$81,250
WATER LEVELS	$15	45	45	45	45	45	$3,375
SAMPLING EQUIPMENT- METERS, PUMPS, TUBING, CALIBRATION SOLUTIONS, ETC							$30,000
Total Five Year Stewardship Cost							**$545,875**
Average cost per year							$109,325

*5 to 10 farms practicing best management practices will be added each yr (25 wells total)

*Average well depth is approximately 60 feet with a cost of approximately $25 per foot.

**Anticipated total sampling events each yr.

Table 2

Peconic Estuary Agricultural Stewardship

Salary Costs

		Salary 2013	Fringe rate	Fringe cost	Total Salary	State Aid Rate (0.36)	% related to health	Net Cost after Article 6 State Aid for Salary
Proposed Positions to be Funded	PH Sanitarian Trainee	$36,671	0.4847*	$17,774	$54,445	$19,600	100%	$34,845
	Engineering Aide	$31,278	0.4847*	$15,160	$46,438	$16,718	100%	$29,721
	Chemist I	$41,969	0.4847*	$20,342	$62,311	$22,432	100%	$39,879
*** This is the old fringe rate, new hires will have decreased rates due to the fact that new hires will be required to contribute into their health and pension benefits for their entire career**					**$163,195**			**$104,445**

Appendix - SCSWCD Agricultural Specialist Job Description

Proposal:
Hiring of a permanent agricultural specialist/agronomist/horticulturalist for the Suffolk County Soil and Water Conservation District.

Goal:
Strengthen Suffolk County's Agricultural Environmental Management (AEM) programming by developing, administering, and implementing certified nutrient and pest management planning program tailored to SC's unique agricultural commodities and resource concerns for the protection and improvement of surface and ground water resources.

Objective:
Retain on staff an agricultural/horticultural specialist with higher education and field experience, in order to overcome educational, expertise and geographic barriers that continuously limit nutrient and pest management planning and training for regional agricultural commodities and agency staff.

Projected cost of additional staff within Suffolk County Soil and Water Conservation District:

Civil Service Position	**Requested Staff Positions (#)**	**Salary (2015)**	**Fringe (**at 2014 Rate)	**Fringe Cost**	**Total Position Request**
District Agricultural Specialist/Agronomist/Horticulturalist	1	46,458.00	0.4847	22,518.19	68,976.19

Citations

Cloern J.E. (2001) *Our evolving conceptual model of the coastal eutrophication problem.* Marine ecology progress series v 210, pages 223-253.

Deegan, L.A., Johnson D.S., Warren R.S., Peterson B.J., Fleeger J.W., Fagherazzi S., Wollheim W.M. *Coastal eutrophication as a driver of salt marsh loss.* Nature 490 (7420), 388-392.

Gobler C.J., DePasquale E.L, Griffith A.W., Baumann H. (2014) *Hypoxia and Acidification Have Additive and Synergistic Negative Effects on the Growth, Survival, and Metamorphosis of Early Life Stage Bivalves*. PLoS ONE 9(1): e83648. doi:10.1371/journal.pone.0083648

Gobler C.J., Burson A., Koch F., Tang Y., Mulholland M. R. (2012) *The role of nitrogenous nutrients in the occurrence of harmful algal blooms caused by Cochlodinium polykrikoides in New York estuaries* (USA) Harmful Algae, Volume 17, May 2012, Pages 64–74.

Latimer J.S., Charpentier M.A. *Nitrogen inputs to seventy-four southern New England estuaries: application of a watershed nitrogen loading model*. Estuarine, Coastal and Shelf Science 89 (2), 125-136.

Lloyd, Steven. *Nitrogen load modeling to forty-three subwatersheds of the Peconic Estuary*. The Nature Conservancy in partnership with the Peconic Estuary Program, May 2014 as accessed at https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/Documents/Nitrogen%20load%20modeling%20to%20the%20Peconic%20Estuary%20-%20TNC%20May%202014.pdf.

O'Neil J.M., Davis T.W., Burford M.A., Gobler C.J. (2012) *The rise of harmful cyanobacteria blooms: The potential roles of eutrophication and climate change*. Harmful Algae Volume 14, February 2012, Pages 313–334.