Appendix G.
Implementation Resources

Funding Programs

The New York State Environmental Protection Fund (EPF) was created by the state legislation in 1993 and is financed primarily through a dedicated portion of real estate transfer taxes. The EPF is a source of funding for capital projects that protect the environment and enhance communities. Several NYS agencies administer the funds and award grants, including NYSDAM, NYSDEC, and Department of State. The following two grant programs are supported by the EPF to award funding to implementation projects to address nonpoint source pollution:

The Agricultural Nonpoint Source Abatement and Control Program (ANSACP), administered by the NYSDAM and the Soil and Water Conservation Committee, is a competitive financial assistance program for projects led by the Soil and Water Conservation Districts that involves planning, designing, and implementing priority BMPs. It also provides cost-share funding to farmers to implement BMPs. For more information visit https://www.nys-soilandwater.org/aem/nonpoint.html.

The Water Quality Improvement Program (WQIP), administered by the NYSDEC Division of Water, is a competitive reimbursement program for projects that reduce impacted runoff, improve water quality, and restore habitat. Eligible applicants include municipalities, municipal corporations, and Soil and Water Conservation Districts.

The Environmental Facilities Corporation (EFC) is a public benefit corporation which provides financial and technical assistance, primarily to municipalities through low-cost financing for water quality infrastructure projects. EFC’s core funding programs are the Clean Water State Revolving Fund and the Drinking Water State Revolving Fund. EFC administers both loan and grant programs, including the Green Innovation Grant Program (GIGP), Engineering Planning Grant Program (EPG), Water Infrastructure Improvement Act (WIIA), and the Septic System Replacement Program. For more information about the programs and application process visit https://www.efc.ny.gov/.

Wastewater Infrastructure Engineering Planning Grant is available to municipalities with median household income equal to or less than $65,000 according to the United States Census 2015 American Community Survey or equal to or less than $85,000 for Long Island, NYC and Mid-Hudson Regional Economic Development Council (REDC) regions. Priority is usually given to smaller grants to support initial engineering reports and plans for wastewater treatment repairs and upgrades that are necessary for municipalities to successfully submit a complete application for grants and low interest financing.

Clean Water Infrastructure Act (CWIA) Septic Program funds county-sponsored and administered household septic repair grants. This program entails repair and/or replacement of failing household septic systems in hot-spot areas of priority watersheds. Grants are channeled through participating counties.
CWIA Inter-Municipal Grant Program funds municipalities, municipal corporations, as well as soil and water conservation districts for wastewater treatment plant construction, retrofit of outdated stormwater management facilities, as well as installation of municipal sanitary sewer infrastructure.

CWIA Source Water Protection Land Acquisition Grant Program funds municipalities, municipal corporations, soil and water conservation districts, as well as not-for-profits (e.g., land trusts) for land acquisition projects providing source water protection. This program is administered as an important new part of the Water Quality Improvement Project program.

Consolidated Animal Feeding Operation Waste Storage and Transfer Program Grants fund soil and water conservation districts to implement comprehensive nutrient management plans through the completion of agricultural waste storage and transfer systems on larger livestock farms.

Water Infrastructure Improvement Act Grants funds municipalities to perform capital projects to upgrade or repair wastewater treatments plants and to abate combined sewer overflows, including projects to install heightened nutrient treatment systems.

Green Innovation Grant Program provides municipalities, state agencies, private entities, as well as soil and water conservation districts with funds to install transformative green stormwater infrastructure.

There may be other opportunities to implement management actions through watershed programs (https://www.dec.ny.gov/chemical/110140.html) or other funding mechanisms.
Agricultural Environmental Management (AEM) Program

The New York State AEM Program ([www.nys-soilandwater.org](http://www.nys-soilandwater.org)) supports farmers in their efforts to protect water quality and conserve natural resources, while enhancing farm viability in a voluntary, incentive-based approach. Started as an initiative in 1996 and codified in New York State law in 2000, New York’s AEM Program helps farmers protect water quality by providing a framework to assess environmental stewardship and coordinate technical and financial assistance from the Federal, State, and local levels to address priority water quality issues on the farm. The driving principle of AEM’s success is a farm specific focus, coordinated through locally developed watershed based strategic plans and an educational component to elicit landowner confidence.

**Why AEM was Developed**

AEM was created to provide a consistent format to address environmental challenges facing NY agriculture in a manner that enhances long-term economic viability. AEM is the “umbrella program” that efficiently identifies environmental concerns through a comprehensive environmental assessment and matches these identified needs with existing financial opportunities for farms. With over 30,000 farms making up New York State’s diverse agricultural industry, the coordination and screening function of AEM is critical to targeting technical and financial assistance to the issues and farms that will yield the greatest environmental benefit. AEM also is the cornerstone of the agricultural component of New York’s Nonpoint Source Water Quality Management Strategy developed to meet requirements of the Clean Water Act, The Safe Drinking Water Act, and the Coastal Zone Management Act.

**Who is Involved in the AEM Program?**

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

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1 Priority water quality issues are based on available resource assessments, including the NYS Priority Waterbodies List, the federal 303(d) list, Total Maximum Daily Loads, Source Water Assessment, NRCS Rapid Watershed Assessment, AEM Watershed Site Evaluation, locally identified water quality priorities, county-level AEM Strategic Plan, and county-level Annual Action Plan.

2 The NYS NPS Water Quality Management Strategy was last updated by DEC in 2000. It had four priority issues with agriculture as one of them and it was to be addressed through AEM.
Such coalitions include the Upper Susquehanna Coalition, the Finger Lakes-Lake Ontario Watershed Protection Alliance, Mohawk River Coalition, and others throughout the State.

**How the AEM Program Works**

The AEM process at the County level begins with the Conservation District forming an AEM Steering Committee made up of local resource professionals and stakeholders. These committees often include local representatives of USDA NRCS and Farm Service Agency (FSA), Cornell Cooperative Extension, County Health and/or Planning Departments, Farm Bureau, environmental organizations, watershed associations, agri-business, farmers, and interested citizens. The committee is tasked with developing an AEM Strategic Plan meeting minimum criteria developed by the State Soil & Water Conservation Committee to guide the local AEM effort for the upcoming five years.

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

**Tier 1** – A resource professional collects farm contact information; inventories farm infrastructure, land use, and livestock; determines the farm’s future plans; informs the farmer of their watershed(s) and watershed concerns and identifies potential environmental concerns and opportunities ([www.nys-soilandwater.org/aem/techtools.html](http://www.nys-soilandwater.org/aem/techtools.html)).

**Tier 2** – A resource professional utilizes pertinent worksheets to conduct an on farm environmental assessment based on watershed concerns and the potential concerns and opportunities identified in Tier 1. Tier 2 documents existing environmental stewardship, provides an educational opportunity with the farmer, and verifies environmental concerns or flags issues for further evaluation during the planning process ([www.nys-soilandwater.org/aem/techtools.html](http://www.nys-soilandwater.org/aem/techtools.html)).

**Tier 3** – Priority farms develop a conservation plan with assistance from a team of resource professionals addressing priority resource concerns derived from the integration of the farm’s business objectives, watershed concerns (as derived through the local AEM Strategic Plan), condition of the involved resources (water, soil, air, plants, and animals) and environmental risk. The level and extent of planning considers farm resources and is often progressive (on-going and seeking continual improvement through behavioral change). All BMPs must be planned according to NRCS Conservation Practice Standards and Cornell University Guidelines. Plan components addressing nutrient management must be completed by an AEM or NRCS Certified Planner. Conservation planning activities are supported through the AEM Base Program or competitive

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3 The term “resource professional” refers to a person who is qualified – based on the general expertise of their employer, or on their job description – to provide conservation assistance to farmers. In New York’s public sector, resource professionals are typically employed by federal agencies (e.g. USDA), state agencies (e.g. NYSDEC or NYSDam), local Soil and Water Conservation Districts, or Cornell Cooperative Extension. Private sector resource professionals in New York may include AEM Certified Planners and Professional Engineers.
State and Federal programs such as NYS Agricultural Nonpoint Source Abatement and Control Program (ANSACP) or USDA’s Environmental Quality Incentives Program (EQIP).

**Tier 4** – Implementation of priority BMPs in priority conservation plans. All BMPs must meet NRCS Conservation Practice Standards and Cornell University Guidelines. BMPs designated as engineering must be designed by Professional Engineers licensed in NYS. Technical assistance for BMP design and installation oversight is supported by the AEM Base Program, or by successful application to NYS ANSACP or USDA Farm Bill Programs.

**Tier 5** – Conduct evaluations of conservation plans and implemented BMPs to ensure effectiveness in protecting the environment, proper operation and maintenance, and needed support to the farmer to safeguard public investment. Conservation plan updates according to current standards and guidelines assure continuous improvement and address concerns resulting from expanding operations and management changes. Tier 5 activities are supported through the AEM Base Program. Through various AEM tools, evaluation can take place at the BMP, farm, watershed and/or county levels.

**Programs Associated with AEM**

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

- **AEM Base Program** – [www.nys-soilandwater.org/aem/basefunding.html](http://www.nys-soilandwater.org/aem/basefunding.html)
- **USDA Farm Bill Programs** – A description of Farm Bill programs available to support New York’s farms is in Section
- **NYS and Federal Agriculture Program Implementation and Targeting**, under the header USDA Farm Bill Programs.

**Incentives to Participate in the AEM Program**

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

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4 Resource professionals work with farmers to prioritize projects that will improve soil and water quality, and have a strong likelihood of being successfully implemented and maintained. This process also results in prioritization of farms in the watershed.
- Free technical assistance to identify and address environmental risks, watershed needs, and farm goals through conservation plans
- Technical assistance to implement conservation plans and practices that can improve farm profitability including, but not limited to: nutrient management, prescribed grazing, cover crops, buffers
- To help maintain and improve farm natural resources for future generations
- Improved consideration when applying for competitive Farm Bill cost share programs
- Eligibility for the NYS ANSACP cost-share program
- Eligibility to participate in NYS Farmland Protection Program
- The desire to be viewed and recognized as an environmental steward. NYS has a program that provides an AEM sign to farms that demonstrate and maintain high levels of environmental stewardship, as well as a Statewide and several County AEM Farmer of the Year Awards
- Discounts for related SWCD services such as Soil Group Worksheets required for Agricultural Tax Assessments
- The desire to be a good neighbor
- Eligibility for the Agricultural Water Quality Revolving Loan Fund - provides low interest loans to farmers to implement BMPs

**AEM Tools**

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

- Manure Storage Screening Tool
- AEM Tool for the Evaluation of Manure Storage Structures
- AEM Tool for the Evaluation of Vegetated Treatment Areas
- AEM Report Card

**NYS Concentrated Animal Feeding Operation Program**

Following the first Concentrated Animal Feeding Operation (CAFO) general permit issuance in New York in 1999, CAFO operators were required to obtain and comply with state wastewater discharge permits. Thirteen years later, New York has one of the most robust CAFO permitting programs in the nation, providing coverage for 230 large- and over 246 medium-sized CAFO farms (Table G1 below shows the cutoffs between medium and large CAFOs by the type of animal). New York’s CAFO program is clear, actively implemented and enforced by DEC, of state-wide

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5 Concentrated Animal Feeding Operation (CAFO) means an Animal Feeding Operation (AFO) that is a point source as defined pursuant to New York Environmental Conservation Law Section 17-0105(16) and is a CAFO. Two or more AFOs under common ownership are considered to be a single AFO for the purposes of determining the number of animals of an operation.
applicability, practical and scientifically supported. New York recognizes the need for farm-specific, technical evaluations by qualified professionals, in the form of Certified Planners and Professional Engineers, to ensure that the farm understands and implements the latest developments in land grant university guidelines, United States Department of Agriculture Natural Resources Conservation Services (NRCS) technical standards and State regulatory requirements.

Since the start of the CAFO permitting program in 1999, New York has required New York Certified Planners to develop Comprehensive Nutrient Management Plans (CNMP) for CAFO farms and Professional Engineers to design and certify NRCS engineering practices on farms. This type of science-based, risk reduction approach to CAFO regulation should be considered the national standard; anything less is inconsistent with the Clean Water Act’s “best technology” requirements. The New York CAFO program has persisted in its efforts to afford superior protection of the environment through continued education, enforcement and applied research efforts. These efforts are supported by New York’s regulated farms as documented by a very high rate of compliance.

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

**Table G1. New York Medium and Large CAFO Cutoffs by Number of Animals**

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Number of Animals to be Considered a Medium CAFO</th>
<th>Number of Animals to be Considered a Large CAFO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature Dairy Cows</td>
<td>200-699</td>
<td>700</td>
</tr>
<tr>
<td>Veal Calves</td>
<td>300-999</td>
<td>1,000</td>
</tr>
<tr>
<td>Cattle</td>
<td>300-999</td>
<td>1,000</td>
</tr>
<tr>
<td>Swine (55 lbs or more)</td>
<td>750-2,499</td>
<td>2,500</td>
</tr>
<tr>
<td>Swine (less than 55 lbs)</td>
<td>3,000-9,999</td>
<td>10,000</td>
</tr>
<tr>
<td>Horses</td>
<td>150-499</td>
<td>500</td>
</tr>
<tr>
<td>Sheep or Lambs</td>
<td>3,000-9,999</td>
<td>10,000</td>
</tr>
<tr>
<td>Birds</td>
<td>Quantity Range</td>
<td>Maximum Capacity</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Turkeys</td>
<td>16,500-54,999</td>
<td>55,000</td>
</tr>
<tr>
<td>Laying Hens or Broilers (if using liquid manure handling system)</td>
<td>9,000-29,999</td>
<td>30,000</td>
</tr>
<tr>
<td>Chickens (if using other than a liquid manure handling system)</td>
<td>37,500-124,999</td>
<td>125,000</td>
</tr>
<tr>
<td>Laying Hens (if using other than a liquid manure handling system)</td>
<td>25,000-81,999</td>
<td>82,000</td>
</tr>
<tr>
<td>Ducks (if using other than a liquid manure handling system)</td>
<td>10,000-29,999</td>
<td>30,000</td>
</tr>
<tr>
<td>Ducks (if using a liquid manure handling system)</td>
<td>1,500-4,999</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Note: Refer to New York’s CAFO General Permits for more detailed definitions of medium and large CAFOs. Visit DEC’s CAFO Program webpage (http://www.dec.ny.gov/permits/6285.html) to download copies of New York’s permits.

Comprehensive Nutrient Management Program

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

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

Technical Standards for CAFO Best Management Practices

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

**CAFO Program Highlights in the Cayuga Basin**

Since 1999, New York State has exceeded the federal minimum CAFO requirements by permitting over 450 medium-sized CAFO farms. New York requires erosion control to “Tolerable Soil Loss” on all CAFO crop land, a technical requirement of NRCS NY590 for nutrient management.

No direct discharge of process water is permitted, except during extreme precipitation events.

In 2009, New York State once again exceeded the federal CAFO requirements through the issuance of the State Environmental Conservation Law (ECL) permit for CAFO-sized farms. The CAFO program provides permit coverage to CAFOs, whether or not there is a discharge to surface waters. There are 32 ECL CAFO permits in the Cayuga watershed (Table 1, Appendix F). The federal CAFO program would require permits for only a small number of the New York permitted CAFOs. There are no Clean Water Act CAFO permits in the Cayuga Lake watershed.

**High level of regulatory oversight**

CAFO permitted farms in NYS are required to utilize the AEM framework and tools when developing their Comprehensive Nutrient Management Plan with their AEM Certified Planner. The advantages of this requirement include:

- Prioritizing CAFOs for ANSACP and Farm Bill financial assistance programs
- Identifying resource needs and opportunities beyond CAFO Permit requirements leading to advanced environmental stewardship
- The educational component of AEM helps farmers better understand the impact their farm has on the environment
- Opening the door for improved teamwork between certified planners, agency resource professionals, and agri-business in developing, implementing, and evaluating conservation plans and BMPs leading to advanced environmental stewardship and continuous improvement

**NYS and Federal Agriculture Program Implementation and Targeting**

The proposed management practice implementation levels in this TMDL reflect practical implementation considering the type of agriculture conducted in New York, climate, social/economic and relevant site-specific details, and an estimate of state and federal funding realistically expected to be available through 2025. Funding comes from State sources, a large part of which is awarded in contracts\(^6\) on a competitive basis and through various USDA – NRCS programs.

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\(^6\) State staff reviews projects before costs are fully reimbursed.
State and Federal programs are coordinated through the Agricultural Environmental Management Program to work together to efficiently provide technical and financial assistance to priority farms and priority environmental issues. These programs include:

**New York State AEM Base Program**

The AEM Base Program ([www.nys-soilandwater.org/aem/basefunding.html](http://www.nys-soilandwater.org/aem/basefunding.html)) is noncompetitive technical assistance funding to New York’s Soil and Water Conservation Districts to inventory and assess farms in priority watersheds then plan and design best management practices (BMP), and evaluate effectiveness of planning and BMPs on priority farms based on County AEM Strategic Plans and Annual Action Plans. This program provides the financial resources to prepare and prioritize farms for participation in various State and USDA Farm Bill programs that provide financial assistance to implement BMPs; then supports the farmer as they manage, operate and maintain their plan and the associated BMPs.

AEM Base also supports outreach, educational, and data management activities needed to assure successful planning, BMP implementation, maintenance, and continuous improvement.

NYS Soil and Water Conservation Committee (SWCC) staff members perform a quantitative review of AEM Base deliverables such as assessments, conservation plans, BMP designs, and evaluations. These reviews advance quality, adherence to policies and participation requirements on an annual basis.

AEM Base requires Conservation Districts to complete an AEM Self-Evaluation Report Card to assess impacts and progress toward watershed goals.

**County AEM Strategic Plans and TMDL Alignment**

The findings and recommendations in this TMDL align with the AEM Strategic Plan mission for Cayuga, Tompkins, and Seneca Counties (the three largest counties in the Cayuga Lake watershed).

Cayuga County’s mission statement:

“It is the mission of the Cayuga County AEM Program to assist the County’s agricultural producers with improving environmental stewardship and the economic viability of their farm, through a voluntary method of assessment, planning, implementation, evaluation along with educational and outreach forums to address natural resource concerns involving the improvement of water quality, reduction of soil erosion, creation of wildlife habitat, and the long term sustainability of existing recreational activities while promoting a diverse economy of industry, commerce, tourism and agriculture.”

AEM Strategic Plans identify local water resource concerns specific to sub-watersheds where agriculture is a primary cause and assess the likelihood of improvement. A general summary of environmental concerns for Cayuga Lake outlined in those plans are: (1) phosphorus loading into surface waters, (2) silt and sediment loading in surface water, (3) nutrient and pathogen loading in surface and ground water, and (4) streambank erosion.
The findings in this TMDL can be used by SWCDs to adjust future AEM plans and focus on different areas of the Cayuga Lake watershed identified as concerns here. For example, load allocations for multiple sub-watersheds (Section #) show that phosphorus and soluble P are concerns throughout the basin and not limited to those identified in Table # (from Cayuga County Soil and Water Conservation District’s 2015-2020 AEM Strategic Plan). Expanding resources and outreach to newly identified areas provide opportunities for large gains in water quality improvement.

Example AEM Strategic Plan goals and objectives to improve environmental quality for the Cayuga watershed are: (1) update existing AEM plans and expand AEM participants, (2) secure funding to implement site specific BMPs to address priority natural resource concerns, (3) expand cover crop participation, (4) develop and/or update Tier 3A or Tier 3B plans to lay out implementation schedules to address concerns on individual farms, and (5) complete Tier V Worksheets on 5 farms annually to ensure the farms are maintaining their installed practices.

Again, these objectives are consistent with the approach taken to improve water quality in this TMDL. As agricultural loading was found to be the dominant source of P and represents the largest controllable source, AEM expansion on non-permitted farms needs to be a priority of Cayuga Lake stakeholders to meet suggested load allocations.

Agricultural BMPs listed subsequently in this TMDL are example practices that in many cases are already being utilized by SWCDs through AEM and CAFO permit requirements. This TMDL has identified TP and SRP as priority pollutants to Cayuga Lake (on the sub watershed level) and provides example best management practices to reduce soluble P losses from the watershed (Section 7.2 and Table 31). These findings, with current and expanded AEM efforts will provide a roadmap to effectively, efficiently improve Cayuga Lake water quality.
AEM Base Program accomplishments in the Cayuga Lake Watershed over the 2011-2016 interval are summarized in Table G2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Location</th>
<th>Use Affected</th>
<th>Primary Cause</th>
<th>Potential for Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sediment</td>
<td>Fall Creek, Cayuga Inlet, Sixmile Creek, Yawger Creek, Cascadilla Creek</td>
<td>Fishing, fish propagation, water supply</td>
<td>Streambank erosion, Agriculture, Urban runoff</td>
<td>Moderate. Requires field investigations to identify causes and contributing factors. In some areas only viable solution may be riparian greenbelt to allow natural meanders. Requires watershed-wide commitment to land use and riparian zone management</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Salmon Creek</td>
<td>Water clarity, aesthetics</td>
<td>Agriculture</td>
<td>Moderate</td>
</tr>
<tr>
<td>Nitrate</td>
<td>Great Gully, Paines Brook, Salmon Creek, Mack Br, Williams Cr, Indian Creek</td>
<td>Potential water supply</td>
<td>Agriculture</td>
<td>Unknown. Highly dependent on mix of agriculture and practices in watershed.</td>
</tr>
<tr>
<td>Pesticides</td>
<td>Salmon Creek, Paines Brook, Yawger Creek, (other locations not surveyed)</td>
<td>Presently none detected over limits of concern. Could affect drinking water use.</td>
<td>Agriculture</td>
<td>Highly dependent on mix of agriculture and practices in watershed.</td>
</tr>
<tr>
<td>Sediment</td>
<td>Mouths of tributaries, particularly in the southern portion of the lake</td>
<td>Aesthetics (water clarity and enhanced habitat for macrophytes) Drinking water</td>
<td>Streambank erosion, agriculture, urban erosion</td>
<td>Difficult. Requires watershed-wide commitment to land use and riparian zone management</td>
</tr>
</tbody>
</table>
Table G2. AEM Base Program Funded Deliverables for Farms in the Cayuga Lake Watershed from 2011 – 2019.

<table>
<thead>
<tr>
<th>AEM Base Year</th>
<th>AEM Tier 1</th>
<th>AEM Tier 2</th>
<th>AEM Tier 3A</th>
<th>AEM Tier 3B</th>
<th>AEM Tier 4</th>
<th>AEM Tier 5A</th>
<th>AEM Tier 5B</th>
<th>AEM Base Funds</th>
<th>Base Year</th>
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<td>20</td>
<td>19</td>
<td>12</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>$118,774.00</td>
<td>2011</td>
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<tr>
<td>2012</td>
<td>28</td>
<td>27</td>
<td>16</td>
<td>8</td>
<td>1</td>
<td>9</td>
<td>0</td>
<td>$128,180.00</td>
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<tr>
<td>2013</td>
<td>17</td>
<td>13</td>
<td>13</td>
<td>3</td>
<td>8</td>
<td>20</td>
<td>0</td>
<td>$145,186.00</td>
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<td>2014</td>
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<td>23</td>
<td>6</td>
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<td>4</td>
<td>0</td>
<td>$169,532.50</td>
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<td>4</td>
<td>4</td>
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<td>4</td>
<td>0</td>
<td>$139,262.32</td>
<td>2017</td>
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<td>2018</td>
<td>26</td>
<td>35</td>
<td>29</td>
<td>3</td>
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<td>55</td>
<td>0</td>
<td>$1,310,830.85</td>
<td>Grand Total</td>
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Note, these data only include funds reimbursed to Cayuga, Seneca, and Tompkins SWCDs for their technical assistance via the AEM Base Program. Additional projects for agricultural environmental management were completed via other local, State, and federal funds than those represented here. The farm and completed AEM Tier numbers are solely from within the Cayuga Lake Watershed, but the "AEM Base Funds" column of data represents work performed across the entire county.

Targeting within New York’s AEM Program

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

On the farm resource professionals working with farmers utilize the AEM Tier 1 Questionnaire, the Watershed Site Evaluation Worksheet, and appropriate Tier 2 Assessment Worksheets to gather information on the farm’s position on the landscape (topography, proximity to waterbodies, soil types, etc.), potential pollution sources, and management practices to determine the lack or presence of an environmental concern, or the need to collect additional information to be analyzed. Armed with this information, decisions can be made by the Conservation District where to rank farms for further technical and financial assistance.

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

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

- **USDA Farm Bill Programs**
- **Environmental Quality Incentives Program (EQIP)**
- **Conservation Reserve Program (CRP)**
- **Farmable Wetlands Program (FWP)**
- **Conservation Reserve Enhancement Program (CREP)**
- **Conservation Stewardship Program (CSP)**

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• Agricultural Management Assistance Program (AMA) 11
• Wetland Reserve Program (WRP)12
• Debt for Nature Program (DFN)
• Grassland Reserve Program (GRP)13
• Farm and Ranch Lands Protection Program (FRPP)14

Other Agricultural Best Management Practices
A description of several major Agriculture BMPs, as useful examples understood and practiced in New York State from the Chesapeake Bay Watershed Implementation Plan are described below. Efficiency rates, when provided, are based on the Chesapeake Bay Program “Non-Point Source Best Management Practices and Efficiencies currently used in Scenario Builder” document dated October 27, 2011. The list below is intended for informational purposes only.

Landowners should work their County Soil and Water Conservation District (SWCD), Certified Nutrient Management Planners (CNMP), Watershed Coordinators, and county planning boards to help identify the BMPs best suited for the agricultural activities. The New York State AEM Program (www.nys- soilandwater.org) supports farmers in their efforts to protect water quality and conserve natural resources, while enhancing farm viability in a voluntary, incentive-based approach. Started as an initiative in 1996 and codified in New York State law in 2000, New York’s AEM Program helps farmers protect water quality by providing a framework to assess environmental stewardship and coordinate technical and financial assistance from the Federal, State, and local levels to address priority water quality issues15 on the farm. The driving principle of AEM’s success is a farm specific focus, coordinated through locally developed watershed based strategic plans and an educational component to elicit landowner confidence.

**BMP: Conservation Tillage**

Conservation tillage involves planting and growing crops with minimal soil disturbance. Conservation tillage requires two components: (1) a minimum 30% residue coverage at the time

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13 Details about the Grassland Reserve Program are on the USDA NRCS website at: http://www.ny.nrcs.usda.gov/programs/grp/index.html.
14 Details about the Farm and Ranch Lands Protection Program are on the USDA NRCS website at: http://www.ny.nrcs.usda.gov/programs/frpp/index.html.
of planting and (2) a non-inversion tillage method. No-till farming is a form of conservation tillage where the crop is seeded directly into vegetative cover or crop residue. Minimum tillage farming involves some disturbance of the soil but uses tillage equipment and leaves much of the vegetation cover or crop residue on the surface.

The opportunities for success on the proposed acreage for conservation tillage are based on several factors. Although not currently found in widespread use, this practice can be successful on some farms and on better-drained soils. This practice can be adopted on any farm but larger farms can more readily accommodate changes in management because they already have more versatile equipment, and because they are often better positioned financially to purchase specialized equipment. Larger farms also have a greater ability to adopt this practice because they tend to control larger acreages of the better drained valley soil, and in general they have larger acreages and field sizes which are more conducive to using custom operators.

*BMP: Continuous No-Till*

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

A system to support farmers who implement these practices is necessary to buffer the economic risks they take in the early years of implementation. Demonstration sites would augment outreach and education efforts to encourage implementation. Equipment cost-share or rental options, yield/performance insurance or guarantees, and incentive payments would stimulate long term use and adoption.

*BMP: Cereal and Commodity Cover Crops*

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

*Commodity cover crops* differ from cereal cover crops because they may be harvested for grain, hay or silage and they may receive nutrient applications, but only after March 1 of the spring following their establishment. The intent of this practice is to modify normal small grain
production practices by eliminating fall and winter fertilization so that crops function similarly to cover crops by scavenging available soil nitrogen for part of their growing cycle. This practice can encourage planting of more acreage of cereal grains by providing farmers with the flexibility of planting an inexpensive crop in the fall and delaying the decision to either kill or harvest the crop based on crop prices, silage needs or weather conditions.

Because fertilizer may be applied in the spring, commodity crop efficiencies may be reduced. The same planting date criteria apply as specified under cereal cover crops.

In 2018, NYSDEC and NYSDAM developed the Eastern Finger Lakes Cover Crop Implementation project to increase land area utilizing cover crops in the region. To further unify the efforts to reduce erosion and protect water quality in the Finger Lakes, NYSDEC has agreed to provide funding through the New York State EPF to support utilizing NYS Soil & Water Conservation Districts to implement cover crops focusing first on non-animal agricultural operations within the Eastern Finger Lakes watershed region. The Eastern Finger Lakes watershed region is defined as the watershed areas of Cayuga, Owasco, Skaneateles, and Otisco Lakes. The Soil & Water Conservation Districts are the best partner to implement cover crops at the local level. This project provided $300,000 to the above watersheds over the 2018-2020 period.

**BMP: Conservation Plans – Field and Pasture Erosion Control Practices**

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

**BMP: Comprehensive Nutrient Management Plans**

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

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

**Agricultural Riparian Forest Buffers** are linear wooded areas, usually accompanied by shrubs and other vegetation, that are adjacent to rivers, streams and shorelines. Forest buffers help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. This practice meets some resistance by farmers because of the loss of cropland, added expense of tree planting, maintenance and potential to shade crops. A graded approach that transitions from trees at the water’s edge to shrubs near the crops provides maximum benefits while reducing farmer concerns of shading.

**Agricultural Riparian Grass Buffers** are linear strips of grass or other non-woody vegetation maintained between the edge of fields and streams or rivers that help filter nutrients and sediment and improve habitat. Credit is given for riparian grass buffers in the model when the recommended buffer width is the same as riparian forests buffers (35ft minimum). This practice is similar to stream protection in pastures (see below). This practice has tremendous potential and would be more widely used if it were eligible for CREP funding on more than just cropland and if the grass grown on the buffer could be cut and utilized. A “natural regeneration” buffer that could ultimately revert to forest also has tremendous potential to reduce nutrient and sediment loss.

**BMP: Land Retirement**

Agricultural land retirement takes marginal and highly erosive cropland out of production by establishing permanent vegetative cover such as shrubs, grasses and trees. Land retired and planted with trees is reported under the “Tree Planting” BMP. Wetland construction could also be considered a form of land retirement. USDA NRCS Programs such as CRP, CREP and Wildlife Habitat Incentives Program (WHIP) provide incentives for retirement. Some agricultural land is also going out of production as farms cease to operate.

**BMP: Tree Planting**

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

Programs exist at the federal, state, and local levels to support tree planting and reforestation in the region. The NRCS provides cost share assistance through its CRP and WHIP programs. DEC encourages planting trees and shrubs by providing nursery service to supply low cost, quality stock that is readily available to the public. The nursery program has been an integral part of forest stewardship on public and private lands since its inception in 1902. Also, every Soil and Water
Conservation District has a seedling program for conservation cover and reforestation to private landowners.

**BMP: Non-Urban Stream Restoration**

A collection of site specific engineering techniques are used to stabilize an eroding streambank and channel. For more information see NYSDEC Non-Point Source Program BMP catalogue ([https://www.dec.ny.gov/chemical/96777.html](https://www.dec.ny.gov/chemical/96777.html))

**BMP: Best Management Practices that Specifically Treat Pasture**

This BMP combines all buffer types, cow exclusion practices, and prescribed grazing to address both agricultural sustainability and community needs in relation to stream bank erosion, habitat improvement and flooding. It is anticipated that education and outreach through the AEM program combined with cost-share and incentive payment programs such as CRP, CREP, EQIP, Grazing Lands Conservation Initiative, and state funding, will result in a very high level of BMP implementation to treat pasture and degraded riparian pasture acres.

**BMP: Stream Access Control with Fencing**

Direct contact of pastured livestock with surface water results in manure deposition, streambank erosion, re-suspension of streambed sediments and nutrients, and aquatic habitat degradation. Stream access also affects herd health by exposure to water borne pathogens and risk of hoof problems. Stream access control with fencing involves excluding a strip of land with fencing along the stream corridor to provide protection from livestock. The fenced areas may be planted with trees or grass, or left to natural plant succession, and can be of various widths (recommended minimum of 35 feet from top-of-bank to fence line). However, the stream access control with fencing BMP is applied specifically to the degraded riparian pasture area when the buffer zone is between 10 and 35 feet between top of stream bank and fence line. The implementation of stream fencing provides stream access control for livestock but does not necessarily exclude animals from entering the stream if incorporating limited and stabilized in-stream crossing or watering facilities. By reducing constant stress on streambanks from hooves, cattle exclusion is also a very important practice for stabilizing stream banks.

**Alternative Watering Facility** – This practice requires the use of alternative drinking water troughs or tanks away from streams. The source of water supplied to the facilities can be from any source including pipelines, spring developments, water wells, and ponds. To be effective, this practice should also include shade away from streams for livestock. To be successful, the practice should show reduced livestock manure deposition in and near streams and move heavy traffic areas surrounding water sources to more upland locations.

**BMP: Prescribed Grazing/Precision Intensive Rotational Grazing**

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

Prescribed Grazing can be applied to pastures intersected by streams or upland pastures outside of the degraded stream corridor (10-35 feet width from top of bank). The modeled benefits of prescribed grazing practices can be applied to pasture acres in association with or without alternative watering facilities. They can also be applied in conjunction with or without stream access control.

Additional grazing initiatives in New York are currently being supported through the SWCC Agricultural Non-point Source Abatement and Control Grants Program, NYS Ecosystem Based Management, and the National Fish and Wildlife Foundation.

**BMP: Animal Waste Management Systems**

These important practices are designed for proper handling, storage, and utilization of wastes generated from confined animal operations. They include a means of collecting, scraping or washing wastes and contaminated runoff from confinement areas into appropriately designed waste storage structures. Waste storage structures are typically made of concrete and require continued operation and maintenance, making them a significant cost item. Controlling runoff from roofs, feedlots and “loafing” areas are an integral part of these systems (See, **BMP: Barnyard Runoff Control Practices and Loafing Lots**, below). Scraping or flushing manure more frequently can reduce ammonia emissions from barns and animal confinement areas, as would manure transfer systems that separate feces from urine. Covered manure storage also emits less ammonia. Failure to properly collect and store generated manure may result in losses of liquid manure to surface water and nutrient leachate to groundwater. For dry manure, contact with precipitation or wet soils under stockpiles can result in nutrient leaching.

**BMP: Barnyard Runoff Control Practices and Loafing Lots**

These practices may be installed as part of a total animal waste management system or as a stand-alone practice, particularly on smaller operations. Barnyard runoff control practices include diversions, rainwater gutters, and similar practices. The rotational loafing lot practice, by proximity, is grouped with barnyard control practices and are defined as the stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, surfacing with suitable materials, and/or installing needed structures.

**BMP: Wetland Restoration (Agriculture)**

Agricultural wetland restoration activities re-establish natural hydrologic conditions that existed prior to installing subsurface or surface drainage. Projects may restore, create or enhance a
wetland. Restored wetlands may be any wetland type including forested, scrub-shrub or emergent marsh.

**BMP: Precision Feed Management on Dairy Farms**

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

New York State has a track record of implementing Precision Feed Management (PFM) on dairy farms in the Delaware River Basin since 2000 and the Susquehanna River Basin since 2005. Cornell Cooperative Extension and Cornell University have developed software tool applications to aid in generating implementation of PFM on farms and to assist in the quantification of economic and environmental impact.

**BMP: Mortality Composting**

Composting provides an inexpensive alternative for disposal of all dead animals, butcher wastes and other biological residuals. Mortality composters involve composting routine mortality in a designed, on-farm facility, with subsequent land application of the compost. This prevents the necessity to bury dead animals that could result in nutrient leachate or rendering of dead animals for processing into animal feeds or incineration. Mortality composting can be, and is applied, to various species including poultry, swine and dairy cows.

In addition to water quality benefits, mortality composting benefits both human and animal health. The temperatures achieved during composting will kill or greatly reduce most pathogens, reduce the risk of disease transmission, prevent nuisances such as flies, vermin and scavenging animals, and combat odors resulting from the anaerobic breakdown of proteins. Properly composted material is environmentally safe and a valuable soil amendment for growing certain crops.

The pollution reductions associated with mortality composting is calculated using a set of equations incorporating the average mortality weight, nitrogen and phosphorus composition,

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percent mortality, the number of animals each year and an effectiveness estimate. Mortality is not consistent; it increases with animal weight. To account for this, average mortality weight is within the 70th weight percentile. The average nutrient composition, percent mortality and number of animals each year is dependent on each animal type.

**Resource Guide for NYS Farm Owners and Operators**

The *2011-2012 Resource Guide for New York State Farm Owners and Operators* was created by the Environmental Finance Center at Syracuse University, with support from USDA Rural Development. The guide is intended to help NYS farmers and agricultural Technical Service Providers identify available funding programs and other resources available to them. The guide identifies federal, state, and local funding resources by the name of the funding program, the source agency or organization, and the source agency’s contact information, as well as eligible applicants, funding cycles, program description, and other relevant information.


**Other Considerations for Agriculture Sector**

CAFO farm expansion or farm expansion above CAFO requirements are required to be accompanied by the addition of appropriate land base prior to additional animals being brought on. New York has an abundant land base available to handle any potential additional expansions for CAFO size farms ([https://www.dec.ny.gov/permits/6285.html](https://www.dec.ny.gov/permits/6285.html)).

**Research**

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

- Groundwater Guidance Revisions and Pilot Program
- Variable Source Area Hydrology - Enhanced P index standard using VSA hydrology
- Mass Balance for Agriculture

**Groundwater Guidance Revisions and Pilot Implementation Program**

Drinking water well contamination issues related to manure management occur in certain areas of New York State. “Karst” is the term used for areas associated with carbonate bedrock (limestone or dolomite), where cracks, fractures and other channel irregularities are present. Karst conditions deteriorate over time due to flowing water which creates sinkholes, depressions in the land surface, disappearing streams, etc. These conditions provide a direct connection between surface and groundwater. This type of landscape and geology allows water to rapidly flow into (or out of) bedrock with little or no filtration. In such areas where groundwater is under the influence of

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19 Hydrologically Sensitive Areas: Variable Source Area Hydrology Implications for Water Quality Risk Assessment by M.Todd Walter, Michael F. Walter, Erin S. Brooks, Tammo S. Steenhuis, Jan Boll, Kirk Weiler
surface water, recharge waters influenced by residential, commercial, industrial, wildlife, or agricultural activities may also generate a contaminant risk to surface and groundwater supplies. Protection of groundwater resources requires additional measures in these areas. DEC is currently working with Cornell University, USDA-NRCS and NYSDAM to develop guidance and a pilot program for farmers and planners to evaluate land conditions in karst areas and implement appropriate best management practices.

**Variable Source Area Hydrology**

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

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

**Mass Balance for Agriculture**

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

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

**Climate Change**

Climate change is an important consideration when selecting management actions for implementation. There is still uncertainty in the understanding of BMP responses to climate change conditions that may influence best management practice efficiencies and effectiveness. More research is needed to understand which BMPs will retain their effectiveness at removing nutrient and sediment pollution under changing climate conditions, as well as which BMPs will be able to physically withstand changing conditions expected to occur because of climate change.

Where possible, selection of BMPs should be aligned with existing climate resiliency plans and strategies (e.g., floodplain management programs, fisheries/habitat restoration programs, or hazard
mitigation programs). When selecting BMPs, it is also important to consider seasonal, inter-annual climate or weather conditions and how they may affect the performance of the BMPs. For example, restoration of wetlands and riparian forest buffers not only filter nutrient and sediment from overland surface flows, but also slow runoff and absorb excessive water during flood events, which are expected to increase in frequency due to climate change. These practices not only reduce disturbance of the riverine environment but also protect valuable agricultural lands from erosion and increase resiliency to droughts.

In New York State, ditches parallel nearly every mile of our roadways and in some watersheds, the length of these conduits is greater than the natural watercourses themselves. Although roadside ditches have long been used to enhance road drainage and safety, traditional management practices have been a significant, but unrecognized contributor to flooding and water pollution, with ditch management practices that often enhance rather than mitigate these problems. The primary objective has been to move water away from local road surfaces as quickly as possible, without evaluating local and downstream impacts. As a result, elevated discharges increase peak stream flows and exacerbate downstream flooding. The rapid, high volumes of flow also carry nutrient-laden sediment, salt and other road contaminants, and even elevated bacteria counts, thus contributing significantly to regional water quantity and quality concerns that can impact biological communities. All of these impacts will be exacerbated by the increased frequency of high intensity storms associated with climate change.

For more information about climate change visit DEC’s website: https://www.dec.ny.gov/energy/44992.html