STATE OF DELAWARE

NONPOINT SOURCE BEST MANAGEMENT PRACTICE IMPLEMENTATION DATA

QUALITY ASSURANCE PROJECT AND VERIFICATION PLAN

September 2019

Delaware Department of Natural Resources and Environmental Control
Division of Watershed Stewardship
Nonpoint Source Program
100 W. Water Street, Suite 6B
Dover, DE 19904
302-739-9922

State of Delaware
Nonpoint Source Best Management Practice Implementation Data
Quality Assurance Project Plan

Group A – Project Management

A1 – Title and Approval Sheet

Plan Coverage: This *Nonpoint Source BMP Implementation Data Quality Assurance Project Plan* reflects the overall Quality Assurance Program framework and management systems necessary to assure that data reported by the Delaware Department of Natural Resources and Environmental Control-Division of Watershed Stewardship-Watershed Assessment Section (DNREC-DWS-NPS) are of acceptable quality to meet the needs of the United States Environmental Protection Agency's Chesapeake Bay Program Office (EPA-CBPO).

Name:
Title: DNREC-DWS-NPS, Program Manager, Quality Assurance Manager

Signature: _____ Date: _____

Name: **Robert Palmer**
Title: DNREC-DWS-NPS, Program Administrator

Signature: _____ Date: _____

Name: Holly Waldman
Title: U.S. EPA Project Officer

Signature: _____ **Date:** _____

Name: Annie Hamm
Title: U.S. EPA Quality Assurance Officer

Signature: _____ Date: _____

Questions or comments regarding this QAPP should be referred to the DNREC NPS Office 302-739-9922

A2- Table of Contents

Contents

List This document is provided to the following:

Last	First	Title	Organization
Absher	Debbie	Agriculture BMP Data Provider	Sussex Conservation District
Atkins	Jared	Stormwater BMP Data Provider	Kent Conservation District
Biddle	Mark	Restoration	DNREC-DWS-WAS
Brosch	Chris	Nutrient Management Data Provider	DDA-NMP
Coleman	Robert	Manure Relocation Data Provider	DDA-NMP
Deputy	Terry	Director	DNREC - DWS
DeSchepper	Timothy	Stormwater BMP Data Provider	Town of Middletown
Devereux	Olivia	Contractor	Devereux Consulting
Donnelly	Kevin	Agriculture BMP Data Provider	New Castle Conservation District
Esposito	Sara	Stormwater BMPs	Delaware Department of Transportation
Hardesty	Marianne	Agriculture BMP Data Provider	New Castle Conservation District/NRCS
Hart	Eugenia	Contractor	Tetra Tech
Monteith	Tyler	Restoration BMP Data Manager	DNREC-DWS-WAMS
Mortazavi	Ellie	Stormwater BMPs	New Castle County
Mwangi	George	Wastewater Treatment Plant Data Provider	DNREC-DW-Surface Water Program
Rhoads	Craig	Restoration BMP Data Provider	DNREC-DFW
Riley	Timothy	Agriculture BMP Data Provider	Kent Conservation District
Rutherford	Jamie	Stormwater BMPs	DNREC-DW-SSWP
Seybold	Bill	Forestry Data Provider	DDA-Forest Service
Stewart	Elena	Restoration BMP Data Provider	DNREC-Parks
Sweeney	Jeffrey	University of Maryland / EPA-CBPO	NPS Data Manager
Vacant		Restoration Data Provider	DNREC-DWS-Drainage
Vacant		CBP Implementation Grant Manager, Quality Assurance Manager	DNREC-DWS-NPS
Waldeman	Holly	Project Officer	EPA-Chesapeake Bay Program Office (CBPO)
Wang	Ping	Wastewater BMP Data Provider	DNREC-DW-Groundwater Discharges Section
Watson	Jessica	Stormwater BMPs	Sussex Conservation District
Williams	Steve	Administrator	DNREC - DWS - WAS
Wozniak	Sara	CBP Regulatory and Accountability Grant Manager	DNREC-DWS-WAS

A4 – Project / Task Organization

Best management practices (BMPs) to reduce nonpoint source (NPS) pollution are funded and installed by numerous federal, state, local, and private agencies within Delaware including the Department of Natural Resources and Environmental Control (DNREC), the Department of Agriculture (DDA), the Natural Resource Conservation Service (NRCS), three county Conservation Districts, counties and towns, and the Perdue AgriRecycle facility. The BMP data that are generated are maintained and undergo quality assurance procedures by the implementing organization, which includes spot checks of installed BMPs.

Data are aggregated from these multiple groups and reported to funding agencies for tracking purposes. Historically, Delaware provided the Environmental Protection Agency – Chesapeake Bay Program Office (EPA-CBPO) with BMP implementation data in a spreadsheet or tabular format. In an attempt to standardize, streamline, and document data manipulations, CBPO and the jurisdictions in the bay watershed signed an agreement specifying that data associated with BMPs will be transferred exclusively through the National Environmental Information Exchange Network (NEIEN) as of December 31, 2010. Grant guidance specifies that the exchange should contain data for projects that were implemented between July 1 and June 30 each year.

The Chesapeake Bay Program (CBP) Implementation Grant Manager serves as an independent quality assurance manager, and develops and maintains the official, approved Quality Assurance Project Plan (QAPP) covering all programs receiving funds from the CBP Implementation Grant and the CBP Regulatory and Accountability Grant. In addition, both Grant Managers prepare and submit annual reports to the EPA-Chesapeake Bay Program Office (CBPO) providing a qualitative description of ongoing activities being done to achieve restoration goals. An organization chart showing reporting and quality assurance responsibilities is provided in Figure 1.

A5 – Problem Definition and Background

The tracking, reporting, and quality assurance of NPS BMPs are requirements of the Delaware CBP Implementation Grant from the EPA-CBPO. Data are provided to EPA-CBPO via NEIEN exchange for inclusion in watershed model progress evaluations on or before December 1st of each year or as otherwise stipulated in the grant documents. Since this work involves the acquisition of environmental data generated from direct measurement activities, data collected from other sources, and data compiled from computerized information databases and systems, an approved QAPP must be in place. This technical document of quality assurance and control procedures and specifications serves as the QAPP in accordance with 40 CFR 30.54 and 31.45. This QAPP will support the quality of the data behind the CBP's annual *Restoration Assessment for Reducing Pollution*, will allow the EPA-CBPO to understand the various sources of NPS BMP data and any analyses done by jurisdictions prior to submission to the EPA-CBPO, and will assist the EPA-CBPO in preparing for possible future scrutiny of all watershed model inputs under the Chesapeake Bay Total Maximum Daily Load (TMDL).

BMPs reported in a particular year include only the implementation of a new BMP. As of 2015, previously reported BMPs have been given a lifespan or credit duration based on the

CreditDurations05222015.xlxs spreadsheet provided by CBP. This spreadsheet includes credit durations for each BMP type approved by the Ag and Urban Stormwater Workgroups in 2015. The lifespan is now added to the implementation date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has been passed, that BMP will be tagged as "retired" and removed from the database. See Section D2-1 through D2.5 for more detail.

A6 – Project / Task Description

Data regarding the implementation of NPS BMPs are compiled in order to assess progress toward reaching water quality goals, which includes both State of Delaware prescribed TMDL reductions for nutrients and bacteria as well as EPA TMDL reductions for nutrients and sediment. Implementation is ongoing and data are reported to the EPA-CBPO annually (on or before December 1st each year) to reflect recent implementation activities. A full description of the quality assurance activities performed on these data sets is included in Section B10 Data Management. The following sections of this QAPP will be updated annually (on or before September 30th) to reflect any changes to field, sample handling and storage, laboratory, quality control, or data management activities.

Details regarding BMP names and crosswalk with Scenario Builder names are listed in Section 10.1. Each BMP is listed by name with BMP short name, a description, the unit in which it is reported and the agency providing the data.

A7 – Quality Objectives and Criteria

Details regarding the quality of the NPS BMP data reported by the DNREC-DWS-NPS to the EPA-CBPO for use in watershed modeling to estimate restoration progress are contained in the following sections. All efforts have been made to produce data that are comparable to data collected previously and currently by other Chesapeake Bay Program grant recipients and partners. Details on the quality of data provided by DNREC are included in the following sections. All BMPs completed must be certified as complete and meeting appropriate standards as deemed by the authorized cost share program.

A8 – Special Training / Certification

Any special training or certification required to implement or inspect NPS BMPs is determined and overseen by the implementing organization. Additionally, individuals involved with NPS BMP data management and data quality assurance and control procedures are not required to have any special training or certification, however in order to perform these functions effectively, training in spreadsheets, databases, and geographic information systems (GIS), as well as computer programming and code writing may be necessary. Delaware's previous Quality Assurance Manager received training from the EPA on Quality Assurance Strategies for the use of Existing Data in February 2013. As of September 2019, Delaware's Quality Assurance Manager position is vacant, and it is anticipated that the new Manager will undergo the same

training. Due to privacy concerns, BMP implementing organizations determine who may have clearance to complete data sets and in some situations restrict the transfer of personal and locational information.

See Sections D2.1 through D2.5 for specific training and certification requirements for BMP Verification and Validation.

A9 – Documents and Records

Implementing organizations will maintain NPS BMP data sets. These data sets are needed for the NEIEN schemas and are transmitted via established NEIEN protocols for inclusion in the annual progress run input deck. Data included in EPA-CBPO annual reports will be retained electronically in Extensible Markup Language (XML) format by the DNREC-DWS-NPS in perpetuity. The DNREC-DWS-NPS will send the QAPP electronically to all individuals on the distribution list (A3) each year for annual review and comment. Any edits to reflect changes in status or procedure will be incorporated into the final document submitted to the EPA-CBPO on or before December 1st each year. The final, EPA-CBPO approved QAPP will be electronically distributed to the same individuals and will be retained in both electronic and paper format in perpetuity by the DNREC-DWS-NPS. Any inspection forms and/or methodology for documenting information are discussed in sections D2.1 through D2.5 for each specific source sector (agriculture, forestry, stream and wetland restoration, stormwater, and wastewater).

Group B – Data Generation and Acquisition

Sections B1 through B8 of this QAPP are not directly applicable to NPS BMP data tracking and reporting. Situations where implementing organizations generate data through sampling to answer research questions do occur. For example, soil samples are taken during the development of a nutrient management plan to determine appropriate fertilizer and manure application rates. Likewise, manure is sampled to determine nutrient content. In addition, samples may be taken to determine the performance level of a BMP, such as taking effluent samples from alternative and innovative onsite wastewater treatment and disposal systems. Details regarding any sampling protocols related to NPS BMPs will be incorporated in future versions of this QAPP. Details regarding surface water quality monitoring protocols can be found in both the DNREC (DNREC, 2007) and Nanticoke Creekwatcher QAPP documents (NWA, 2015). Additionally, the Delaware Natural Resources and Conservation Service (NRCS) completed a QAPP and Corrective Action Plan in FY2012 (NRCS, 2012).

B1 – Sampling Process Design (Experimental Design)

B2 – Sampling Methods

B3 – Sample Handling and Custody

B4 – Analytical Methods

B5 – Quality Control

B6 – Instrument / Equipment Testing, Inspection, and Maintenance

B7 – Instrument / Equipment Calibration and Frequency

B8 – Inspection / Acceptance of Supplies and Consumables

B9 – Non-direct Measurements

DNREC's Division of Watershed Stewardship, Nonpoint Source Program (DNREC-DWS-NPS) obtains NPS BMP tracking data from both internal and external sources (See Figure 1), which are then reported to the EPA-CBPO for inclusion in model scenario runs via NEIEN. BMP data associated with stormwater fall under the responsibility of the nine delegated agencies under DNREC's Division of Watershed Stewardship - Sediment and Stormwater Program (DNREC-DWS-SSW). BMPs associated with wastewater treatment are implemented, tracked, and reported by DNREC's Division of Water - Groundwater Discharges Section (DNREC-DW-GWDS). BMP data associated with agriculture are implemented, tracked, and/or maintained by multiple agencies including the NRCS, DNREC's Non-Point Source 319 Program, Delaware Department of Agriculture, the three county Conservation Districts, and the Perdue AgriRecycle Company.

In the spring of 2007, DNREC's Divisions of Water Resources and Soil and Water Conservation (now known as the Divisions of Water and Watershed Stewardship) contracted with URS

Corporation to conduct an assessment of BMP data collection activities across the state. The resulting report, which summarizes the points of contact, type of BMP data maintained by each agency, data storage structures, data sharing limitations, and supporting software, can be found in Appendix A. The implementing agencies described in Appendix A are responsible for ensuring delivery of quality data and the independent Quality Assurance Manager reviews all data to ensure BMP reported levels reasonably reflect on-the-ground conditions. The data providers collect, manage and report data to the DNREC Quality Assurance Manager. DNREC-DWS-NPS addresses the quality assurance process related to data as received from data providers.

B10 – Data Management

BMP data are requested on an annual or more frequent basis from numerous agencies that implement, track, and/or maintain this type of data in the stormwater, wastewater, and agriculture-related sectors. Figure 1 depicts BMP data reporting and quality assurance responsibilities.

Previously, the majority of data submitted to DNREC-DWS-NPS were done electronically in Excel spreadsheets; however, paper copies were occasionally submitted from some reporting agencies as well. This varied data had to be compiled into a single document with a consistent format and as such, was inconvenient and time consuming for all involved. In an attempt to standardize, streamline, and document data manipulations, CBPO and the jurisdictions in the bay watershed signed an agreement specifying that data associated with BMPs will be transferred exclusively through the National Environmental Information Exchange Network (NEIEN) as of December 31, 2010. Grant guidance specifies that the exchange should contain data for projects that were implemented between July 1 and June 30 each year.

The NEIEN is a partnership between the Bay jurisdictions and the CBPO for the secure, real time exchange of environmental information. The Network uses extensible markup language (XML), web services, and common data standards to transmit data from the jurisdictions to the CBPO. Existing data management systems are able to remain in place and, through the Network; data are delivered based on pre-described methods, or a schema. The CBP NPS BMP schema was developed by PA, VA, and MD with a $390,000 grant, which included the building of a node at the CBPO. Delaware began mapping data from state sources into the schema. The schema in use contains fields such as jurisdiction, data source, contact information, name of practice, practice components, location, unit of measure, quantity, status, and funding source.

In Delaware, data from each implementing organization are supplied to DNREC's OIT for conversion into an XML document. Once all data sources have been received, data are transmitted through DNREC's network node. Since the 2010 data submission was the first through NEIEN, Delaware required the assistance of Tetra Tech to complete several of these XML documents. DNREC's OIT prepared the XML data for stormwater and onsite wastewater practices. Data from the DDA Forest Service and Nutrient Management Program (manure relocation and nutrient management planning) were provided to NPS in GIS, database, or Excel format for this work. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was

reached to have federal agencies, such as the USDA's NRCS and FSA, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf.

B10.1 – Data Management: BMPs for Agricultural Source Sector

NRCS/FSA Data - Data are provided by Devereux Environmental Consulting (third party contractor of USGS) in excel format at the state and county level. The NRCS cover crop data as well as detailed cover crop information submitted by the Conservation Districts are subtracted from FSA cover crop data. The NRCS data, the Conservation District Data, and the remaining FSA acreage are reported to avoid double counting.

DDA Manure Transport – Manure Transport is provided by DDA as tons of poultry manure. The data include the sending watershed, receiving watershed, receiving town, receiving state, claim tons, claim date, application number, and whether the relocation was "farm to farm in DE", "farm to farm outside DE", "farm to alternative use", and "farm to alternative use (off peninsula)". Delaware does not transport any manure besides poultry. The poultry in Delaware are all broilers except for one layer facility; therefore, the Animal Group is labeled as "Poultry". Majority of the Nanticoke watershed is in Sussex County (86%) and a small portion is in Kent County (14%); therefore, the assumption was made that all manure (within the Nanticoke watershed) comes from Sussex County. The Marshyhope Watershed is within two counties, so the claim tons are split evenly between the 2 counties. Only manure exported from the Chesapeake Bay watershed is included and all other watersheds (Indian River, Indian River Bay and Murderkill watershed entries) are deleted. COUNTY_TO in the Excel sheet is left blank if the manure leaves the Chesapeake Bay watershed or is identified as "farm to alternative use" and "farm to alternative use off peninsula".

Irrigation Management – The acreage of irrigated land was calculated in July 2010 based on Google Earth Imagery by NRCS. The 2013 Irrigated Land Project is an update to this dataset based on 2012 imagery in ArcGIS. A complete methodology is listed in Appendix B. Data are reported as acreage by HUC using 2013 as the implementation year. This GIS analysis will be conducted periodically or until the cropland irrigation management BMP is approved by the Partnership.

Conservation District Cover Crop Data – Detailed cover crop information is received from each County Soil & Water Conservation District – New Castle, Kent, and Sussex. Data are received in excel format. Cover crop data are reviewed and determined to be commodity (harvested) or traditional (destroyed). Only those crops identified in the Chesapeake Bay Watersheds are included.

> *Sussex County* – In 2012, some cover crops were provided as multiple crops (e.g., barley/wheat) which means part of the field was planted in one and one planted in the other. Sometimes crops are planted as a seed mix. Records with seed mixes are split 50/50 for acreage in each crop. In 2013, the Cover Crop Expert Panel Report was approved and many of these seed mixes are acceptable in Phase 5.3.2 for 2013 progress. Planting dates are provided and were used to determine whether the crops are early/late/standard.

Kent County – Data are compiled using the criteria set above for Sussex County. Additionally, a few records had two planting dates listed. For these entries, the latter date was assumed as implementation date.
New Castle County – The same methodology was followed as Sussex and Kent counties.

DNREC Restoration Database **–** DNREC –DWS-WAS maintains a restoration database that captures restoration practices like grass buffers and water control structures. These practices are compiled from various projects throughout DNREC. The restoration database links DNREC BMPs to NRCS practice codes. The database is not set to match the BMPs reporting to EPA-CBPO. Therefore, DNREC-DWS-NPS must make judgment calls when assigning acres (or other units) to specific EPA-CBPO BMPs.

Historical Water Control Structures – DNREC-DWS-NPS and Sussex Conservation District worked collaboratively in the summer of 2013 to update water control structure data by ground truthing and verifying structures with GPS. A complete methodology is listed in Appendix B. Data are reported as acreage by HUC using 2013 as the implementation year. Water control structures implemented by DNREC are also captured in the DNREC Restoration Database.

Double counting of these agricultural practices is avoided by submitting data by the primary funding source or the primary implementing agency. For example, BMP implementation data that are cost-shared with NRCS are submitted by NRCS. Non-cost shared data are submitted by the state or conservation districts.

B10.1.1 – List of Agricultural BMPs

BMP	BMP Short Name	BMP Description	Unit	Data Source
5, 10, or 35-ft Riparian Buffer Setback	Delaware definition only	Trees planted next to waterways filter and take up nutrients from run-off, stabilize the soil, and provide wildlife habitat. The recommended buffer width for streamside forest buffers is 100 feet. This practice is for buffers that do not meet the 100 foot recommendation but have widths of either 35 ft., 10 ft., or 5 ft.	acres	DDA, DNREC, USFWS
Agronomic Improvements	Delaware definition only	New seed varieties are being developed for additional nutrient efficiency. Current seed varieties are 40% to 50% efficient at utilization and up-take of nutrients.		DDA, Conservation Districts
Alternative Crops	CarSeqAltCrop	Alternative crops is a BMP that accounts for those crops that are planted and managed as permanent, such as warm season grasses, to sequester carbon in the soil. Carbon sequestration refers to the conversion of the Watershed Model land uses that are cropland to the hay land use.	acres	DNREC, USFWS
Alternative Use of Manure	Delaware definition only	Livestock Manure (primarily poultry litter) generated on Delaware farms is currently applied as fertilizer to Delaware crop fields or transported to areas of need through DDA's Nutrient Relocation Program. A small percentage is pelletized and sold as an organic fertilizer for residential and commercial use through Perdue AgriRecycle. Developing alternative uses for manure produced in the Chesapeake Bay Watershed represents a large opportunity for area farmers. One potential use for the region’s excess manure is energy generation. Using excess manure to feed energy generation systems	tons	DDA
Barnyard Runoff Control	BarnRunoffCont	Includes the installation of practices to control runoff from barnyard areas. This includes practices such as roof runoff control, diversion of clean water from entering the barnyard and control of runoff from barnyard areas. Different efficiencies exist if controls are installed on an operation with manure storage or if the controls are installed on a loafing lot without a manure storage.	acres	NRCS, FSA
Biofilters	Biofilters	Ammonia emission reduction includes housing ventilation systems that pass air through a biofilter media with a layer of organic material, typically a mixture of compost and wood chips or shreds that supports a microbial population. The ammonia emissions are reduced by oxidizing volatile organic compounds into carbon dioxide, water and inorganic salts. The ammonia conserved in the BMP is no longer considered in the model.		NRCS, FSA

BMP	BMP Short Name	BMP Description	Unit	Data Source
Commodity Cover Crop Early Arial Rye	ComCovCropEAR	A winter rye crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early Arial Wheat	ComCovCropEAW	A winter wheat crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early Drilled Barley	ComCovCropEDB	A winter barley crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early Drilled Rye	ComCovCropEDR	A winter rye crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early Drilled Wheat	ComCovCropEDW	A winter wheat crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early Other Rye	ComCovCropEOR	A winter rye crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early Other Wheat	ComCovCropEOW	A winter wheat crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early-Planting Aerial Corn Barley	ComCovCropEAB	A winter barley crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early-Planting Aerial Soy Barley	ComCovCropEASB	A winter barley crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The cover crop follows soybeans. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Commodity Cover Crop Early-Planting Aerial Soy Rye	ComCovCropEASR	A winter rye crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. This cover crop follows soybeans. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Commodity Cover Crop Early-Planting Aerial Soy Wheat	ComCovCropEASW	A winter wheat crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. This crop follows soybeans. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Early-Planting Other Barley	ComCovCropEOB	A winter barley crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Late Other Wheat	ComCovCropLOW	A winter rye crop planted after the average first frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Late-Planting Drilled Rye	ComCovCropLDR	A winter rye crop planted after the average first frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Late-Planting Drilled Wheat	ComCovCropLDW	A winter wheat crop planted after the average first frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Late-Planting Other Rye	ComCovCropLOR	A winter rye crop planted after the average first frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Standard Drilled Rye	ComCovCropSDR	A winter rye crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Standard Other Rye	ComCovCropSOR	A winter rye crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Standard Other Wheat	ComCovCropSOW	A winter wheat crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Commodity Cover Crop Standard-Planting Drilled Barley	ComCovCropSDB	A winter barley crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Standard-Planting Drilled Wheat	ComCovCropSDW	A winter wheat crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Commodity Cover Crop Standard-Planting Other Barley	ComCovCropSOB	A winter barley crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). A commodity cover crop may receive nutrient applications after March 1 of the following year after establishment.	acres	Conservation Districts
Conservation Till Without Nutrients	ConserveTillom	This conservation till BMP reflects conservation tillage on land areas that receive only inorganic fertilizer. This BMP is a reduction applied to high till without nutrients and requires: (a) a minimum 30% residue coverage at the time of planting, and (b) a non-inversion tillage method.	acres	NRCS
Continuous No Till	ContinuousNT	The Continuous No-Till (CNT) BMP is a crop planting and management practice in which soil disturbance by plows, disk or other tillage equipment is eliminated. CNT involves no-till methods on all crops in a multi-crop, multi-year rotation. When an acre is reported under CNT, it will not be eligible for additional reductions from the implementation of other practices such as cover crops or nutrient management planning. Multi-crop, multi-year rotations on cropland are eligible. Crop residue should remain on the field. Planting of a cover crop might be needed to maintain residue levels. The system must be maintained for a minimum of five years. All crops must be planted using no-till methods.	acres	NRCS
Continuous, High Residue, Minimum Soil Disturbance Tillage Management	HRTill	Continuous, High Residue, Minimum Soil Disturbance Tillage (HRTill) Management is a crop planting and residue management practice in which soil disturbance by plows and implements intended to invert residue is eliminated. Any disturbance must leave a minimum of 60% crop residue cover on the soil surface as measured after planting. The practice involves all crops in a multi-crop, multi-year rotation and the crop residue cover requirement (including living and dead material) is to be met immediately after planting of each crop.	acres	NRCS
Cover Crop Early Arial Barley	CoverCropEAB	A winter barley crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early Arial Rye	CoverCropEAR	A winter rye crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early Arial Wheat	CoverCropEAW	A winter wheat crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early Drilled Rye	CoverCropEDR	A winter rye crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Cover Crop Early Drilled Wheat	CoverCropEDW	A winter wheat crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early Other Rye	CoverCropEOR	A winter rye crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early Other Wheat	CoverCropEOW	A winter wheat crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early-Planting Aerial Soy Barley	CoverCropEASB	A winter barley crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The cover crop follows soybeans. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early-Planting Aerial Soy Rye	CoverCropEASR	A winter rye crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The cover crop follows soybeans. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early-Planting Aerial Soy Wheat	CoverCropEASW	A winter wheat crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The cover crop follows soybeans. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early-Planting Drilled Barley	CoverCropEDB	A winter barley crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Early-Planting Other Barley	CoverCropEOB	A winter barley crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Late Drilled Rye	CoverCropLDR	A winter rye crop planted after the average first frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Late Other Wheat	CoverCropLOW	A winter wheat crop planted after the average first frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Late-Planting Drilled Wheat	CoverCropLDW	A winter wheat crop planted after the average first frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Late-Planting Other Rye	CoverCropLOR	A winter rye crop planted after the average first frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Standard Drilled Barley	CoverCropSDB	A winter barley crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Cover Crop Standard Drilled Rye	CoverCropSDR	A winter rye crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Standard Drilled Wheat	CoverCropSDW	A winter wheat crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Standard Other Barley	CoverCropSOB	A winter barley crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Standard Other Rye	CoverCropSOR	A winter rye crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cover Crop Standard Other Wheat	CoverCropSOW	A winter wheat crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Cropland Irrigation Management	Cropirrmgmt	Cropland under irrigation management is used to decrease climatic variability and maximize crop yields. The potential nutrient reduction benefit stems not from the increased average yield (20-25%) of irrigated versus non-irrigated cropland, but from the greater consistency of crop yields over time matched to nutrient applications. This increased consistency in crop yields provides a subsequent increased consistency in plant nutrient uptakes over time matched to applications, resulting in a decrease in potential environmental nutrient losses. The current placeholder effectiveness value for this practice has been proposed at 4% TN, 0%TP and 0%TSS, utilizing the range in average yields from the 2002 and 2007 NASS data for irrigated and non-irrigated grain corn as a reference. The proposed practice is applied on a per acre basis, and can be implemented and reported for cropland on both lo-till and hi-till land uses that receive or do not receive manure.	acres	DNREC, NRCS
Decision Agriculture	DecisionAg	A management system that is information and technology based, is site specific and uses one or more of the following sources of data: soils, crops, nutrients, pests, moisture, or yield for optimum profitability, sustainability, and protection of the environment. This BMP is modeled as a land use change to a nutrient management land use with an effectiveness value applied to create an additional reduction.	acres	NRCS, FSA
Enhanced Nutrient Application Management Efficiency Version	EffNutManEnhance	Based on research, the nutrient management rates of nitrogen application are set approximately 35% higher than what a crop needs to ensure nitrogen availability under optimal growing conditions. In a yield reserve program using enhanced nutrient management, the farmer would reduce the nitrogen application rate by 15%. An incentive or crop insurance is used to cover the risk of yield loss. This BMP effectiveness estimate is based on a reduction in nitrogen loss resulting from nutrient application to cropland 15% lower than the nutrient management recommendation. The effectiveness estimate is based on conservativeness and data from a program run by American Farmland Trust.	acres	NRCS, FSA, DDA

BMP	BMP Short Name	BMP Description	Unit	Data Source
Enhanced Nutrient Management	EnhancedNM	Based on research, the nutrient management rates of nitrogen application are set approximately 35% higher than what a crop needs to ensure nitrogen availability under optimal growing conditions. In a yield reserve program using enhanced nutrient management, the farmer would reduce the nitrogen application rate by 15%. An incentive or crop insurance is used to cover the risk of yield loss. This BMP effectiveness estimate is based on a reduction in nitrogen loss resulting from nutrient application to cropland 15% lower than the nutrient management recommendation. The effectiveness estimate is based on conservativeness and data from a program run by American Farmland Trust. This BMP is modeled as a land use change to a nutrient management land use with an effectiveness value applied to create an additional reduction.	acres	DDA
Forage Radish + Grass , Early, Drilled	CoverCropEDFRG	A winter mix of radish and grasses planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish + Grass, Early, Aerial	CoverCropEAFRG	A winter mix of radish and grasses planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish + Grass, Early, Aerial, After Soy	CoverCropEASFRG	A winter mix of radish and grasses planted following a soybean crop at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish + Grass, Early, Other	CoverCropEOFRG	A winter mix of radish and grasses planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor h	acres	Conservation Districts
Forage Radish + Grass, Normal, Drilled	CoverCropSDFRG	A winter mix of radishes and grasses planted no more than 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish + Grass, Normal, Other	CoverCropSOFRG	A winter mix of radishes and grasses planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized	acres	Conservation Districts
Forage Radish, Early, Aerial	CoverCropEAFR	A winter radish crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish, Early, Aerial, After Soy	CoverCropEASFR	A winter radish crop planted following a soybean crop at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish, Early, Drilled	CoverCropEDFR	A winter radish crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Forage Radish, Early, Other	CoverCropEOFR	A winter radish crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Grass Buffers; Vegetated Open Channel - Agriculture	GrassBuffers	Agricultural riparian grass buffers are linear strips of grass or other non-woody vegetation maintained between the edge of fields and streams, rivers or tidal waters that help filter nutrients, sediment and other pollutants from runoff. The recommended buffer width for riparian forests buffers (agriculture) is 100 feet, with a 35 feet minimum width required. Vegetated open channels are modeled identically to grass buffers.	acres in buffers	NRCS, FSA, DDA, DNREC, USFWS
Heavy Use Poultry Area Pads	Delaware definition only	Establishing a pad structure that stabilizes areas frequently and intensively used by people, animal, or equipment to prevent nutrient movement into surface and groundwater.	structure	NRCS
Land Retirement to hay without nutrients (HEL)	LandRetireHyo	Converts land area to hay without nutrients. Agricultural land retirement takes marginal and highly erosive cropland out of production by planting permanent vegetative cover such as shrubs, grasses, and/or trees. Agricultural agencies have a program to assist farmers in land retirement procedures.	acres	NRCS, FSA, DDA, DelDOT, DNREC
Large Animal Mortality Program	Delaware definition only	Large animal mortality handling for operations with large animals. Program will assure off-site transport for large animal mortality.	animal units	DDA, Conservation Districts, DNREC
Livestock Waste Structures	Delaware definition only	Animal waste is stored in structures to protect it from the weather until it can be used as a crop fertilizer when conditions are appropriate for transport to another location.	structure	NRCS, FSA
Loafing Lot Management	LoafLot	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. This does not include poultry pad installation.	acres	DDA, Conservation Districts, NRCS
Manure Relocation	Delaware definition only	Excess manure is transported away from farms with high phosphorus levels to other farms or locations that can use the manure safely.	acres	DDA
Mortality Composters	MortalityComp	A physical structure and process for disposing of any type of dead animals. Composted material land applied using nutrient management plan recommendations.	structure	NRCS, FSA
Nutrient Management	NutMan	Nutrient management plan (NMP) implementation (crop) is a comprehensive plan that describes the optimum use of nutrients to minimize nutrient loss while maintaining yield. A NMP details the type, rate, timing, and placement of nutrients for each crop. Soil, plant tissue, manure and/or sludge tests are used to assure optimal application rates. Plans should be revised every 2 to 3 years.	acres	DDA, NRCS, FSA
Poultry House Remediation	Delaware definition only	The roofing of abandoned houses is often removed as scrap metal and when it rains, the nutrient rich floors leach into groundwater. The amount of legacy nutrients under poultry houses is sizable. This practice removes and composts the wood materials and soil below the house to eliminate this pollutant source.		DDA, NRCS, FSA

BMP	BMP Short Name	BMP Description	Unit	Data Source
Poultry Litter Treatment (alum, for example)	Alum	Surface application of alum, an acidifier, to poultry litter to acidify poultry litter and maintain ammonia in the non-volatile ionized form (ammonium).		
Poultry Litter Windrowing	Delaware definition only	The mechanical, chemical, and biological treatment of poultry litter to provide for extended reuse and timing of applying nutrients to crop needs.		NRCS, FSA
Poultry Waste Structures	Delaware definition only	These structures protect poultry waste from rain so that it can be used as a crop fertilizer when conditions are appropriate for transport to another location.	structure	NRCS, FSA
Prescribed Grazing	PrecRotGrazing	This practice utilizes a range of pasture management and grazing techniques to improve the quality and quantity of the forages grown on pastures and reduce the impact of animal travel lanes, animal concentration areas or other degraded areas. PG can be applied to pastures intersected by streams or upland pastures outside of the degraded stream corridor (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. Pastures under the PG systems are defined as having a vegetative cover of 60% or greater.	acres	NRCS, FSA
Retire Highly Erodible Land	Delaware definition only	Land that is especially vulnerable to erosion is removed from crop or hay production and planted in either grass or forest. This land is not usually disturbed for at least 10 years.	acres	DNREC, USFWS, DFS
Soil Conservation and Water Quality Plans	ConPlan	Farm conservation plans are a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality, and to prevent deterioration of natural resources on all or part of a farm. Plans may be prepared by staff working in conservation districts, natural resource conservation field offices or a certified private consultant. In all cases the plan must meet technical standards.	acres	NRCS, FSA
Stream Access Control with Fencing	PastFence	Stream access control with fencing involves excluding a strip of land with fencing along the stream corridor to provide protection from livestock. The fenced areas may be planted with trees or grass, or left to natural plant succession, and can be of various widths. To provide the modeled benefits of a functional riparian buffer, the width must be a minimum of 35 feet from top-of-bank to fence line. The implementation of stream fencing provides stream access control for livestock but does not necessarily exclude animals from entering the stream by incorporating limited and stabilized in-stream crossing or watering facilities. The modeled benefits of stream access control can be applied to degraded stream corridors in association with or without alternative watering facilities. They can also be applied in conjunction with or without pasture management systems such as prescribed grazing or PIRG. Alternative watering facilities typically involves the use of permanent or portable livestock water troughs placed away from the stream corridor. The source of water supplied to the facilities can be from any source including pipelines, spring developments, water wells, and ponds. In-stream watering facilities such as stream crossings or access points are not considered in this definition.	acres	NRCS, FSA

BMP	BMP Short Name	BMP Description	Unit	Data Source
Stream Protection without Fencing	Delaware definition only	This BMP requires the use of alternative drinking water sources away from streams. The BMP may also include options to provide off-stream shade for livestock, and implementing a shade component is encouraged where applicable. The hypothesis on which this practice is based is that, given a choice between a clean and convenient off-stream water source and a stream, cattle will preferentially drink from off-stream water source and reduce the time they spend near and in streams and streambanks. Alternative watering facilities typically involves the use of permanent or portable livestock water troughs placed away from the stream corridor. The source of water supplied to the facilities can be from any source including pipelines, spring developments, water wells, and ponds. In-stream watering facilities such as stream crossings or access points are not considered in this definition. The modeled benefits of alternative watering facilities can be applied to pasture acres in association with or without improved pasture management systems such as prescribed grazing or PIRG.	acres	NRCS, FSA
Streamside Grass Buffers	GrassBuffersTrp	Converts degraded riparian pasture to hay without nutrients	acres in buffers	NRCS, DNREC, DFS
Tier 1 Crop Group Nutrient Application Management Efficiency Version	EffNutMan	The Crop Group Nutrient Application Management reflects operations with documentation for manure and/or fertilizer application management activities in accordance with basic land grant university (LGU) recommendations. This documentation should support farm-specific efforts to maximize growth by application of nitrogen and phosphorus with respect to proper nutrient source, rate, timing and placement for optimum crop growth consistent with LGU recommendations. Particular attention is paid to: 1) standard, realistic farm-wide yield goals; 2) credit of N sources (soil, sod, past manure and current year applications; 3) P application rates consistent with LGU recommendations based on soil tests for fields without manure; 4) N based application rates consistent with LGU recommendations for fields receiving manure.	acres	DDA
Triticale, Early, Aerial	CoverCropEAT	A winter triticale crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Triticale, Early, Aerial, After Soy	CoverCropEAST	A winter triticale crop planted following a soybean crop at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Triticale, Early, Drilled	CoverCropEDT	A winter triticale crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Triticale, Early, Other	CoverCropEOT	A winter triticale crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Triticale, Late, Drilled	CoverCropLDT	A winter triticale crop planted after the average first frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Triticale, Late, Other	CoverCropLOT	A winter triticale crop planted after the average first frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Triticale, Normal, Drilled	CoverCropSDT	A winter triticale crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Triticale, Normal, Other	CoverCropSOT	A winter triticale crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Voluntary BMPs	Delaware definition only	A program to conduct farm assessments and inventory of voluntary conservation practices that have been installed but farmers and landowners, since 2005, but are not part of current data inventories.		DDA, DNREC
Water Control Structures	WaterContStruc	Installing and managing boarded gate systems in agricultural land that contains surface drainage ditches.	acres	DDA, DNREC, USFWS
Winter Hardy Brassica, Early, Aerial	CoverCropEAHB	A winter brassica crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Brassica, Early, Aerial, After Soy	CoverCropEASHB	A winter brassica crop planted following a soybean crop at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Brassica, Early, Drilled	CoverCropEDHB	A winter brassica crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Brassica, Early, Other	CoverCropEOHB	A winter hardy brassica crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvest	acres	Conservation Districts
Winter Hardy Oats, Early, Aerial	CoverCropEAHO	A winter hardy oats crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Oats, Early, Aerial, After Soy	CoverCropEASHO	A winter hardy oats crop planted following a soybean crop at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Oats, Early, Drilled	CoverCropEDHO	A winter hardy oats crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Oats, Early, Other	CoverCropEOHO	A winter hardy oats crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts

BMP	BMP Short Name	BMP Description	Unit	Data Source
Winter Hardy Oats, Normal, Drilled	CoverCropSDHO	A winter hardy oats crop planted no more than 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Hardy Oats, Normal, Other	CoverCropSOHO	A winter hardy oats crop planted no more than 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvest	acres	Conservation Districts
Winter Killed Oats, Early, Aerial	CoverCropEAKO	A winter killed oats crop planted at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Killed Oats, Early, Aerial, After Soy	CoverCropEASKO	A winter killed oats crop planted following a soybean crop at least 2 weeks prior to the average frost date with an aerial seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Killed Oats, Early, Drilled	CoverCropEDKO	A winter killed oats crop planted at least 2 weeks prior to the average frost date with a drilled seeding method. The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Winter Killed Oats, Early, Other	CoverCropEOKO	A winter killed oats crop planted at least 2 weeks prior to the average frost date with a seeding method that is neither drilled nor aerial (e.g. surface broadcast or with stalk chopping or light disking). The crop may be neither fertilized nor harvested.	acres	Conservation Districts
Agriculture Strategies on DNREC/DDA Lands	Delaware definition only	Agriculture strategies include adopting applicable actions and practices from the Chesapeake Bay Executive Order Section 502, including cover crops, on Publicly Owned Lands and maintained by DNREC, DDA, and DelDOT.	acres	DDA, DelDOT, DNREC
CAFO Setbacks	Delaware definition only	Setbacks are defined as a specified distance from surface waters or potential conduits to surface waters where manure, litter, and process wastewater may not be land applied. CAFO owners or operators are prohibited from applying manure, litter, or process wastewater within 100 feet of any down gradient surface water or conduit surface water, or they must have a 35 foot vegetated buffer setback planted in accordance with the Vegetated Buffer Strip Technical Standard.	acres	DDA

B10.2 – Data Management: BMPs for Forestry Source Sector

DDA Forestry Harvesting - The DDA Delaware Forest Service (DFS) provides acreage of harvested forestland. DDA-DFS provides GIS coverage of permitted timber harvest practices in the Chesapeake Bay watershed. HUCs are identified using GIS by intersecting the Timber Harvest coverage with the USGS HUC12 coverage to determine the HUC 12 for each harvest area.

> *Historical Harvested Forest Data* – DNREC-DWS-NPS and DDA-DFS worked collaboratively in the summer of 2013 to update forest harvest area data by digitizing harvested forest areas with ArcGIS. The digitization of these harvest areas are linked to an Access database containing all permit information, creating a spatial reference. Capturing these data will allow Delaware to report these historical harvested forest data for inclusion in the CBWSM. A complete methodology is listed in Appendix D.

DDA Forestry Tree Planting **–** The Department of Agriculture's Delaware Forest Service (DFS) provides acreage of afforestation tree plantings. DDA provides GIS coverage of tree planting in the Chesapeake Bay watershed. HUC12s are identified by using GIS for each planting area. The GIS coverage includes an attribute table that includes the "type" of project (either afforestation or reforestation). Only "afforestation" records are included in the progress run. Most of Forestry's reforestation projects are cost-shared through NRCS funds; and therefore, are already counted by NRCS data. When the project is paid by DDA Forestry or the private landowner that information will not be reported by NRCS and only DFS acreage will be used in the progress run.

DDA Urban Tree Planting – The DDA-DFS provides number of trees planted, by the Urban and Community Forestry Program, in Microsoft Word. The data are entered into Excel with unique identifier, implementation date, number of trees, and HUC.

DNREC Restoration Database **–** DNREC –DWS-WAS maintains a restoration database that captures restoration practices like wetland restoration, tree plantings, forest buffers, and grass buffers. These practices are compiled from various projects throughout DNREC. The restoration database links DNREC BMPs to NRCS practice codes. The database is not set to match the BMPs reporting to EPA-CBPO. Therefore, DNREC-DWS-NPS must make judgment calls when assigning acres (or other units) to specific EPA-CBPO BMPs.

Double counting is unlikely to occur for forestry harvesting practices because they are being provided by one agency (DDA). The same is true for urban tree planting data. This data is only submitted by DDA-DFS. Forest buffers are submitted by multiple agencies and funding sources are distinctively tracked by the QA Manager. As a result, double counting is avoided.

B10.2.1 – List of Forestry BMPs

BMP	BMP Short Name	BMP Description	Unit	Data Source
Streamside Forest Buffers	ForestBuffersTrp	Converts streamside areas to forest. In the model, converts degraded riparian pasture to hay without nutrients. Should be used with Stream Access Control with Fencing to convert from hay without nutrients to forest.	acres in buffers	NRCS, DNREC, DFS
Vegetative Environmental Buffers	Delaware definition only	Tree planting includes any tree planting, except those used to establish riparian forest buffers, targeting lands that are highly erodible or identified as critical resource areas.	acres	DDA, DNREC
Forest Buffers	ForestBuffers	Agricultural riparian forest buffers are linear wooded areas along rivers, stream and shorelines. Forest buffers help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. The recommended buffer width for riparian forest buffers (agriculture) is 100 feet, with a 35 feet minimum width required.	acres in buffers	DDA, DNREC, USFWS
Tree Planting	TreePlant	Tree planting includes any tree planting, except those used to establish riparian forest buffers, targeting lands that are highly erodible or identified as critical resource areas.	acres	NRCS, USFWS, DFS, DelDOT, DNREC
Forest Harvesting Practices	ForHarvestBMP	Forest harvesting practices are a suite of BMPs that minimize the environmental impacts of road building, log removal, site preparation and forest management. These practices help reduce suspended sediments and associated nutrients that can result from forest operations.	acres	DDA
Urban Tree Planting; Urban Tree Canopy	UrbanTreePlant	Urban tree planting is planting trees on urban pervious areas at a rate that would produce a forest-like condition over time. The intent of the planting is to eventually convert the urban area to forest. If the trees are planted as part of the urban landscape, with no intention to covert the area to forest, then this would not count as urban tree planting	acres	DDA

B10.3 – Data Management: BMPs for Wetland and Stream Restoration Source Sector *(Restoration)*

NRCS/FSA Data - Data are provided by Devereux Environmental Consulting (third party contractor of USGS) in excel format at the state and county level for wetland restoration practices.

DNREC Restoration Database **–** DNREC –DWS-WAS maintains a restoration database that captures restoration practices like wetland restoration and creation, and stream restoration. These practices are compiled from various projects throughout DNREC. The restoration database links DNREC BMPs to NRCS practice codes. The database is not set to match the BMPs reporting to EPA-CBPO. Therefore, DNREC-DWS-NPS must make judgment calls when assigning acres (or other units) to specific EPA-CBPO BMPs.

Double counting of these agricultural practices is avoided by submitting data by the primary funding source or the primary implementing agency. For example, BMP implementation data that are cost-shared with NRCS are submitted by NRCS. Non-cost shared data are submitted by the state or conservation districts.

B10.3.1 – List of Restoration (Wetland and Stream) BMPs

BMP	BMP Short Name	BMP Description	Unit	Data Source
Streamside/Tax Ditch Restoration	Delaware definition only	A suite of innovative alternative practices designed to enhance the removable of nutrients once they leave the field. These include increasing vegetative buffers that protect ditches from sediment and nutrient runoff. This may include reengineering of drainage channels to reestablish floodplains or redirect storm flows to wetland areas.	linear feet	DNREC, DFS, USFWS, Conservation Districts
Non Urban Stream Restoration	NonUrbStrmRest	Stream restoration in urban areas is used to restore the urban stream ecosystem by restoring the natural hydrology and landscape of a stream, help improve habitat and water quality conditions in degraded streams. The reduction is 0.2 lb nitrogen per foot, 0.068 phosphorus per foot, and 54.25 lbs sediment per foot .	feet	DDA, DNREC, NRCS, USFWS
Streamside Wetland Restoration	WetlandRestoreTrp	Converts degraded riparian pasture to forest.	acres	NRCS, DNREC, DFS
Wetland Restoration	WetlandRestore	Agricultural wetland restoration activities re-establish the natural hydraulic condition in a field that existed prior to the installation of subsurface or surface drainage. Projects may include restoration, creation and enhancement acreage. Restored wetlands may be any wetland classification including forested, scrub-shrub or emergent marsh.	acres	NRCS, DDA, DNREC

B10.4 – Data Management: BMPs for Urban Stormwater Source Sector

DelDOT Stormwater Practices – DNREC-DWS-NPS works with the approved DelDOT contractor (KCI) to receive all DelDOT stormwater practices. The contractor submits XML to DNREC-DWS-NPS and OIT for CBPO reporting.

DelDOT Street Sweeping – DelDOT compiles street sweeping data from roadways in New Castle and Kent Counties. Pollutant loads are calculated using the mass loading approach outlined in the Chesapeake Urban Stormwater Workgroup's recommendations memo (http://chesapeakestormwater.net/wp-content/uploads/downloads/2012/06/CBP-Expert-Panel-Memo-on-Street-Sweeping.pdf).

DNREC Stormwater Practices - Data are pulled from the MudTracker Database. DNREC-DWS-NPS works with OIT to extract data inputted into MudTracker by the DNREC-DWS-SSW.

Double counting is unlikely to occur for these stormwater practices because they are being provided by one agency (DNREC) and there are no cost-share practices.

B10.4.1 – List of Urban/Suburban and Septic BMPs

BMP	BMP Short Name	BMP Description	Unit	Data Source
Bioretention/raingardens - A/B soils, no underdrain	BioRetNoUDAB	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.	acres treated	DNREC, Conservation Districts
Bioretention/raingardens - A/B soils, underdrain	BioRetUDAB	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.	acres treated	DNREC, Conservation Districts
Bioretention/raingardens - C/D soils, underdrain	BioRetUDCD	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.	acres treated	DNREC, Conservation Districts
Bioswale	BioSwale	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.	acres treated	DNREC
Dry Detention Ponds and Hydrodynamic Structures	DryPonds	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.	acres treated	DNREC

BMP	BMP Short Name	BMP Description	Unit	Data Source
Dry Extended Detention Ponds	ExtDryPonds	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.	acres treated	DNREC
Erosion and Sediment Control	EandS	Erosion and sediment control practices applied to construction land. Acres in excess of available construction land rolls to other urban land uses. Protects water resources from sediment pollution and increases in runoff associated with land development activities. By retaining soil on-site, sediment and attached nutrients are prevented from leaving disturbed areas and polluting streams.	acres treated	DNREC
Impervious Urban Surface Reduction	ImpSurRed	Reducing impervious surfaces to promote infiltration and percolation of runoff storm water.	acres	DNREC
Permeable Pavement w/ Sand, Veg. - A/B soils, no underdrain	PermPavSVNoUDAB	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.	acres treated	DNREC
Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	PermPavSVUDAB	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.	acres treated	DNREC
Permeable Pavement w/ Sand, Veg. - C/D soils, underdrain	PermPavSVUDCD	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.	acres treated	DNREC
Permeable Pavement w/o Sand, Veg. - A/B soils, no underdrain	PermPavNoSVNoUDAB	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.	acres treated	DNREC

BMP	BMP Short Name	BMP Description	Unit	Data Source
Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	PermPavNoSVUDAB	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.	acres treated	DNREC
Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	PermPavNoSVUDCD	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.	acres treated	DNREC
Shoreline Erosion Control	ShoreEC	Protection of shoreline from excessive wave action by creating a marsh or an offshore structure such as a sill, breakwater or sand containment structure.	feet	DelDOT, DNREC
Street Sweeping 25 times a year-acres (formerly called Street Sweeping Mechanical Monthly)	StreetSweep	Street sweeping conducted on a twice monthly basis. The regularity of the street sweeping and reduces nitrogen, phosphorus, and sediment whereas less regular street sweeping reduces only sediment. The same street must be swept 25 times a year. The acres submitted are for the area of streets that are swept.	acres	DelDOT
Street Sweeping 25 times a year-lbs	StreetSweepLbs25x	Street sweeping conducted on a twice monthly basis. The regularity of the street sweeping and reduces nitrogen, phosphorus, and sediment whereas less regular street sweeping reduces only sediment. The same street must be swept 25 times a year. The lbs submitted are for the lbs of material picked up by the sweeper. These lbs of material are the lbs of TSS removed. The TN reduction is 0.00175 of the TSS. The TP reduction is 0.0007 of the TSS.	lbs	DelDOT
Street Sweeping Pounds	StreetSweepLbs	Street sweeping measured by the weight of street residue collected. Street sweeping and storm drain cleanout practices rank among the oldest practices used by communities for a variety of purposes to provide a clean and healthy environment, and more recently to comply with their National Pollutant Discharge Elimination System stormwater permits. The ability for these practices to achieve pollutant reductions is uncertain given current research findings. Only a few street sweeping studies provide sufficient data to statistically determine the impact of street sweeping and storm drain cleanouts on water quality and to quantify their improvements. The ability to quantify pollutant loading reductions from street sweeping is challenging given the range and variability of factors that impact its performance, such as the street sweeping technology, frequency and conditions of operation in addition to catchment characteristics. Fewer studies are available to evaluate the pollutant reduction capabilities due to storm drain inlet or catch basin cleanouts.	lbs	DelDOT

BMP	BMP Short Name	BMP Description	Unit	Data Source
Urban Filtering Practices	Filter	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.	acres treated	DNREC, DelDOT
Urban Grass Buffers	UrbGrassBuffers	This BMP changes the land use from pervious urban to pervious urban. Therefore, there is no change and no reduction from using this BMP.	acres in buffers	DDA, DNREC
Urban Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	Infiltration	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration.	acres treated	DelDOT, DNREC
Urban Nutrient Management Plan	UrbanNMPlan	An urban nutrient management plan is written, site-specific plan which addresses how the major plant nutrients (nitrogen, phosphorus and potassium) are to be annually managed for expected turf and landscape plants and for the protection of water quality. The goal of an urban or turf and landscape nutrient management plan is to minimize adverse environmental effects, primarily upon water quality, and avoid unnecessary nutrient applications. It should be recognized that some level of nutrient loss to surface and groundwater will occur even by following the recommendations in a nutrient management plan. The impacts of urban nutrient management plans will differ from lawn-to-lawn depending on nutrient export risk factors. This BMP is the default for lawns with an unknown risk type.	acres	DDA, DelDOT
Urban Nutrient Management Plan High Risk Lawn	UrbanNMPlanHR	An urban nutrient management plan is written, site-specific plan which addresses how the major plant nutrients (nitrogen, phosphorus and potassium) are to be annually managed for expected turf and landscape plants and for the protection of water quality. The goal of an urban or turf and landscape nutrient management plan is to minimize adverse environmental effects, primarily upon water quality, and avoid unnecessary nutrient applications. It should be recognized that some level of nutrient loss to surface and groundwater will occur even by following the recommendations in a nutrient management plan. The impacts of urban nutrient management plans will differ from lawn-to-lawn depending on nutrient export risk factors. This BMP is for lawns with a high risk of nutrient export.	acres	DDA, DelDOT
Urban Nutrient Management Plan Low Risk Lawn	UrbanNMPlanLR	An urban nutrient management plan is written, site-specific plan which addresses how the major plant nutrients (nitrogen, phosphorus and potassium) are to be annually managed for expected turf and landscape plants and for the protection of water quality. The goal of an urban or turf and landscape nutrient management plan is to minimize adverse environmental effects, primarily upon water quality, and avoid unnecessary nutrient applications. It should be recognized that some level of nutrient loss to surface	acres	DDA, DelDOT

BMP	BMP Short Name	BMP Description	Unit	Data Source
		and groundwater will occur even by following the recommendations in a nutrient management plan. The impacts of urban nutrient management plans will differ from lawn-to-lawn depending on nutrient export risk factors. This BMP is for lawns with a low risk of nutrient export.		
Vegetated Open Channels - A/B soils, no underdrain	VegOpChanNoUDAB	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.	acres treated	DNREC
Vegetated Open Channels - C/D soils, no underdrain	VegOpChanNoUDCD	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in thechannel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.	acres treated	DNREC
Wet Ponds and Wetlands	WetPondWetland	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.	acres treated	DelDOT, DNREC

B 10.5 – Data Management: BMPs for Wastewater Source Sector

DNREC Onsite Wastewater Practices – Data are pulled from the Delaware Environmental Network (DEN). WAS works with OIT to extract data inputted into DEN by the GWDS. Information is compiled for septic connections, septic pumping, and septic inspections and OIT creates XML for CBPO reporting.

DNREC Septic System and Abandonment – DNREC-DWS-NPS and GWDS worked collaboratively in November 2013 to update septic system connection data with ArcGIS. The digitization of these septic connections is linked to the Delaware Environmental Navigator database containing all permit information, creating a spatial reference. A complete methodology is listed in Appendix E.

Double counting is unlikely to occur for these wastewater practices because they are being provided by one agency (DNREC) and there are no cost-share practices.

B 10.5.1 – List of Wastewater BMPs

BMP	BMP Short Name	BMP Description	Unit	Data Source
Septic Connection	SepticConnect	This is when septic systems get converted to public sewer. This reduces the number of systems because the waste is sent into the sewer and treated at a wastewater treatment plant.	systems	DNREC
Septic Denitrification	SepticDenitrify	Septic denitrification represents the replacement of traditional septic systems with more advanced systems that have additional nitrogen removal capabilities. Traditional septic systems usually consist of a large tank designed to hold the wastewater allowing grits and solids time for settling and decomposition. Wastewater then flows to the second component, the drainfield. An enhanced septic system like that shown can provide further treatment of nitrogen through processes that encourage denitrification of the wastewater.	systems	DNREC
Septic Pumping	SepticPump	Septic systems achieve nutrient reductions through several types of management practices, including frequent maintenance and pumping. On average, septic tanks need to be pumped once every three to five years to maintain effectiveness. The pumping of septic tanks is one of several measures that can be implemented to protect soil absorption systems from failure. When septic tanks are pumped and sewage removed, the septic system's capacity to remove settable and floatable solids from wastewater is increased.	systems	DNREC

Group C – Assessment and Oversight

C1 – Assessments and Response Actions

A variety of assessments are performed on the NPS BMP data that are reported to the EPA-CBPO for inclusion in model scenario runs. Depending on the type of BMP, field assessments may be performed and implementing organizations are responsible for ensuring that reported BMPs have indeed been installed. Procedures are in place for verifying implementation when cost share or permits are involved. Funding from the Regulatory and Accountability grant helps to ensure that adequate staff and resources are available to inspect the upkeep and maintenance of long-term BMPs, such as stormwater ponds, on a regular basis rather than only if a problem is reported. Inspection frequencies can be found in Appendix A. If a BMP is found to be unsatisfactorily installed or maintained, cost share funds may be recouped if the BMP is not brought into compliance. In addition to field inspections, BMP data are regularly assessed by the Quality Assurance Manager to determine status and trends. This analysis will review any anomalies, errors, or questionable levels of implementation. Verification and validation procedures for each sector are provided in sections D2.1 through D2.5 for agriculture, forestry, stream and wetland restoration, stormwater, and wastewater practices.

C2 – Reports to Management

Status and trends assessments of BMP implementation levels by the Quality Assurance Manager are done annually as data are submitted, prepared, and reported to the EPA-CBPO. If anomalies, errors, or questionable levels of implementation are suspected, the Quality Assurance Manager will work directly with implementing organizations to verify and validate reported data.

Group D – Data Validation and Usability

D1 – Data Review, Verification, and Validation

Executive Order 13508, the Chesapeake Executive Council, the Scientific and Technical Advisory Council, the National Academy of Sciences, and others have called for increased transparency and scientific rigor in the verification of the best management practices (BMPs) that are implemented as part of the states' Watershed Implementation Plans and the Chesapeake Bay Total Maximum Daily Load (TMDL). To respond to this request, *Strengthening Verification of Best Management Practices Implemented in the Chesapeake Bay Watershed: A Basinwide Framework, Report and Documentation from the Chesapeake Bay Program Water Quality Goal Implementation Team's BMP Verification Committee* (Verification Framework) (Chesapeake Bay Program 2014), was developed. The Verification Framework is intended to serve as a guide for the states to document the methodology for verification of BMP installation, function, and continued effectiveness of practices over time. This Verification Framework provides the requirements for reporting and documentation of practice verification for the states to follow. Specific guidance is provided for each of the source sectors (agriculture, forestry, restoration [streams and wetlands], urban stormwater, and wastewater).

Verification is formally defined by the Chesapeake Bay Program partners as "the process through which agency partners ensure practices, treatments, and technologies resulting in reductions of nitrogen, phosphorus, and/or sediment pollutant loads are implemented and operating correctly." The Chesapeake Bay Program partnership's Principals' Staff Committee formally adopted five verification principles in December 2012; these are described in Table D1-1.

Table D1-1. Verification Principles adopted by the Principles' Staff Committee.

Principle	Description
Practice Reporting	Affirms that verification is required for practices, treatments and technologies reported for nitrogen, phosphorus and/or sediment pollutant load reduction credit through the Bay Program. This principle also outlines general expectations for BMP verification protocols.
Scientific Rigor	Asserts that BMP verification should assure effective implementation through scientifically rigorous and defensible, professionally established and accepted sampling, inspection and certification protocols. Recognizes that BMP verification shall allow for varying methods of data collection that balance scientific rigor with cost effectiveness and the significance of or priority placed upon the practice in achieving pollution reduction.
Public Confidence	Calls for BMP verification protocols to incorporate transparency in both the processes of verification and tracking and reporting of the underlying data. Recognizes that levels of transparency will vary depending upon source sector, acknowledging existing legal limitations and the need to respect individual confidentiality to ensure access to non-cost shared practice data.

Adaptive Management	Recognizes that advancements in practice reporting and scientific rigor, as described above, are integral to assuring desired long-term outcomes while reducing the uncertainty found in natural systems and human behaviors. Calls for BMP verification protocols to recognize existing funding and allow for reasonable levels of flexibility in the allocation or targeting of funds.
Sector Equity	Calls for each jurisdiction's BMP verification program to strive to achieve equity in the measurement of functionality and effectiveness of implemented BMPs among and across the source sectors.

D 1.1 - Selection of Priority BMPs for Verification

While it is the goal to verify implementation of all BMPs implemented within the Chesapeake Bay Watershed, resource constraints dictate that priorities be set to focus on those BMPs of greatest importance to achieving Delaware's pollutant load reduction goals. BMPs considered to be of the highest priority for developing verification protocols were those that are projected to contribute at least 5 percent of the load reduction to the state by 2025. This determination was based on the "watermelon charts" provided by the Chesapeake Bay Program in Appendix P of the Verification Framework document. These watermelon charts provided the percent contribution from each BMP based on the state WIP. The resulting priority BMPs were grouped appropriately and are listed in Table D1-2. Verification protocols for other BMPs with lower anticipated contributions to the overall load reductions will be developed but at a slower pace, given the reduced reliance on these practices to Delaware's reduction strategy.

Table D1-2. Highest Priority BMPs for verification protocol development.

Sector	BMP Groupings
Agriculture	Cover Crops; Conservation Tillage; Grass Buffers; Manure Transport; Animal Waste Management Systems
Forestry	Forest Buffers
Restoration	Stream Restoration
Restoration	Wetland Restoration
Stormwater	Wet ponds and wetlands; Infiltration practices; Filtering practices; Bioretention; Bioswales
Stormwater	Erosion and sediment control
Wastewater	Septic Connections

It is the responsibility of the implementing organization to verify that all data reported to the DNREC-DWS-NPS are complete, correct, and complies with all rules and policies of that organization. The independent Quality Assurance Manager conducts an additional review of compiled NPS BMP data for completeness, anomalies, errors, or questionable levels of implementation through a status and trends evaluation as a validation procedure. Section D2 provides a more detailed description of the data review, verification, and validation process for each BMP group listed in Table D1-2.

D2 – Verification and Validation Methods

DNREC hosted a BMP verification kickoff meeting in March 2015 with the 5 source sector groups (agriculture, forestry, stream and wetland restoration, stormwater, and wastewater) to review the CBP's Verification Framework. Workgroups were formed for each of the five sectors listed above at the kickoff meeting (Table D2-1). The kickoff meeting was followed by two additional meetings for each individual workgroup where they developed Verification and Validation Protocols for each BMP group within each source sector. The resulting Verification and Validation Protocols are presented in sections D2.1 through D2.5.

Table D2-1. Source sector workgroups **** Denotes Workgroup Chairs**

Workgroup	Group member	Agency/Organization
Agriculture	Ben Coverdale	DDA
	Bob Coleman	DDA
	Bob Palmer**	DNREC
	Dale Churchey	DNREC
	Dan Severson	UD
	Debbie Absher	SCD
	Gary Chambers	Purdue
	Gene Vanderwende	DNREC
	Jacob Urian	DNREC
	Jayme Arthurs	USDA
	Jen Nelson	Resource Smart Consulting
	Jennifer Volk	UD
	John Bushey	USDA
	Kerin Hume	DNREC
	Kip Foskey	SCD
	Larry Towle	DDA
	Lauren Torres	DDA
	Marcia Fox	DNREC
	Marianne Hardesty	USDA
	Michael Biggs	DNREC
	Rick Mickowski	DNREC
	Robert Baldwin	DACD
	Robin Talley	USDA
	Sally Kepfer	USDA/NRCS
	Sharon Webb**	DNREC
	Susan Truehart	UD
	Tim Riley	KCD
	Tom Barthelmeh	DNREC
	Tyler Monteith	DNREC
	Ziggy Savage	USDA
Forestry	Bill Jones	DNREC

Workgroup	Group member	Agency/Organization
	Bill Seybold	DDA
	Bob Palmer	DNREC
	Chris Miller	DDA
	Craig Rhoads	DNREC
	Jason Davis	DNREC
	Jim Dobson	DDA
	Kesha Braunskill	DDA
	Kyle Hoyd	DDA
	Lynn Manges	USDA
	Marcia Fox**	DNREC
	Mike Valenti	DDA
	Sally Claggett	USFS
	Sally Kepfer	NRCS
	Sam Topper	DDA
	Tom Barthelmeh	DNREC
Restoration (streams & wetlands)	Amy Jacobs	TNC
	Bill Jones	DNREC
	Brian Jennings	USFWS
	Brittany Sturgis**	DNREC
	Brooks Cahall	DNREC
	Craig Rhoads	DNREC
	Dale Churchey	DNREC
	Elena Stewart	DNREC
	Jake McPherson	Ducks Unlimited
	Mark Biddle	DNREC
	Robert Gano	DNREC
	Sara Esposito	DNREC
	Steve Williams	DNREC
	Tim Garrahan	USDA
	Tom Barthelmeh	DNREC
	Tyler Monteith**	DNREC
Stormwater	Beau Croll	DNREC
	Elaine Webb	DNREC
	Eugenia Hart**	TetraTech
	Jamie Rutherford	DNREC
	Jared Adkins	KCD
	Jennifer Roushey	DNREC
	Jessica Watson	SCD
	LaTonya Gilliam	DelDOT
	Randy Cole	DelDOT
	Randy Greer	DNREC
Wastewater	Andy Whitman	DNREC
	Dave Schepens	DNREC
	Jason Baumgartner	DNREC

Workgroup	Group member	Agency/Organization
	Jennifer Walls**	DNREC
	Jim Cassidy	DNREC
	John DeFriece	DNREC
	Ron Graeber	DNREC
	Scott Eichholz	DNREC

Agricultural Sector Verification Protocol

D2.1 Agriculture

This section of the verification protocol represents the BMP groupings for the Agriculture Source Sector. Table F-1 in Appendix F provides a sector-specific checklist of Delaware BMP verification protocol components and maps them to the relevant QAPP sections where they are documented. Delaware's verification program focuses on cost shared, regulatory, and permitted practices. In the future, as Delaware implements the verification program, resource improvements will be incorporated.

D2.1.1- Cover Crops

Visual Assessment – Single Year: Cover Crop Practices (Traditional and Commodity)
Through Delaware's Conservation District's Cover Crop Cost Share Programs, each conservation district – New Castle, Kent, and Sussex - inspect and report cover crop best management practices. Each conservation district operates its own Cover Crop Program to ensure best management practices comply with respective cover crop policies. Additional cover crop information is obtained from NRCS and FSA. Cover crop practices are annual practices. Details regarding verification and validation procedures for cover crop practices are contained in Table D2.1.1.1 and summarized in the following sections.

Table D2.1.1-1 Visual Inspection – Cover Crops

Jurisdictional Agriculture Verification Protocol Design Table: Visual Assessment BMPs - Single Year											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment: Annual	Cover Crops	Visual Assessment	Annual	Trained District or NRCS Conservation Planners	District BMP Compliance Inspection Forms or NRCS Toolkit	Single Year	100% are inspected annually	Not Eligible for Cost Share Funds	Single Year	100% Tracked during inspections within District Cover Crop databases or NRCS Toolkit. QA'd data entered into NPS BMP Database.

D Data Verification

Method

Cover Crop practices are non-regulatory and 100% of all practices are inspected after planting and destruction of crop. The information is gathered annually to assure Cover Crop Program compliance.

District practices are reported at the site-level, with planting date, crop type, destruction date (if applicable). Additionally, NRCS and FSA submit cover crop data; however, the data reported by these agencies are not as detailed as District Cover Crop Programs. All BMPs meet NRCS standards, state standards, and Chesapeake Bay Program definitions for inclusion in the Chesapeake Bay Watershed Model. Currently, resource improvement practices are not reported.

Verifiers

Cover Crops are visually inspected by District or NRCS Conservation Planners. All District planners are trained in the interpretation of Cover Crop Program standards and specifications necessary to perform the inspections. Once cover crops are planted, the farmer will self-certify in writing by completing a certification form for the acres of cover crops planted. These forms are mailed to the farmer along with a cost-share approval letter specifying how much cost-share the farmer may get. Information requested on the certification form include farm and tract number, farm name, number of acres, type of cover crop species, seeding date, previous crop, and planting method. After certification, District planners map the acres and physically inspect each field for program compliance. In the spring, a destruction form is mailed to the farmer and they must certify in writing each field as destroyed. The destruction certification form captures acres destroyed, acres harvested, destruction method, and destruction date. The planners go out again to inspect each field to ensure the cover crop has been destroyed. Application of commercial fertilizers or animal manures (N and P) are not allowed on crop fields intended to receive or is receiving cover crop incentive payments. During the course of inspections, a planner will document all cover crop information on District BMP inspection forms and NRCS information is entered into Toolkit. When inspections are complete, and conditions are met, payment is made to the landowner.

Documentation of Verification

BMPs are inspected by Conservation District Planners and documented on District specific inspection forms. Each District has separate databases for their cover crop programs - New Castle Conservation District, Kent Conservation District, and Sussex Conservation District. Cover crop data is entered into spreadsheets by the Conservation Planners. The data are maintained on private servers within each of the three Districts. Information from both the planting and destruction certification forms is recorded into an Excel spreadsheet. Data recorded includes the tract number, watershed name, crop species, total acres, harvested acres, destroyed acres, planting date, cost-share amount, planting method, destruction method, and destruction date. Future spreadsheets will also record prior crop.

Additional cover crop information is provided by NRCS and FSA; however, the data reported by these agencies are not as detailed as District cover crop data. NRCS data are provided by USGS, per the Basinwide 1619 Agreement for CBP modeling, at the state and county level to be evenly distributed. FSA data are aggregated and reported by the state office as part of the federal crop

insurance program. Farmers are required to annually file a crop report, certifying the location and acres of crops. Crop reports are printed for producer signatures and maintained in files at the county office. The data is also stored by FSA's computer system. FSA data are submitted at the lowest nutrient use efficiency.

End of contract/project lifespan
Cover crop BMPs are annual practices and thus have a lifespan of one year. New data are reported annually by all cover crop implementing agencies.

2.1.1.3 Data Validation

Quality Assurance
All (100%) cover crop practices are inspected annually. Inspections are made after implementation and after destruction/harvest. All records are provided to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach to submitting data for bay program progress and for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices into the DE NPS BMP database with their provided login information and are only permitted to review their own data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year. See QAPP Section D2.1 for specific agricultural BMP submittal methodology.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry
Data are collected and entered into the respective cost sharing entity's database by trained staff. Cover crop data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. The code in the DE NPS BMP Database has been modified so that the lifespan/credit duration is added to the implementation

date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has been passed, that BMP will be tagged as "retired".

Double counting is avoided by submitting data by the primary funding source or the primary implementing agency. For example, BMP implementation data that is cost-shared with NRCS is submitted by NRCS. Cover crop data are also submitted by the conservation districts.

Training for entering data into DE NPS BMP Database has been provided by webinar in the past (2013) and an additional face to face training will occur at DNREC in late 2015. The NPS BMP Database also contains a link to a user's manual. There will be no "certification" required for personnel to enter data. However, the person entering data will receive some training on how to use the database and enter data properly.

As of 2019, the previous DE NPS BMP Database that was created by Tetra Tech developed terminal errors and no longer functioned as designed. The contractor no longer supported the maintenance of the DE NPS BMP Database, and therefore, Delaware's NPS Program had to explore alternative options for managing and submitting Delaware's BMP data. DNREC-DWS-NPS Program contracted with KCI Technologies to develop a BMP Tracking Tool and Database Application to be completed before December 1, 2019.

External Data

Data are provided from external agencies as mentioned above. The data are reviewed for accuracy – correct reporting period and that all necessary fields for NEIEN have been included. District data are the most specific data reported and are specific to the Chesapeake Bay watershed. NRCS and FSA acres are provided for the entire state/county (not just the CB watershed) so they need to be spread evenly. Any NRCS cover crop acres are subtracted from the FSA cover crop acres and any remaining acres were included as "Commodity Cover Crop Late Other Wheat" for minimum credit.

Historic Data Verification

Historic data were captured in June 2015 – see NEIEN Methodology for Historical Data Clean Up (Appendix H). Data quality assurance and data entry were conducted as discussed in the above sections.

BMP Performance

During the visual field assessments, BMPs are inspected for compliance or failure by implementing agency. If a BMP is not performing up to its standards and specifications, a maintenance inspection report or letter is provided to the landowner. Agency staff work with landowners to bring the BMP back into compliance or the landowner must pay back the funds used to implement the BMP.

BMP inspection records are entered into the NPS BMP Database. Each BMP is assigned a lifespan or credit duration. A BMP will be considered "retired" once the Lifespan End Date has passed. If the BMP is re-inspected and deemed functioning (pass), it will be entered back into the

database for inclusion in progress reporting. Any BMP deemed failing (fail), will be retired from the system until the BMP is brought back into compliance.

D2.1.2 - Soil and Water Conservation Plans

Non-Visual Assessment – Single Year: Soil and Water Conservation Plans
A Conservation Plan is a written record of management decisions and conservation practices and systems used to develop and maintain a farm. NRCS and Conservation District Planners write the plans for farmers as required for Farm Bill Program eligibility. The plan contains a listing of the conservation practices and a schedule for implementation. Included with these practices are a description of the impacts of the selected practices on their natural resources. The plans are used by the farmer to achieve goals and maintain the resources of the land. This BMP is a non-visual assessment BMP as it is written once and is considered permanent until land management changes.

2.1.2.1 Table - Soil and Water Conservation Plans

Delaware Agriculture Protocol Design Table: Non-Visual Assessment BMPs – Single Year											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	NRCS Policy – required for Farm Bill Program eligibility	Conservation Plans – *Full Farm Plan*	Resource Inventory & Plan Development	1/year	NRCS and Districts	Plan Development and CPA06	Upon Plan Amendment	N/A	Ineligib-ility for cost share funds	Permanent until management changes	Toolkit

2.1.2.2 Data Verification

Method

Soil and Water Conservation Plans meet NRCS standards, state standards, and Chesapeake Bay Program definitions. Each of Delaware's Conservation Districts' partners with USDA's Natural Resources Conservation Service (NRCS) in developing conservation plans. One hundred percent (100%) of all Conservation Plans are inspected during the lifespan of the practice. This BMP is reported only by NRCS. All plans are non-visually assessed each year as required by NRCS contracts. Funding for this BMP is provided by USDA programs or state cost share funding.

Conservation plans are written by District or NRCS Conservation Planners. The plans are required by NRCS policy for Farm Bill Program eligibility. Any landowner seeking BMP cost share funding must have an active Soil and Water Conservation Plan. District and NRCS enter data into Toolkit for inclusion in the Chesapeake Bay Watershed Model progress runs.

Verifiers

All practices are visually inspected on-site during the lifespan of the BMP as required by USDA. NRCS verification timing will be at the organization's discretion. BMP inspectors are trained NRCS or District Planners. Training is ongoing as all new personnel are trained in the collection of BMP data; however, there is no "certification requirement" for staff collecting BMP data. If any of the data collectors have questions regarding functionality, contact is usually made with USDA NRCS.

Documentation of Verification

This BMP is inspected and entered into NRCS Toolkit by trained NRCS or District planners. An outline of practice data submissions can be found in section B10 of Delaware's QAPP. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was reached to have federal agencies, such as the USDA's NRCS, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf. All NRCS data are aggregated at the County level. All BMPs currently reported are approved by CBP for inclusion in model application.

End of contract/project lifespan

Once the practice contract expires with NRCS, the BMP is retired from the NPS BMP database. It is the implementing agency's discretion to submit updated data to the DNREC Quality Assurance Officer for inclusion in Delaware's reporting and BMP tracking database.

2.1.2.3 Data Validation

Quality Assurance

All plans are inspected within the practice lifespan by NRCS or Conservation Districts. Additionally, checks are made upon implementation and before contract end dates by the funding agency; hence, BMPs are verified for functionality. Inspection records (pass/fail) will be provided to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for Chesapeake bay progress submission and generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only permitted to review their own data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into NRCS toolkit by trained staff. Data are provided to NPSto input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

External Data

Data are provided from external agencies as mentioned above. Double counting is avoided since this BMP is reported by one agency. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were provided by DNREC and NRCS. Data quality assurance and data entry were conducted the same way as in the past (as discussed in the above sections).

BMP Performance

Landowners must have a conservation plan to be eligible for federal cost share funding. All on-farm BMPs are inspected during this time; however, the conservation plan does not expire until in farming operation changes occur. When developing a conservation plan, visual field assessments are made and BMPs are inspected for compliance or failure. If a BMP is not performing up to its standards and specifications, a maintenance inspection report or letter is provided to the landowner. Agency staff work with landowners to bring the BMP back into compliance.

D2.1.3 Nutrient Management Planning

Non-Visual Assessment – Single Year: Nutrient Management Planning
DNREC, DDA, and the Delaware Nutrient Management Commission (DNMC) have statutory and regulatory authority to manage animal agricultural programs in Delaware, including the Delaware Nutrient Management Law and regulations. Under this law, DDA inspects Nutrient Management Plans (NMPs) for compliance with Nutrient Management Law & Regulations. NMPs are cost shared through several agencies in the state including DDA and NRCS. Farmers that meet the criteria for Nutrient Management are required to become certified through a partnership with University of Delaware. Once certified, plans are written and captured through a cost share program with NRCS or DDA. Plans are housed on the farm and the Delaware Nutrient Management Commission is notified of plan development. Certified Individuals - generators, handlers (private or commercial), and consultants - are required to submit annual reports for the implementation of nutrient management planning activities. Annual reports are recorded with DDA. Visual inspections are done randomly at the discretion of DDA or by complaints. DDA staff meets with individuals to determine if compliant with the law and discuss any additional requirements needed to become compliant. At this time, additional BMPs like animal waste facilities or composters are reviewed. Landowners have 14 days to make corrective actions; failure to do so will result in penalties documented in the Nutrient Management Law and regulations.

2.1.3.1 Table – Nutrient Management Planning

Delaware Agriculture Protocol Design Table: Non-Visual Assessment BMPs – Single Year											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Non-Visual Assessment: Annual	Nutrient Management Core N & P (Supplemental rate, timing, placement)	Visual Assessment: Plan documented at DDA	Annual	Trained DDA Staff	NM Evaluation Report Forms	Single Year	100%	Not Eligible for Cost Share Funds	Single Year	Self NM Annual Report; Inspection report; public formal complaint process; all recorded in database
High	NMP Creation, Cost Share – Conservation District	Nutrient Management Core N & P cost share	Visual Inspection; Plan Creation	Every 3 years	District Staff – Certified Nutrient Consultants	The NM Plan written to 590 standard	None – authority transferred to DDA until another NMP update is needed			3 years	Plans are housed at District Office. Information is entered into District Database.
High	Cost Share	Nutrient Management Core N & P	Farm Record Review	Annually	NRCS	590 EQIP Standard	Annual	All Contracts	Violation of contract; consultant will need to correct	3 years	Toolkit

High	Cost Share	Nutrient Management Core N & P	Farm Record Review	Annually	NRCS	CSP – Conservation Security Program for Advanced NM Plan	Annual	All Contracts	Violation of contract; consultant need to correct	5 years	Toolkit
High	On-farm record review: Permit and Regulation.	Nutrient Management Core N & P : Nutrient Management Annual Report Review and Compliance Checks	Farm Record Review	Annually	DDA	Invoice for Cost Shared Plan and Inspection Forms for Compliance checks	Compliance Check	17.7% inspections/ year. Farmers are required to submit an annual report (Appendix)	Work with landowner or consultant to correct	Annual	Self NM Annual Report; Inspection report; public formal complaint process; all recorded in database

2.1.3.2 Data Verification

Method

Nutrient management practices are regulatory and all practices are non-visually inspected annually through agencies involved in the nutrient management process – rigorously certified private planners or Conservation Districts and NRCS develop and continuously update the plans; DDA receives annual reports documenting implementation of plans; and Based on recent previous compliance rates between 75 and 85 percent the Program estimates 17.7% of farms require verification evaluations annually (See Appendix A, Table 1).. The information is gathered annually to assure landowners comply with Delaware's Nutrient Management Law. The Nutrient Management Law requires Delaware to make nutrient consultants available through the conservation districts to provide free Nutrient Management Plans (NMPs) to anyone requesting assistance, or to reimburse at a determined rate anyone who chooses to hire a private nutrient consultant.

Plans for nutrient management comply with all applicable federal, state, and local laws and regulations. Nutrient management plans are developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

One hundred percent of all nutrient management plans from newly certified planners are inspected at initial implementation or plan conception by the Nutrient Management Program Administrator. Several agencies conduct follow-up inspections; however, DDA follows compliance requirements per nutrient management regulations. DDA reviews approximately 17.7% of plans annually. The Program staff can select an operator and/or operation for audit via any of the following manners:

1) Random selection- operators may be picked at random from a database of contacts by Program staff scientist at any given time- not due to non-compliance or complaint- to reach target verification evaluation numbers
   a) Selection interval follows the recommendation in Appendix A below: *Sampling Recommendations for Delaware Nutrient Management Verification*
2) Consultant selection- if willing, consultants can help arrange verification evaluations for their clients to mitigate the travel and schedule burdens of random audits.
3) Targeted by Non-Compliance- an operator may be selected for a verification evaluation due to annual report inaccuracies or incompleteness or non-compliance from previous audit.
4) Targeted by Program staff- an operator may be selected for a verification evaluation due to complaint investigation initiated by a public citizen or program official. If the Program staff investigates a complaint and has suspicion of non-compliance, officer may ask Program staff scientist to conduct verification evaluation.

   Participation in other state and federal programs – higher inspection rates for select groups of farmers participating in state land leasing, federal cost-share programs or other

programs for which nutrient management activities are involved may be preselected by a fellow agency for Nutrient Management Program verification evaluation based on available funding and program verification goals. These evaluations may be performed with Program partner staff in an advisory role and may result in regulatory enforcement beyond the scope of the Program itself.

Each operation is required to have a minimum of one (1) certified operator. The certified operator or a certified designee should be present for the verification evaluation. *An hour-long verification evaluation should receive one credit. No more than one credit should be issued per verification evaluation within each renewal cycle.*

a) Animal only (and CAFO no-land – GP1): Operator(s) should be certified as Nutrient Generator or higher.
b) Land plans (and CAFO with land – GP2 & 3): Operator(s) should be certified as Private Nutrient Handler or higher.

The Nutrient Management Plan or Animal Waste Management Plan is to be written by a certified nutrient management consultant without conflict of interest in the operation. An Animal Waste Management Plan may be written by the certified (Nutrient Generator or higher) operator as outlined below. During the verification evaluation the Program staff scientist will check for completeness of each plan according to the plan requirements.

1) Each operator is required to keep certain records of implementation outlining their operation practices for five years. We advise a minimum of previous 3 crops or 24 months of history, whichever is less, be available upon inspection. Plans that are cost-shared or updated annually would need to present two consecutive plans. Two and three year plans cover the requested time period for routine inspection. The Program Staff scientist may inspect as little as 12 months of record keeping for the following areas.
   c) Actual Yield: Specific field or management unit yield information for the last 7 years or less if the yield goal is based on less historical information.
   d) Nutrient Type(s): Type of nutrients applied such as inorganic fertilizer, organic fertilizer (manure), or other (ex. DAF). i.e. fertilizer receipts or manure weigh tickets; note: if all inorganic fertilizer was purchased and applied by a custom application fertilizer company, then the invoice detailing the total blend weight would be sufficient.
   e) Analysis/Nutrient Content of fertilizers or manures: N-P-K analysis of fertilizers applied i.e. fertilizer labels, blend work orders, manure analyses.
   f) Application Rates & Quantity: Pounds, gallons, or tons applied per acre and total amount applied per total crop acres per application period. Applications such as pre-plant, side-dress or fertigation should be itemized by quantity and traceable to analysis as indicated above. i.e. application records sent by a co-op, log book of applications kept by operator or bulk order receipts with supplemental records of annualized rates.
   It is expected that all records are kept on a field scale. Two to three fields will be evaluated per operation. Program staff, at their discretion, may accept farm gate scale

records in the few cases where the operation has homogenous management across multiple fields and records to match.

g) Application Timing & Placement: Date(s) applied and indicated method such as banded or starter. Date of last calibration of spreading equipment should be verified as appropriate. i.e. log book of maintenance and application records kept by operator or plan notations in the margins

h) Manure Management Information: Manure type, date of removal from production area or manure shed, receiver information, approximate tonnage removed (if applicable). i.e. manure export records kept by operator, receipts from manure export company, weigh tickets from certified truck scales.

The inspection of Component BMPs is outlined below, by BMP type:

a) Phosphorus Site Index (PSI) (if applicable): spot check records of actual nutrient application on fields where a PSI has been calculated to make sure the actual application did not result in over fertilization of phosphorus (P). If no PSI has been performed on fields with a FIV >150, then the P application can be no more than a 3 year crop removal rate. (Staff would need a printout detailing the University of Delaware's crop removal rates by bushel and crop) See **https://cdn.extension.udel.edu/wp-content/uploads/2016/03/23084930/Part-A-phosphorus-loss-potential-due-to-site-and-transport-characteristics.pdf** and **https://dda.delaware.gov/nutrients/downloads/PSI_DE_All_Counties_110910.pdf**

b) Carry over nitrogen credits: Legumes and cover crops provide plant available nitrogen in the next season with sufficient yield of biomass. Residual Nitrogen values can be estimated using the Mid-Atlantic Nutrient Management Handbook (**https://s3.amazonaws.com/udextension/ag/files/2013/06/The-Mid-Atlantic-Nutrient-Management-Handbook-2006.pdf**). Additionally, available nitrogen from legume cover crops, non-legume cover crop, or any other green manure source, can be assessed by determining plant available nitrogen (Staff would need to see available nitrogen test results and the provider of the results).

c) Pre-side-dress Nitrate Tests (PSNT): Provide all relevant test results on all fields that received manure applications to check that side-dress N application rates were within the allowable range recommended by the a certified consultant or lab. (Example: UD calculation table & knowledge of how to perform the calculations to determine the side-dress N recommendation – *See Attached)*
http://extension.udel.edu/factsheets/nitrogen-removal-by-delaware-crops/
http://extension.udel.edu/factsheets/phosphorus-removal-by-delaware-crops/

Nutrient Management practices – both Core N and Core P (as well as supplemental rate, timing, placement – are reported at the watershed-level, with implementation date, and acreage. The BMPs featured in this section meet NRCS standards and state standards. Resource improvement practices are not reported.

Verifiers

Once a NMP is completed and being implemented, the NMPs must be maintained on-site and must be made available for inspection by the DDA. Each person who is required to implement a NMP must submit an annual report to the DDA by March 1 of every calendar year, on a form developed and supplied by the DDA. The report details nutrient handling activities that occurred during the previous calendar year, including at a minimum:

1. The amount of animal waste applied to the land and the area of land to which it was applied;
2. The amount of animal waste transferred for alternative uses (if applicable); and
3. The amount of inorganic fertilizer applied to the land.

Information obtained from these reports is used to verify the existence and utilization of the NMP by the DDA. Any revisions to the NMP must be justified, documented, and included in the records. Any significant alterations in operations or upon a 25% or greater increase in operation caused by unforeseen circumstances (ex. weather) that occur prior to a NMP's expiration date will require an addendum to the NMP from the certified nutrient consultant. In the event that 1-2 years of records does not exhibit compliance with the plan specifications, a Program staff scientist, in their sole discretion can evaluate antecedent conditions and records to better evaluate overall farmer performance.

1) Additional BMPs may be inspected for crediting practices that exist as separately tracked items. Some of these may be required for CAFO compliance and others may be collected in an effort to better capture BMP extent across the state for non-cost shared practices.
   i) Animal Operation BMPs:
      i) Composter
      ii) Mortality Freezers
      iii) Manure Shed
      iv) Heavy use area pads (HUAPs) or concrete end pads
      v) Stockpiling
      vi) Storm Water Retention Pond
      vii) Pasture Rotation
      viii) Pasture Stream Fencing
      ix) Grassed Waterway
      x) Windbreaks
      xi) Regular Manure Sample
   j) Land Operation BMPs:
      i) Temporary Field Staging
      ii) Application Setbacks
         (1) Can be verified with inquiry and application rate and quantity information
      iii) Application Rates less than Recommendations
      iv) Cover Crops
      v) Grid Soil Sampling
      vi) Annual or semi-annual Soil Test
      vii) PSNT; following a recommendation from a certified consultant or approved lab.

viii) CSNT; following a recommendation from a certified consultant or approved lab.
ix) Precision Application
x) Yield Mapping
xi) Strip Trials
xii) Split N or P Applications
xiii) Variable Rate N or P Applications
xiv) Manure Incorporation
xv) Subsurface Injections

Documentation of Verification

In addition to reviewing the completed NMP, DDA staff inspects approximately 17.7% of farms annually to verify the contents and implementation of the Nutrient Management Plan. Agency staff are trained in NM program standards and specifications necessary to perform the inspections. Each DDA inspection reviews the records maintained by the landowner. During a verification evaluation two different parties are subject to evaluation- the operator and the certified Nutrient Management Consultant (Consultant). The consultant is held accountable for elements of the plan that are missing or incomplete. The operator is held accountable for the certification, implementation (e.g. records) and farm management aspects of the audit. Compliance and non-compliance will be aggregated on a semi-annual basis for reporting purposes under various agreements, but protecting anonymity where legally required. The levels of compliance are listed below:

1) Compliance: an operation is in compliance if all aspects of the verification evaluation pass with no reason to follow up. Certification status is enabled and up to date, the operation plan is complete and valid, records of implementation are kept and complete, and farm management is up to specification.
2) Substantive Compliance: an operation is in substantive compliance if the findings of the verification evaluation have a good explanation and are within nutrient management recommendations. (i.e. the operator applied less N or P than the plan recommended and this rate maintained productivity.)
3) Procedural Non-Compliance: an operation could be in procedural non-compliance if the findings of the verification evaluation have a good explanation and within nutrient management recommendations. (i.e. According to plan a field should have been planted in corn, instead soybeans were planted due to weather the nutrients however were applied at soybean rate.)
4) Non-Compliance: an operation will be in non-compliance if there is an environmental issue that needs to be addressed. (i.e. not following nutrient management plan recommendations, records of implementation not being kept, waste being handled improperly.)

Records include but are not limited to:

- The following are required by §2247 (c) of the DE Nutrient Management Law:
  - Soil test results,

    - Recommendations for nutrient application,
    - Rate and sources of nutrients applied,
    - Manure analysis provided free by State Compliance Lab,
    - Crops planted with estimated yields,
    - Crop residues removed,
    - Dates of nutrient applications,
    - Method of application including type of incorporation, if applicable.
- In addition to what the Law requires to be presented by the producer at time of inspection:
    - Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
    - Actual yields with documentation of reasons for missed expectations
    - Results of applicable water, plant, and/or organic by-product analyses.

Amount and type of manure exported from the farm and the name, address, and organization responsible for exporting manure.

Follow up practices will be communicated to the operator and/or the consultant at the conclusion of a verification evaluation. If compliant, no verification evaluation should be repeated for up to 5 years, unless otherwise determined by selection process. Follow-ups can be made as soon as two weeks or as long as 1 year determined by the cause of follow up. These guidelines are outlined below.

1) Compliant: normal selection criteria employed
2) Substantive Compliance: normal selection criteria employed, next random selection will seek to cull further deviations.
3) Procedural Non-compliant: discretion of program staff
4) Non- Compliant: follow up verification evaluation as soon as 2 weeks and as late as 1 year depending on cause, examples provided:
    a) Waste storage facility being improperly used or not tidy- 2 week follow up
    b) Insufficient records- 1 year follow-up implementation verification
    c) No plan or out of date plan- 3 month follow-up to validate current plan and subsequent 1 year implementation verification

On-farm records are maintained for a minimum of six years or longer as required by regulations.

The written guidance and documentation on verification systems for Nutrient Management Plan development and implementation is found on DDA's Nutrient Management Evaluation Report. Information obtained from evaluation reports and annual reports are entered into a web based database by DDA. The required annual reporting information is entered when received, and aggregated data reports are generated to provide information on nutrient management planning implementation and nutrient handling activities throughout the state to establish trends and indicate nutrient use efficiency gains at an aggregated scale.

<u>End of contract/project lifespan</u>

Nutrient management planning BMPs are typically annual practices, but can also be written on a 3 year cycle and thus have a lifespan of one to three years. New data are reported annually for each progress reporting period through the Nutrient Management Programs Annual Report.

2.1.3.3 Data Validation

Quality Assurance

All nutrient management plans are inspected upon implementation and results recorded with DDA (via annual reports). Other agencies involved in the nutrient management process include Conservation Districts and NRCS in plan development; and DDA inspects 17.7% of farms annually for compliance. All plan inspections are made before cost share funding is received by the cost sharing agency. DDA conducts 17.7% QA checks annually for compliance of the Nutrient Management Law. Nutrient management plan data are reported annually to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN. In 2016, methods for collection of soil test phosphorus categories will support decadal trends in high fertility index value P soils downwards, as well as an upward trend in low FIV P soils, indicating drawdown of hotspots, utilization of manure resources where agronomic need can be met and maintenance of optimum testing soils.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only permitted to review their own data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into the respective cost sharing entity's database by trained staff. Nutrient Management data are provided to DNREC to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. The code in the DE NPS BMP Database has been modified so that the lifespan/credit duration is added to the implementation date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has

been passed, that BMP will be tagged as "retired" unless it has been recertified in that lifespan as continuing to operate consistent with NRCS or Chesapeake Bay Program Office approved BMP definitions, whichever is more easily visually certifiable.

Double counting is avoided by submitting data by the primary funding source or the primary implementing agency. For example, BMP implementation data that is cost-shared with NRCS is submitted by NRCS. Non-cost shared data are submitted by the state or conservation districts.

External Data

Data are provided from DDA. The data are reviewed for accuracy – correct reporting period and that all necessary fields for NEIEN have been included. Nutrient management planning acres are calculated using the total number of acres cost-shared verified by the DDA annual reports database or adjusted downward based on compliance rates of statistically significant numbers of random inspections yielding a more reliable compliance rate as approved by the CBPO Agriculture Workgroups Verification Protocol.

Historic Data Verification

Historic data were submitted by using the NEIEN Methodology for Historical Data Clean Up (Appendix H). Data quality assurance and data entry were conducted as discussed in the above sections. Compliance through history is not obtainable based on the adaptive management established through improving verification protocols.

BMP Performance

Nutrient management planning acres are annual practices. Performance is only noted during inspections conducted by DDA. The inspection results of a statistically defensible sample size of 17.7% will be used to determine compliance. All data are entered annually and will supersede any previous records.

For Core NM:

- Both N and P core NM credit requires nutrient application rates according to LGU recommendations as outlined in the Delaware Nutrient Management Program State Technical Standard 'Nutrient Management Code 590.' This standard applies to producers who apply nutrients to ten acres or more and/or have 8 Animal Units or more.
- Both N and P core NM credit requires yield estimates and cropping plan at field management unit as outlined in the Delaware Nutrient Management Program State Technical Standard 'Nutrient Management Code 590.' This standard applies to producers who apply nutrients to ten acres or more and/or have 8 Animal Units or more.
- Both N and P core NM credit requires cropping and manure history at field management unit as outlined in the Delaware Nutrient Management Program State Technical Standard 'Nutrient Management Code 590.' This standard applies to producers who apply nutrients to ten acres or more and/or have 8 Animal Units or more.
- Both N and P core NM credit requires manure analysis as outlined in the Delaware Nutrient Management Program State Technical Standard 'Manure Sampling and Analysis.' This standard applies to producers who plans to land apply manure or manure and fertilizer.

- Both N and P core NM credit requires a spreader and applicator calibration as outlined in the Delaware Nutrient Management Program State Technical Standards 'Calibrating Fertilizer Applicators' and 'Calibrating Poultry Litter and Other Solid Manure Spreaders.' The first standard applies to all farming operations that land apply commercial fertilizers, and the second applies to all farming operations that land apply poultry litter and other solid manures.
- P core NM credit additionally requires P soil tests at field management unit level as outlined in the Delaware Nutrient Management Program State Technical Standard 'Nutrient Management Code 590.' This standard applies to producers who apply nutrients to ten acres or more and/or have 8 Animal Units or more.

For Placement:

- Both N and P placement NM credit requires either subsurface application or application setbacks. Setbacks are required according to the Delaware Nutrient Management Program State Technical Standard 'Field Application Setbacks.' This practice applies to all CAFOs in the state and requires a 100 foot setback or 35 foot vegetated buffer adjacent to water.

For Rate:

- P rate NM credit requires either P based manure rate based on annual crop P removal, P rate less than the LGU recommendations or variable P rate at sub-field management unit level. The Delaware Nutrient Management Program State Technical Standard 'Nutrient Management Code 590' requires a Phosphorus Site Index (PSI) test wherever phosphorus levels are higher than agronomic need.

D2.1.4 Manure Relocation (Transport)

Non - Visual Assessment – Single Year: Manure Relocation (Transport)
Through the Department of Agriculture's Manure Relocation Cost Share Program, the State can report manure transport inside and outside of the Chesapeake Bay Watershed. Manure relocation practices are annual practices. Details regarding verification and validation procedures for manure relocation practices are contained in Table D2.1.4.1 and summarized in the following sections.

2.1.4.1 Table – Manure Relocation

Jurisdictional Agriculture Verification Protocol Design Table: Non-Visual Assessment BMPs - Single Year											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Non-Visual Assessment: Annual	Nutrient Transport	Self-Certification	Annual	Trained DDA Staff	Cost assistance receipts	Single Year	100%	Not Eligible for Cost Share Funds	Single Year	100% NM Transport Cost Share

2.1.4.2 Data Verification

Method

Manure relocation practices are non-regulatory. Only a portion of the manure transported throughout the state are captured through DDA's Manure Relocation Cost Share Program. The Delaware Nutrient Management Relocation Program is available annually on a first come, first served basis. Current funding is provided to the DDA through CWA Section 319 Grant and Chesapeake Bay Implementation grant funds, and state cost share funds. To apply for cost assistance, landowners submit an application to the Delaware Nutrient Management Program. Once the application has been approved, the landowner will receive a letter of approval and a Claim for Payment form. After completion of the manure transport, the landowner must send in the Claim for Payment form and the weight slips for payment. Payment of cost assistance is contingent upon funding availability.

Data are gathered annually through the Nutrient Management Relocation Program cost assistance program. Information obtained from this program is the only verifiable and reportable data for relocation. The BMPs featured in this section meet state standards and Chesapeake Bay Program definitions. Practices captured through this process include: Manure Transport Outside and Inside the Chesapeake Bay Watershed. This section does not include resource improvement practices.

Verifiers

DDA staff is trained in Nutrient Management (NM) Relocation Program standards and specifications necessary to perform the inspections. The written guidance and documentation on the data collection and verification systems is found on DDAs Nutrient Management Relocation Program website: http://dda.delaware.gov/nutrients/nm_reloc.shtml

Documentation of Verification
NM Relocation Program information is recorded and maintained on NM Relocation Program application forms. Data recorded includes the transport agent, eligible sender and eligible receiver/nutrient destination. Data is transferred from a paper copy to an Excel spreadsheet and maintained on DDA's servers.

End of contract/project lifespan
Manure relocation BMPs are annual practices and thus have a lifespan of one year. New data are reported annually by DDA.

2.1.4.3 Data Validation

Quality Assurance
All (100%) cost-shared manure relocation practices are recorded annually. Forms are verified by DDA staff and compared to manure handler reports before payment is made. All records are provided to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only permitted to review their own data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into DDA's manure relocation database by trained staff. Data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

Double counting is avoided because DDA is the only agency that submits manure relocation data.

External Data

Data are provided from DDA. The data are reviewed for accuracy – correct reporting period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were verified for this practice - see NEIEN Methodology for Historical Data Clean Up (Appendix H). Data quality assurance and data entry were conducted as discussed in the above sections.

BMP Performance

Manure relocation BMPs are annual practices. All data are entered annually and will supersede any previous records.

D2.1.5 Conservation Tillage and High-Residue Tillage

Visual Assessment – Single Year: Transect Survey – Conservation Tillage and High-Residue Tillage

This section incorporates two, high priority BMPs captured through the statistically valid state-wide transect survey including conservation tillage and high-residue minimum soil disturbance (HRMSD) tillage.

In October 2015, EPA's statistical team reviewed Delaware's approach for generating and verifying BMP data for both conservation tillage and cover crops. The team verified that Delaware's survey will accurately estimate tillage and cover crop BMPs with the proposed 100% verification protocol and 100% statistical sampling.

2.1.5.1 Table - Conservation Tillage, High-Residue Tillage, and Cover Crops

Jurisdictional Agriculture Verification Protocol Design Table: Visual Assessment BMPs - Single Year											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment: Single Year	Non-cost Shared Programs: Conservation Tillage, High-Residue Tillage, and Cover Crops	Visual Assessment: Residue Cover and Cover Crop Establishment	Yearly survey along statistically valid transect route	Trained DDA Staff, County Conservation Districts, and UD Agronomists	Delaware's “Procedures for Cropland Roadside Transect Survey for Obtaining Tillage/Crop Residue Data”	Single Year	10% Sub-sample of all observations along statistically valid transect route	Review all previously recorded data from current year’s survey	Single Year	10% Compliance Checks by State Agency/NPS Database/Transect Survey Application

2.1.5.2 Data Verification

Method

Tillage practices are annual, non-regulatory and collected using a statistically valid driving transect survey method. In addition to tillage practices, this survey also incorporates the observation of annual cover crop practices across the state. Practices collected from this state-wide transect survey are reported at the state-wide level. Conservation Tillage and High Residue Minimum Soil Disturbance (HRMSD) Tillage are reported as a percent implemented throughout the entire state. Cover crops are collected as an observation percentage, which later get converted to an acreage based on available cropland. The collection process of this survey is part of a statistically valid transect that targets agricultural areas. The methodology for this survey was adopted by Delaware with help from the Chesapeake Bay Program from the Conservation Technology Information Center (CTIC), the original suppliers of Conservation Tillage data for the Chesapeake Bay States.

This cropland driving transect survey procedure provides a high degree of confidence in the data summaries. Users can have 90% or more confidence in the accuracy of the results. The driving route is required to be at least 110 miles long in each of Delaware's three counties. The routes do not double-back along the same road more than once. The survey is conducted after the majority of the main crops have been planted, but before the crop canopy closes or the first row cultivation takes place. To obtain a statistically reliable data set, approximately 460 cropland sites are observed along the driving route, in each county. The survey team stops and checks field conditions at particular intervals to ensure correct estimates are being made for different crop, tillage, and residue conditions. The team re-calibrates their visual estimates when entering a region of the county with different soil surface conditions due to changes in moisture, organic matter levels, stoniness, or crops grown. In addition to the original survey team, a Quality Assurance and Quality Control team retraces the original routes after the initial survey is conducted to ensure the data captured is consistent. The QA/QC team consists of members that did not participate in initial survey, but from the same organizations. Using the same GPS coordinates as marked in the initial survey run-through, the team checks and confirms or rejects the initial observations on at least 10% of the observations. Members on the QA/QC team have access to the original observations and are able to compare them with their own judgments. The QA/QC team begins immediately after the initial observations are made. The team is able to verify a random sample of the initial observations; at most, two days after the initial observations are made. This ensures that the conditions originally observed are as close as possible to what was viewed in the QA/QC runs. In addition to the immediacy of the quality assurance and quality control review, the lead observer ground truths and interviews the land manager of several of the fields with their permission. The lead observer may utilize the bead-and-line residue estimation method in several cases to verify that correct observations are recorded.

Verifiers

The agricultural partners associated with this survey are invested and willing to partake in the survey on an annual basis. These associated parties include the Conservation Districts, University of Delaware Cooperative Extension, NRCS, FSA, and Delaware Dept. of Agriculture. Two teams are utilized to verify the presence/absence of residue and make observations – the Observation Team and Quality Assurance Team.

The observation team consists of two observers, a driver, navigator, and recorder. Everyone conducting the survey is trained prior to making observations and as needed for recalibration. This survey targets data collection shortly after producers have planted their main crops in the spring, but before canopy closure on these fields has been reached. This allows for "windshield observations" from the survey vehicles. An initial driving transect is conducted by the observation team and followed by the QA/QC team. The QA/QC teams are able to retrace the original driving route for verification purposes almost immediately after initial observations are made, in most cases approximately two days later. This ensures that the conditions observed by the QA/QC team are as close as possible to those conditions viewed by the initial observation team. The observation teams conduct a second survey run mid-summer to observe double-cropping systems, in order to capture crops planted after the early spring crop. A third pilot survey is conducted in early winter in order to capture winter-planted cover crops.

The data collectors and verifiers have worked closely throughout the development of the data collection application and have been properly trained. Training for the data collection and verification was part of the initial training held in conjunction with University of Maryland's Chesapeake Bay Representative Mark Dubin to practice residue estimation techniques, calibration of the observer's eye for estimation, as well as data entry and examination. For subsequent survey years, trainings will be held prior to the actual survey to introduce new survey members and serve as a refresher for past members.

Documentation of Verification

The written guidance and documentation on the data collection and verification systems is found in Delaware's "Procedures for Cropland Roadside Transect Survey for Obtaining Tillage/Crop Residue Data" (Appendix J), which was approved by the Chesapeake Bay Program Workgroup in December 2014.

Data are uploaded real-time into an iOS supported device utilizing Esri's ArcCollector software. This allows for a more streamlined and reliable collection process, utilizing a tablet device rather than previous methods of paper data sheets. The driving route is preloaded onto the application for each county and by using the GPS feature; the team can track their driving progress throughout the day and follow the predetermined path. As the team arrives at their observation locations, a list of selectable fields appear for the data recorder to enter exactly what the observer notates. Data is automatically backed up through a cellular network to minimize chance of data loss. The addition of GPS technology ensures that the teams can return to the exact observation point, whether that is for QA/QC verification or for subsequent survey years. Keeping the data in this digitized form also allows for the randomized selection of the 10% QA/QC checks. Data are maintained on private servers within Delaware's Department of Technology and Information. Information collected within the ArcCollector software is tied to a locked and secure ESRI account.

End of contract/project lifespan

Tillage and Cover Crop BMPs are annual practices and thus have a lifespan of one year. Therefore reported practices are implemented and credited for that submission period only.

2.1.5.3 Data Validation

Quality Assurance

All (100%) tillage and cover crop practices are surveyed annually by the observation team as described above. Additionally, a 10% sub-sample is made by the Quality Assurance and Quality Control Team also described above. Data entry has proven to be a very simple and streamlined process. Predetermined locations have been identified and are able to be selected from a drop-down menu within the ArcCollector software to minimize the chance of errors. There have been no issues associated with the complicatedness of data entry. Updates to the system are easily completed within the Esri Arc Suite of tools.

Upon survey completion, data is downloaded by a GIS Specialist housed within the Nonpoint Source Program of DNREC. Raw data are reviewed and categorized based on Chesapeake Bay Program definitions for conservation tillage and high residue minimum soil disturbance. Data are summarized and entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model.

Acres of cover crops based on the CTIC survey are reported utilizing the methodology that was approved by the Agricultural Workgroup at the September 2015 meeting. The cover crop observation percentages that were made during the survey are categorized by species, planting time, and planting method based on the NEIEN appendix for approved cover crop BMPs. The observation percentages for each of the cover crop categories are then applied the 2012 NASS county-wide harvested cropland acreages, yielding estimated acreages for traditional cover crops based on the survey. The acreages for each cover crop category reported by the county conservation districts are then subtracted from the matching cover crop category calculated from the CTIC-based survey. The acres left are submitted through NEIEN at the county-wide level, where model simulation calculates acreages within the watershed. NRCS acres of cover crops are not reported in order to prevent double counting of cover crops.

To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year.

Data Entry

Conservation tillage is not reported by any other agency. Therefore, double counting is not an issue. Conservation tillage practices were previously reported by CTIC for historical data submissions; however, data from CTIC are no longer used. Data collected from this survey serves as a replacement for the CTIC dataset. At the conclusion of the survey, the percentage of observations for each residue BMP type (High Residue Tillage and Conservation Tillage including High Residue Tillage) are reported county wide to NEIEN. These percentages are then simulated by the model for acreage calculation. The cover crop acreages are compared to the

cover crop submissions by NRCS and FSA for accuracy. These acres submitted from the survey replace the acres that have historically been submitted by NRCS and FSA to prevent double-counting.

Data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. The agriculture Excel template is provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. The code in the DE NPS BMP Database has been modified so that the lifespan/credit duration is added to the implementation date of a particular BMP to calculate the Lifespan End Date. The BMP will be tagged as "retired once the Lifespan End Date has passed.

External Data

Historic data was submitted to the CBPO by CTIC. Since 2014, all data for tillage practices are provided by DNREC NPS. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were provided by CTIC. Data quality assurance and data entry were conducted the same way as in the past (as discussed in the above sections).

BMP Performance

Tillage and cover crop practices are annual practices. Performance is only noted during the transect survey. All tillage and cover crop data are entered annually and will supersede any previous records.

2.1.6 Animal Waste Management Systems and Mortality Composting

Visual Assessment – Multi-Year: Animal Waste Management Systems and Mortality Composting

These two (2) BMPs – Animal Waste Management Systems and Mortality Composting were grouped together because they follow similar verification and validation protocols. Table B10.3.1 in Section B.10 of this QAPP provides definitions for each of these BMP types. Details regarding verification and validation procedures for these two practices are contained in Table D2-1 and summarized in the following sections.

2.1.6.1 Table - Animal Waste Management Systems and Mortality Composting

Table B-3. Delaware Agriculture Protocol Design Table: Visual Assessment BMPs – Multi Year											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment Multi-Year: Cost Shared	Animal Waste Management Systems	Field Visit/Visual Inspection	All Cost-Shared Animal Waste Management Systems	Trained NRCS and Conservation District Staff	Inspection forms and Database	1-3 Years Following Implementation	All Cost-Shared Animal Waste Management Systems	Contact Landowner if out of compliance; Possible removal from program	10 Years in Kent County, 15 Years in Sussex County	Maintain database for current and expired structures
High	Visual Assessment Multi-Year: Permit and Regulation	Animal Waste Management Systems	Field Visit/Visual Inspection	All Permitted Structures Under CAFO at Application	Trained DDA Staff	Inspection Report	3-5+ Years Following Implementation	All Permitted Structures Under CAFO	Contact Landowner if out of Compliance	5 Years (Duration of CAFO Permit)	Maintain Database for CAFO Permits and Inspections
Low	Visual Assessment Multi-Year: Cost Shared	Mortality Composting	Field Visit/Visual Inspection	All Cost-Shared Mortality Composters	Trained NRCS and Conservation District Staff	NRCS Standard	1-3 Years Following Implementation	All Cost-Shared Mortality Composters	Contact Landowner if out of Compliance	15 Years	Toolkit
Low	Visual Assessment Multi-Year: Permit and Regulation	Mortality Composting	Field Visit/Visual Inspection	All Permitted Structures Under CAFO at Application	Trained DDA Staff	Inspection Report	3-5+ Years Following Implementation	Percentage, Subsample, Targeted	Contact Landowner if out of Compliance	5 Years (Duration of CAFO Permit)	Maintain Database for CAFO Permits and Inspections

2.1.6.2 Data Verification

Method

The BMPs featured in this section meet NRCS standards, state standards, and Chesapeake Bay Program definitions. Practices that will be captured through this evaluation include: livestock waste management systems, animal waste management systems, and poultry waste management systems, and mortality composters. This section does not include resource improvement practices. One hundred percent of all practices are inspected at initial implementation. Follow-up inspections (10%) will be randomly chosen, while ensuring no successive duplication, by the Quality Assurance Officer from practices entered into the NPS BMP database. Additionally, inspections may be conducted by the implementing agency for contract requirements; those inspections will be reported to the Quality Assurance Officer. All practices (100%) will be inspected prior to end of lifespan.

One hundred percent (100%) of all animal waste management and mortality composting facilities are inspected during the lifespan of the contract or permit. BMPs are collected by multiple agencies - USDA, NRCS, Conservation Districts, and DDA. The BMPs meet NRCS, State, and Chesapeake Bay Program definitions for agricultural practices. All are inspected by visual on-site inspection during the time of BMP implementation as required by NRCS contracts and DNREC/DDA permits. Funding for these BMPs are provided by USDA programs or state cost share funding. Additional funding is available through CWA Section 319 Grant and Chesapeake Bay Implementation (Section 117) Grants funds.

Structural BMPs are inspected by a Conservation Planner. The goal is to inspect all structural BMPs every year. The BMP inspection form is used to collected BMP related information during the inspection including: date of inspection; tract number; owner name; farm name; watershed name; whether or not the farmer was contacted; BMP implementation date; whether the BMP is being used; contents of BMP (if applicable); compliance status; and cost-share program (funding source).

Data collection includes implementation date, project type, animal type and project size. Projects submitted by NRCS are reported at the county level. An outline of practice data submissions can be found in section B10 of Delaware's QAPP. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was reached to have federal agencies, such as the USDA's NRCS, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf. All other submitted practices are reported at the site-level, with corresponding latitude-longitude coordinates. All BMPs currently reported are approved by CBP for inclusion in model application.

Verifiers

All practices (100%) are inspected by visual on-site inspection after implementation and once during the lifespan of the BMP or as required by the cost sharing agency. BMP data are collected for several years by the aforementioned agencies to determine if BMPs are functioning properly. Verification efforts occur year round and NRCS verification timing will be at the organization's discretion. BMP inspectors are trained NRCS, District or DDA agency employees. Training is

ongoing as all new personnel are trained in the collection of BMP data; however, there is no "certification requirement" for staff collecting BMP data. If any of the data collectors have questions regarding functionality, contact is usually made with USDA NRCS.

Documentation of Verification
BMPs are inspected and entered into databases by trained NRCS, District planners or DDA staff. Each Agency has separate verification documentation:

- NRCS Toolkit – NRCS cost shared practices
- DDA– animal waste management systems and composting facilities are captured in hard copy forms housed at DDA in NMP or CAFO files. Additional QA is performed DDA staff during NMP inspections. During that time, DDA staff inspect for compliance of their enforceable regulations.
- Conservation Districts – New Castle, Kent, and Sussex document the existence of practices during conservation plan and nutrient management plan development. Each district uses excel spreadsheets to record BMPs. Sussex completes inspection forms and inputs the data into their own Compliance Database.

Data regarding the parcel location of each BMP, visual functionality, and whether or not the practice is meeting standards and specifications are recorded in written files as well as respective databases.

End of contract/project lifespan
DDA will continue on-farm assessments through the nutrient management program and will review waste and composting system functionality. Additionally, the conservation districts will continue to work with farmers to include animal waste and composting facilities in their on-farm inspections. This data will be submitted, as requested, to the DNREC Quality Assurance Officer for inclusion in Delaware's reporting and tracking database.

2.1.6.3 Data Validation

Quality Assurance
All (100%) facilities are inspected within the contract/permit lifespan by various agencies. Additionally, checks are made upon implementation and before contract end dates by the funding agency; hence, BMPs are verified for functionality. Inspection records (pass/fail) will be provided to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. The DNREC-DWS-NPS Program staff enter all practices and are the only ones permitted to review and edit data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into the respective cost sharing entity's database by trained staff. Data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

BMPs are aggregated by the funding agency at the County level. DDA and Conservation District is summarized and NRCS data are subtracted by animal type for each BMP type. Any remaining units are added to the current year's progress submission. These data are entered with the current year's implementation date and re-set with new lifespan. Double counting is avoided because NRCS provides the active contracted BMPs and the Districts and DDA submit all on-the-ground BMPs.

External Data

Data are provided from external government agencies as mentioned above. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were verified for this practice - see NEIEN Methodology for Historical Data Clean Up (Appendix H). Data quality assurance and data entry were conducted as discussed in the above sections.

BMP Performance

During visual field assessments, the BMPs are inspected for compliance or failure by the inspecting agency. If a BMP is not performing up to its standards and specifications, a maintenance inspection report or letter is provided to the landowner. Agency staff work with landowners to bring the BMP back into compliance or the landowner must pay back the funds used to implement the BMP. A BMP is retired from the system if it is not brought into compliance.

2.1.7 Grass Buffers, Land Retirement, and Water Control Structures.

Visual Assessment – Multi-Year: Grass Buffers, Land Retirement, and Water Control Structures.

These three (3) BMPs –Grass Buffers, Land Retirement, and Water Control Structures were grouped together because they all follow similar verification and validation protocols. Table B10.3.1 in Section B.10 of this QAPP provides definitions for each of these BMP types. Details regarding verification and validation procedures for these three practices are contained in Table D2-1 and summarized in the following sections.

2.1.7.1 Table - Grass Buffers, Land Retirement, and Water Control Structures

Table B-3. Delaware Agriculture Protocol Design Table: Visual Assessment BMPs – Multi Year

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low	Visual Assessment Multi-Year: Cost Shared	Water Control Structures	Field Visit/Aerial/Visual Inspection	All Cost-Shared Water Control Structures	Trained NRCS and Conservation District Staff	NRCS Standard, DNREC Restoration Database	1-5+ Years Following Implementation	All Cost Shared Water Control Structures	Contact Landowner if out of Compliance	5 years	Districts Maintain Spreadsheets; DE NPS BMP Database
Moderate	Visual Assessment: Annual	Grass Buffers	Visual Assessment	Annual	Trained District Conservation Planners	Kent Conservation District or DNREC DFW BMP Compliance Inspection Forms	Multi-Year	100%	Verbal Warning, letter of compliance, return of cost share funds	10 years	100% Tracked within District BMP database; DNREC Restoration Database; DE NPS BMP Database
Low	Visual Assessment	Land Retirement	Visual and Aerial Inspection	Annually – FSA 3-5 years - DNREC	Trained DNREC Staff	GIS shapefiles, DNREC Restoration Database	Targeted	100% every 5 years	Verbal Warning, letter of compliance, return of cost share funds	3 years	100% Tracked within Kent Conservation District BMP database; DNREC Restoration Database; DE NPS BMP Database

2.1.7.2 Data Verification

Method

The BMPs featured in this section meet NRCS standards, state standards, and Chesapeake Bay Program definitions. Practices that will be captured through this evaluation include: Water Control Structures, Grass Buffers, and Land Retirement. One hundred percent of all practices are inspected at initial implementation. Follow-up inspections (10%) will be randomly chosen, while ensuring no successive duplication by the Quality Assurance Officer from practices entered into the NPS BMP database. Additionally, inspections may be conducted by the implementing agency for contract requirements; those inspections will be reported to the Quality Assurance Officer. All practices (100%) will be inspected prior to end of lifespan.

One hundred percent (100%) of all the grouped BMPs are inspected during the lifespan of the practice. BMPs are collected by multiple agencies - USDA, NRCS, Conservation Districts, and DNREC. The BMPs meet NRCS, State, or Chesapeake Bay Program definitions for agricultural practices. All are inspected by visual on-site inspection during the time of BMP implementation, as required by NRCS contracts. Additionally, DNREC inspects and reports practices funded through the agency. Funding for these BMPs are provided by USDA programs or state cost share funding. Additional funding is available through CWA Section 319 Grant and Chesapeake Bay Implementation (Section 117) Grants funds.

Structural BMPs, like water control structures, are inspected by a DNREC or Conservation Planners. The BMP inspection form is used to collected BMP related information during the inspection including: date of inspection; tract number; owner name; farm name; watershed name; BMP implementation date; compliance status; and cost-share program (funding source). An outline of practice data submissions can be found in section B10 of Delaware's QAPP. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was reached to have federal agencies, such as the USDA's NRCS, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf. All other submitted practices are reported at the site-level, with corresponding latitude-longitude coordinates. All BMPs currently reported are approved by CBP for inclusion in model application.

Verifiers

All practices are inspected by visual on-site inspection during the lifespan of the BMP as required by the cost sharing agency. BMP data are collected for several years by the aforementioned agencies to determine if BMPs are functioning properly. Verification efforts occur year round and NRCS verification timing will be at the organization's discretion. BMP inspectors are trained NRCS, District or DNREC agency employees. Training is ongoing as all new personnel are trained in the collection of BMP data; however, there is no "certification requirement" for staff collecting BMP data. If any of the data collectors have questions regarding functionality, contact is usually made with USDA NRCS.

Documentation of Verification

BMPs are inspected and entered into databases by trained NRCS, District planners or DDA staff. Each Agency has separate verification documentation:

- NRCS Toolkit – NRCS cost shared practices
- DNREC – land retirement, water control structure, and grass buffer practices are entered into the Restoration Database. Additional QA is performed by DNREC staff. During that time, DNREC staff inspect for functionality.
- Conservation Districts – New Castle, Kent, and Sussex document the existence of practices during conservation plan and nutrient management plan development. The written guidance and documentation on the data collection and verification systems is found in the District Cost Share Compliance documents individually drafted by each of the three Districts.

Data regarding the parcel location of each BMP, visual functionality, and whether or not the practice is meeting standards and specifications are recorded in written files as well as respective databases by the funding agency.

End of contract/project lifespan

Once the practice contract expires with NRCS, the District will report and inspect. DNREC reports their own practices and therefore are never double counted with NRCS practices. The implementing agency will submit updated data to the DNREC Quality Assurance Officer for inclusion in Delaware's reporting and tracking database.

2.1.7.3 Data Validation

Quality Assurance

All (100%) facilities are inspected within the practice lifespan by various agencies. Additionally, checks are made upon implementation and before contract end dates by the funding agency; hence, BMPs are verified for functionality. Inspection records (pass/fail) will be provided to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only permitted to review their own data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into the respective cost sharing entity's database by trained staff. Data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

External Data

Data are provided from external government agencies as mentioned above. Double counting is avoided since BMPs are reported by the funding agency. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were verified for this practice - see NEIEN Methodology for Historical Data Clean Up (Appendix H). DNREC conducted an extensive historical clean-up for water control structures see Appendix C. Data quality assurance and data entry were conducted as discussed in the above sections.

BMP Performance

During visual field assessments, the BMPs are inspected for compliance or failure by the inspecting agency. If a BMP is not performing up to its standards and specifications, a maintenance inspection report or letter is provided to the landowner. Agency staff work with landowners to bring the BMP back into compliance or the landowner must pay back the funds used to implement the BMP. A BMP is retired from the system if it is not brought into compliance.

2.1.8 Low Priority BMPs

Section D1 of the QAPP discusses that verification protocols for additional BMPs with lower anticipated contributions to the overall load reductions will be developed but at a slower pace, given the reduced reliance on these practices to Delaware's reduction strategy. All of the lower priority agricultural BMPs are either (1) accounted for in NRCS inspections at 5% per year; (2) have numeric milestones established but have not been reported; or (3) are not approved BMPs.

The low priority BMPs that are accounted for in NRCS inspections at 5% per year, but not specifically listed in the Verification Program include:

- Pasture alternative watering
- Prescribed grazing
- Precision intensive rotational grazing
- Stream access control with fencing
- Barnyard runoff control
- Loafing lot management

Carbon sequestration has numeric milestones, but is currently not reported. Cropland irrigation management and heavy use area pads are not approved BMPs, therefore, they are not included in the Verification program. If the aforementioned BMPs become high priority BMPs in the future, Delaware will develop a timeframe for verification. Delaware will develop a verification program for cropland irrigation management (currently using methodology listed in Appendix B) and heavy use area pads, once approved by CBP.

Forestry Sector Verification Protocol

D2.2 Forestry

This section of the verification protocol represents the BMP groupings for Forestry Source Sector. Table F-2 in Appendix F provides a sector-specific checklist of Delaware BMP verification protocol components and maps them to the relevant QAPP sections where they are documented.

D.2.2.1 Forest Buffers, Tree Planting, and Urban Tree Planting

These three BMPs – forest buffers, tree planting, and urban tree planting - were grouped together because they all follow the same verification and validation protocol. Table B10.3.1 in Section B.10 of this QAPP provides definitions for each of these BMP types. Details regarding verification and validation procedures for these three practices are contained in Table 2.2.1.1 and summarized in the following sections.

2.2.1.1 Table - Forest Buffers, Tree Planting, and Urban Tree Planting

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment: Multi-Year	Cost-Shared Agricultural Forest Buffers	Visual Inspection	100% post installation	NRCS staff	Inspection form and signed contract	Visual assessment – FSA	5% annually or 100% by end of contract lifespan	Bring back into compliance or loss of money – must pay back funds.	Contract Lifespan 15 yrs	Toolkit, 319 Program Database; if fail inspection documented and filed at FSA. If reenrolled information is updated in NPS BMP database.
High	Visual Assessment	CREP RFB	Field Inspection	100% post installation (1 year after)	Delaware CREP Coordinator (Partnership between USDA FSA and DNREC 319 Program)	319 Program Data Tracking	Mid - Contract	100% Initial by DDA, 100% post installation, 100% Mid-Contract, 100% sampled by end of contract	Compliance Letter	10-15 yrs.	100% Tracked by FSA and 319 Program database
High	Visual Assessment: Multi-Year	Cost-Shared Agricultural Tree Planting – NRCS EQIP	Visual Inspection	100% post installation	NRCS staff	Inspection form and signed contract	Follow-up inspection conducted via aerial imagery thru CBPO. No inspection required due to Land Use change.	GIS analysis; 100%	Bring back into compliance or loss of money – must pay back funds.	10 yrs – Land Use change in Model	Toolkit. If reenrolled information is updated in NPS BMP database.

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment: Multi-Year	Cost-Shared Agricultural Tree Planting – Delaware Forest Service (DFS)	Visual Inspection	100% during installation and post installation (1 year after)	DDA foresters	Forestry database entered using cost share forms (DDA funding)	Survival Checks conducted one year after implementa-tion	100%	Work with landowners to bring into compliance	10 yrs – Land Use change in model	DDA Forestry Database – files sent to NPS BMP database.
High	Visual Assessment Multi year	Cost Share Ag Tree Planting – DFW	Visual Inspection	100% during instllation and post installation (1 year after)	DFW biologists	Spreadsheet form – LIP inspections	Annual Inspection for each project in contract	100% Initial; 100% Mid-Contract; 100% by end of contract lifespan	Work with landowner to resolve	10 yrs	LIP database to NPS BMP database.
High	Visual Assessment Multi year	Ag Tree Planting – public lands	Visual Inspection	100% during installation and post installation	DFW biologists	DFW database	Survival Checks conducted one year after implementa-tion	100%	Work to establish per planting specificatio n	10 yrs – Land Use change in model	DFW Database – files sent to NPS BMP database.

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low	Visual Assessment Multi year	Cost Share Urban Tree Planting	Visual Inspection – reported by # trees	100%	DDA urban foresters	Urban database	Visual Inspection for each project before payout	100% within 3 years	Work with contract (local govt) to resolve	10 yrs	Urban Database

2.2.1.2 Data Verification

Method

One hundred percent of all forest buffers, tree planting and urban tree plantings are inspected during the lifespan of the contract (ag tree planting and buffers) or project (urban). BMPs are collected by multiple agencies:

- Ag forest buffers – USDA standard - implemented by USDA and DNREC
- Ag tree planting – USDA standard – implemented by USDA, DNREC and DDA
- Urban tree planting – CBP definition – 300 trees/acre – implemented by DDA

The listed BMPs meet NRCS, State, and Chesapeake Bay Program definitions for forestry practices. All are inspected by visual on-site inspection during the time of BMP implementation as required by NRCS and CREP contracts, and DNREC/DDA projects. Funding for these BMPs are provided by USDA programs or state cost share funding. Additional funding is available through CWA Section 319 Grant, US Forest Service, and Chesapeake Bay Implementation (Section 117) Grants funds.

In Delaware, DDA DFS installs most large scale buffer and tree planting projects. DFS inspects 100% of plantings post installation (following the Forestry Workgroup's verification guidance of inspection at implementation). Approximately 1 year after planting, DFS inspects the projects again (100%) (following the Forestry Workgroup's inspection recommendation for 1-4 years). One hundred percent of the buffer and tree planting projects are spot checked on average every 7.5 years by the cost sharing agency (NRCS, DFW, DFS, etc) (following the Forestry Workgroup's inspection recommendation of 5-10 years). During this time, projects are assessed for water quality impacts. NRCS verification timing will be at the organization's discretion. A final inspection is completed at contract or lifespan expiration (approximately 10-15 years) (following the Forestry Workgroup's inspection recommendation of 5-10 years). Once project lifespan or contract expires, Delaware will use high resolution imagery and Light Detection and Ranging (LiDAR) data to determine the existence of riparian forest buffer and tree planting practices.

Data collection includes implementation date, project type, and project size. Projects submitted by NRCS are reported at the county level. An outline of practice data submissions can be found in section B10 of Delaware's QAPP. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was reached to have federal agencies, such as the USDA's NRCS and FSA, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf. All other submitted practices are reported at the site-level, with corresponding latitude-longitude coordinates. All BMPs currently reported are approved by CBP for inclusion in model application.

Verifiers

All practices are inspected by visual on-site inspection during the lifespan of the BMP as required by the cost sharing agency. BMP data are collected for several years by the aforementioned agencies to determine if BMPs are functioning properly. The time and frequency

of sampling has a large influence on quality of information gained. While forestry practices are present year-round, most of the verification will occur during the growing season.

BMP inspectors are trained NRCS, DDA, or DNREC agency employees. Training is ongoing as all new personnel are trained in the collection of BMP data; however, there is no "certification requirement" for staff collecting BMP data. If any of the data collectors have questions regarding functionality, contact is usually made with USDA NRCS.

DFS Urban foresters have made great strides to capture urban forestry grant funded tree planting projects and verify historical practices. For urban tree planting, DFS urban foresters have reviewed historical grant files and visited tree projects and evaluated the location of trees. For each tree planting project, site observations are made and geolocated – presence and absence of trees are noted.

Documentation of Verification

BMPs are inspected and entered into databases by trained NRCS, DFS Foresters, or DNREC Scientists or Biologists. Each Agency has separate databases for their reportable BMPs:

- DDA DFS Planting Database – agricultural tree planting data implemented by DDA DFS is geolocated and stored in GIS shapefiles. DFS foresters are responsible for entering their own planting data. Additional QA is performed by a senior forester and GIS manager on data entries. Planting projects performed on State Forest owned lands are also entered into the Planting database.
- DDA DFS Urban Database – urban tree planting data implemented by DDA DFS urban foresters are geolocated and stored in an Urban Database. The Urban forestry coordinator enters and stores information in the database provided by the urban foresters.
- DNREC Landowner Incentive Program (LIP) Database – DNREC DFW biologists maintain spreadsheets for those landowners enrolled in LIP. The LIP manager maintains the database and submits data for CB progress.
- USDA Toolkit – NRCS cost shared practices
- 319 USDA FSA CREP Program – riparian forest buffer data are maintained on private servers within DNREC in excel and GIS databases at the Delaware 319 NPS Program Office. The CREP coordinator maintains data and submits for CB progress.

Data regarding the location of each BMP, visual functionality, and whether or not the practice is meeting standards and specifications are recorded in written files as well as the respective databases. Due to the large number of contracts held by cost sharing agencies like USDA NRCS and FSA, Delaware is confident that 90% of all riparian forest buffers are avoiding water quality impacts because landowners comply with contract requirements to receive monetary payment.

End of contract/project lifespan

All CREP contracts will be fulfilled to contract end date; federal funding is secure and payments will continue through the active period of the contract up until re-enrollment. After contract end date, if State funding is secured, contracts will be re-enrolled for another term; however, if State funding is

not secure, the acreage will not be re-enrolled. The CREP Coordinator will inspect riparian forested buffers if the landowners' will continue to allow the BMP to function. If contracts are renewed or inspected without incentive payments, the DNREC CREP coordinator will submit updated data to the DNREC Quality Assurance Officer for inclusion in Delaware's reporting and tracking database.

All other forestry BMPs will be reviewed after contract end date. All implementers will work together to inspect tree planting projects after contract end date.

In order to prioritize forestry needs, it is essential to have a good understanding of the current resource. Once project lifespan or contract expires, Delaware will use high resolution imagery and Light Detection and Ranging (LiDAR) data to determine the existence of riparian forest buffer and tree planting practices. The Delaware Forest Service has quantified the spatial extent of forests and urban tree canopy coverage in the State. Periodically, DNREC and DFS will use these original datasets developed by DFS to determine if a net gain occurs over time and practices exist upon expiration.Additionally, the U&CF with DNREC will utilize Davey i-Tree software to set tree canopy goals and facilitate proper urban forest management strategies. Furthermore, the CBP Forestry Workgroup will release new High Resolution Land Cover dataset for the Phase 6 Watershed Model. This imagery will allow jurisdictions to further enhance verification programs.

2.2.1.3 Data Validation

Quality Assurance

All (100%) forestry practices are inspected within the contract/project lifespans. Additionally, checks are made upon implementation and before contract end dates – hence, BMPs are verified for functionality. Inspection records (pass/fail) will be provided to DNREC's Nonpoint Source Program (NPS) for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only be permitted to review their own data.

The data are entered into the agriculture Excel template (Appendix I) for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year. See QAPP Section B10.3 for specific urban BMP submittal methodology.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into the respective cost sharing entity's database by trained staff. Forestry data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. The code in the DE NPS BMP Database has been modified so that the lifespan/credit duration is added to the implementation date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has been passed, that BMP will be tagged as "retired" unless that BMP been inspected or maintenance has been performed. If an inspection or maintenance has occurred and the BMP is functioning properly, the BMP is credited with a new lifespan.

Double counting is unlikely to occur for these forestry practices because they are being tracked by the funding agency.

Training for entering data into DE NPS BMP Database has been provided by webinar in the past (2013) and an additional face to face training will occur at DNREC in 2016. Tetra Tech will conduct the training to review use of the database and any updates to the database since the original training. The NPS BMP Database also contains a link to the user's manual. There will be no "certification" required to enter data. However, the person entering data will receive some training on how to use the database and enter data properly. DNREC will likely have an O&M contract with Tetra Tech to address any issues with the NPS BMP Database in the future and to provide any additional training if necessary (e.g., if there have been significant updates).

As of 2019, the previous DE NPS BMP Database that was created by Tetra Tech developed terminal errors and no longer functioned as designed. The contractor no longer supported the maintenance of the DE NPS BMP Database, and therefore, Delaware's NPS Program had to explore alternative options for managing and submitting Delaware's BMP data. DNREC-DWS-NPS Program contracted with KCI Technologies to develop a BMP Tracking Tool and Database Application to be completed before December 1, 2019.

External Data

Data are provided from external government agencies as mentioned above. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were provided by some of the cost sharing agencies. Data quality assurance and data entry were conducted the same way as in the past (as discussed in the above sections). For additional information on historic data collection, please see Appendix H.

BMP Performance

During the visual field assessment, the BMPs are inspected for compliance or failure by implementing agency. If a BMP is not performing up to its standards and specifications, a maintenance inspection report or letter is provided to the landowner. Agency staff work with

landowners to bring the BMP back into compliance or the landowner must pay back the funds used to implement the BMP.

2.2.2 Forest Harvesting Practices

Through the Erosion and Sediment Program, the Delaware Forest Service ensures forest management activities follow Best Management Practices (BMPs), and thus comply with the Forest Harvesting Practices via the Forest Practices Erosion and Sedimentation Law (Title 3, Chapter 10, Subchapter VI). Loggers or operators submit a permit prior to commencing forest management activities, and DFS staff reviews the site during the operation. Forest harvesting practices are temporary, while the other BMPs have a much longer lifespan. Details regarding verification and validation procedures for erosion and sediment control practices are contained in Table 2.2.2.1 and summarized in the following sections.

2.2.2.1 Table – Forest Harvesting Practices

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low – CB WIP High - Forestry	Visual Assessment Regulatory	Forest Harvesting Practices	Visual Inspection	100% inspected initially; upon receipt of E&S Permit from landowner/ logger	DDA FS Staff	Timber Harvest Inspection Reports	Possibly multiple times during the permit cycle. At least 1 inspection- done after job is completed.	100%	Work with loggers to address concerns – verbal warnings & remediation plan. If Severe – have regulatory action (fines).	3 yrs.	Database – GIS polygons provided at parcel level to NPS BMP db.

2.2.2.2 Data Verification

Method

Forest harvesting practices are regulatory and 100% of all practices are inspected during the duration of an Erosion and Sediment Control permit. The forest harvesting practices comply with the Forest Practices Erosion and Sedimentation Law (Title 3, Chapter 10, Subchapter VI). All BMPs are inspected by visual on-site inspection during the time of permit application, during silviculture operations. Operators provide written notification to DFS at least five (5) business days prior to initiation of covered silviculture operations greater than one acre.

Site operators are responsible for following BMPs as indicated on the Erosion and Sediment Law Notification Form and Permit until a forester has made a final inspection of the site and issued a final inspection report. Forest Harvesting BMPs are collected by the Delaware Forest Service. All practices are reported at the site-level, with implementation date (date of permit), and corresponding latitude-longitude coordinates. All BMPs currently reported are approved by CBP for inclusion in model application.

Verifiers

DFS Foresters visit silviculture operation tracts, perform BMP inspections, and record total acreage of forest harvesting BMPs. During the course of the inspection, a forester will determine the status of the effectiveness of BMPs in protecting water quality and record this determination on the inspection forms. If a potential water quality problem exists, as defined by the law, the forester will document the problem on the BMP inspection forms.

Documentation of Verification

BMPs are inspected by a DFS forester and documented on the BMP inspection form. Water Quality (WQ) classifications are used to determine severity of problems:

1. No WQ problem
2. Potential WQ problem – a typical problem that would cause excessive sedimentation and erosion during a normal rainfall.
3. Severe WQ problem – any silvicultural activity which is causing sediment deposition or will immediately create serious sediment deposition in a rainfall event.

If no WQ problem exists, the landowner and operator are notified on site, if possible, and in writing within five (5) business days following the inspection. However, if a potential WQ problem exists on an initial field visit, the Forester will note the problem on the BMP inspection form, including written directions to alleviate the potential problem, to the operator and landowner, and a time limitation of up to five (5) business days to correct the problem. The Forester will notify his/her immediate supervisor of the existence of a potential WQ problem. When the time limitation specified in the recommendation for a potential WQ problem has elapsed, the Forester will return for a second visit. If the problem persists with no extenuating circumstances such as bad weather, all operations will be halted until specified corrective actions have been made to the satisfaction of the Forester.

If a severe WQ problem exists, such as skidding logs across a stream or ditch with no bridge, the Forester will cause all operations to cease immediately, issue a written warning containing

instructions how to immediately correct the problem. If WQ problems are not resolved, the Department will take actions on the operator including no further issuance of permits or a fine.

Forest harvesting practices are entered into the DFS GIS database by DFS Foresters. Data regarding the location of each BMP, visual functionality, and whether or not the practice is meeting standards and specifications are recorded in written files.

End of contract/project lifespan
Harvest permits are annual practices and thus have a lifespan of one year.

2.2.2.3 Data Validation

Quality Assurance
All (100%) forestry practices are inspected within the contract/project lifespans. Additional, checks are made upon implementation and before contract end dates – hence, BMPs are verified for functionality. Inspection records (pass/fail) will be provided to DNREC-DWS-NPS for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only be permitted to review their own data.

The data are entered into the agriculture Excel template for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year. See QAPP Section B10.3 for specific urban BMP submittal methodology.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry
Data are collected and entered into the respective cost sharing entity's database by trained staff. Forestry data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. The code in the DE NPS BMP Database has been modified so that the lifespan/credit duration is added to the implementation

date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has been passed, that BMP will be tagged as "retired" unless that BMP been inspected or maintenance has been performed. If an inspection or maintenance has occurred and the BMP is functioning properly, the BMP is credited with a new lifespan.

Double counting is unlikely to occur for these forestry practices because they are being provided by one agency (DDA) and there are no cost-share practices.

Training for entering data into DE NPS BMP Database has been provided by webinar in the past (2013) and an additional face to face training will occur at DNREC in late 2015. Tetra Tech will conduct the training to review use of the database and any updates to the database since the original training. The NPS BMP Database also contains a link to the user's manual. There will be no "certification" required to enter data. However, the person entering data will receive some training on how to use the database and enter data properly. DNREC will likely have an O&M contract with Tetra Tech to address any issues with the NPS BMP Database in the future and to provide any additional training if necessary (e.g., if there have been significant updates).

As of 2019, the previous DE NPS BMP Database that was created by Tetra Tech developed terminal errors and no longer functioned as designed. The contractor no longer supported the maintenance of the DE NPS BMP Database, and therefore, Delaware's NPS Program had to explore alternative options for managing and submitting Delaware's BMP data. DNREC-DWS-NPS Program contracted with KCI Technologies to develop a BMP Tracking Tool and Database Application to be completed before December 1, 2019.

External Data

Data are provided from external government agencies as mentioned above. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were previously captured by a joint project with DFS and NPS – see Appendix D. Data quality assurance and data entry were conducted as discussed in the above sections. For additional information on historic data collection, please see Appendix H.

BMP Performance

During the visual field assessment, the BMPs are inspected for compliance or failure by implementing agency. If a BMP is not performing up to its standards and specifications, a maintenance inspection report or letter is provided to the landowner. Agency staff work with landowners to bring the BMP back into compliance or the landowner must pay back the funds used to implement the BMP.

Restoration Sector Verification Protocol

D2.3 Restoration

This section of the verification protocol represents the BMP groupings for stream and wetland restoration. Table F-3 in Appendix F provides a restoration-specific checklist of Delaware BMP verification protocol components and maps them to the relevant QAPP sections where they are documented.

2.3.1 Stream Restoration

This part of the verification protocol incorporates all stream restorations that are implemented and accounted for within Delaware's WIP, including non-urban stream restoration and urban stream restoration. Table B10.1.1 in Section B.10 of this QAPP provides definitions for each of these BMP types. Details regarding verification and validation procedures for these practices are contained in Table D2.3.1.1 and summarized in the following sections.

2.3.1.1 Table – Stream Restoration

Stream Restoration Protocol Design Table: Visual Assessment BMPs – Multi-Year

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment: Multi-Year	Cost-Shared Stream Restorations	Visual Assessment: On-site	100% of All Tracked and Reported Stream Restorations	Non-regulator Agency	Projects plans and specifications sealed by Delaware Professional Engineer	Inspect every year for first 3 years, once every 5 years after established and/or after major storm events	10% a year	Structures to be fixed if funding available. If cannot be achieved remove from database	10 years	10% compliance checks

2.3.1.2 Data Verification

Method

The Stream Restoration Verification Protocol incorporates all stream restorations that are implemented and accounted for in Delaware's Chesapeake Bay Watershed Implementation Plan (WIP). All stream restorations (100%) will be inspected every year for first three years of the project establishment. Following the first three years, projects will be inspected at least once every five years as well as after heavy storm events, which are defined as a 10 year storm recurrence interval. This will entail verifying at least 10 percent of reported practices every year.

The reported BMPs (non-urban stream restoration and urban stream restoration) meet NRCS, State, and Chesapeake Bay Program (CBP) definitions for stream restorations practices and have been approved by the CBP. Resource improvement practices are not reported. Reported BMPs, whether by NRCS or the state of Delaware, all have an implementation date, project type, and project size. Projects submitted by NRCS are reported at the county level. All other implemented practices are reported at the site-level with corresponding latitude-longitude coordinates.

The selected collection method is the *Rapid Stream Restoration Monitoring Protocol* methodology established by the Chesapeake Bay Field Office and U.S. Fish and Wildlife Service (June 2014).

This methodology is approved by the CBP workgroup as well as NRCS and the state agencies reporting stream restorations. Delaware has decided to adopt the use of the *Rapid Stream Restoration Monitoring Protocol*, including the use of the associated data recording sheets found in Appendix A of the USFWS document. A link to the *Rapid Stream Restoration Monitoring Protocol* is provided here:

http://www.fws.gov/chesapeakebay/Stream/StreamsPDF/Restoration%20Monitoring%20Protocol%20FINAL%20%206-30-14.pdf

The purpose of the protocol is to allow for the rapid assessment of these restoration projects and the determination of potential shortfalls in project design that may lead to failure. The following list identifies the main objectives of the protocol:

- Develop a function-based rapid and standardized method to evaluate the stability and functional success of a restored stream
- Establish a minimum standard necessary to evaluate the stability and functional success of a restored stream
- Promote consistent and reproducible results
- Identify situations that require additional monitoring
- Identify potential causes for impairment
- Identify potential corrective actions

This monitoring and verification protocol can be applied to almost any type of stream restoration, making it an ideal fit for stream restorations within the state. Observations will be made to evaluate the functional stability of stream restoration projects which focuses on vertical

stability, lateral stability, riparian condition and instream structures, as well as vegetative stability. The *Rapid Stream Restoration Monitoring Protocol* report consists of eight main sections: A) design approach, B) bank-full determination, C) limits of investigation, D) rapid stream restoration monitoring form, E) evaluation attribute definitions, F) monitoring procedures, G) limited stream measurements, and H) monitoring recommendations.

The evaluator must be familiar with the various design approaches associated with stream restoration projects including analytical based, regenerative storm conveyance, sand berm seepage systems, Natural Channel Design, and valley/base flow approaches, all of which have unique criteria and standards.

During the verification process, the evaluator will examine bankfull field indicators, such as a significant slope break or floodplain feature, along the stream banks as a critical component to assess stream stability and function. The evaluation of the project will start and end at the points where the restoration has no visual influence on the stream, typically beginning upstream and working their way downstream.

Observations will be recorded on the Rapid Stream Restoration Monitoring Form found in the *USFWS Rapid Stream Restoration Monitoring Protocol*, Appendix A. This monitoring form is divided into six sections: 1) project information, 2) station identification, 3) problem description, 4) recommended actions, 5) measurements, and 6) evaluation attributes. An in depth review of each of these sections in the monitoring form can be found in Section E of the *USFWS Rapid Stream Restoration Monitoring Protocol*.

The procedures for field monitoring are as follows. The evaluator will review all relevant materials prior to the site visit including assessment and design reports and/or plans, as well as the rapid stream restoration monitoring protocol and monitoring forms. These materials should also be brought into the field for reference, as well as for filling out the monitoring field form. In order to document observations, a measuring tape, survey rod, and camera should also be utilized. The evaluator will determine the start and end points of the evaluation, as well as determine the monitoring stations. These locations should be documented for subsequent inspections. All problems that are present will be documented and addressed separately.

If significant potential structural or functional failures are identified, the evaluator should conduct a more intensive stream survey. Measurements should be made to compare to the initial design criteria to determine if remediation should occur.

Verification for stream restoration practices will occur annually throughout the first 3 years of project establishment, specifically during the practice installation and following severe storm events. It will take several years to determine if a BMP is properly functioning. Monitoring continues throughout the determined monitoring period as established in the contract, which will be at least once every 5 years.

<u>Verification Team</u>

As outlined in the *Rapid Stream Restoration Monitoring Protocol*, the evaluator must be knowledgeable of fluvial geomorphic and watershed processes, and be well trained in the design approach used for the stream restoration.

The evaluations will be conducted through DNREC's Division of Watershed. The appropriate staff will be trained in person to ensure the verification protocol is being followed and the correct information is being collected and reported back to the responsible agency. There will be no certification requirement beyond the initial training for those collecting data. The verification collectors will call the project-sponsoring organization if questions arise about the specific project.

Documentation of Verification

Stream restoration data are requested on an annual or more frequent basis from numerous agencies that implement, track, and/or maintain stream restoration practice data. An outline of practice data submissions can be found in Section B10 of Delaware's QAPP. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was reached to have federal agencies, such as the USDA's NRCS and FSA, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf. DNREC–DWS-NPS maintains a restoration database that captures restoration practices like stream restoration, tree plantings, forest and grass buffers are compiled from various projects throughout DNREC. More information can be found in Section B10.1 of Delaware's QAPP.

The guidance and documentation on the data collection and verification systems can be found in *Rapid Stream Restoration Monitoring Protocol*, as well as in Delaware's approved QAPP.

Independent Verification

The chosen system allows for verification by the agency responsible for implementation, with the possibility of hiring additional conservation district staff that would be responsible for practice verification. In addition, the permitting authority provides post construction approval upon project completion.

2.3.2 Wetland Restoration

This Verification Protocol incorporates all wetland related BMPs that are implemented and accounted for within Delaware's WIP, including wetland restorations and creations. Table B10.1.1 in Section B.10 of this QAPP provides definitions for each of these BMP types. Details regarding verification and validation procedures for these practices are contained in Table D2.3.2.1 and summarized in the following sections.

2.3.2.1 Table – Wetland Restoration

Wetland Restoration Protocol Design Table: Visual Assessment BMPs – Multi-Year

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Visual Assessment: Multi-Year	Cost-Shared Wetland Restorations	Visual Assessment: On-site	100% of All Tracked and Reported Wetland Restorations	Non-regulator Agency	Meets NRCS Code (657, 656)	<5 years	10% per year	Work with landowner to achieve compliance. If cannot be achieved; remove from database	10 years	10% compliance checks by non-regulatory database

2.3.2.2 Data Verification

Method

The Wetland Restoration Verification Protocol incorporates all wetland restorations that are implemented and accounted for in Delaware's Chesapeake Bay Watershed Implementation Plan (WIP). All wetland restorations (100%) will be inspected through onsite visits while the restoration is being implemented. These onsite inspections will ensure the proper implementation of conservation practices, components, measures, or activities based on topography, groundwater, and stream water flow assessments. These visits will be conducted as often as needed, but at least annually. Once restoration has been implemented all monitoring will occur at least once every 5 years through an onsite visit. The site will be monitored through offsite or remote sensing methods the other four years. This will entail verifying at least 10 percent of reported practices every year.

While wetland restoration practices are present year-round, most of the verification will occur during the fall, winter, and spring seasons to avoid scheduling conflicts during the busy summer season. NRCS verification timing will be at the organizations discretion. It will take several years to determine if the BMP is properly functioning. Monitoring will continue throughout the determined monitoring period as established in the contract.

The wetland restoration BMP meets NRCS, State, and Chesapeake Bay Program (CBP) definitions for wetland restorations practices and have been approved by the CBP. Resource improvement practices are not reported. Reported BMPs, whether by NRCS or the state of Delaware, all have an implementation date, project type, and project size. Projects submitted by NRCS are reported at the county level. All other implemented practices are reported at the site-level with corresponding latitude-longitude coordinates.

The state has decided to adopt the NRCS methodology for collecting and monitoring wetland restoration projects. This methodology is approved by the CBP workgroup as well as NRCS and the state agencies reporting wetland restorations. The permitting authority provides post construction approval upon project completion. All wetland restorations will be monitored in accordance with the following schedules, using the standard Wetland Reserve Program (WRP) monitoring worksheet. While the restoration is being implemented, all enrollments will be monitored through onsite visits to ensure the proper implementation of conservation practices, components, measures, or activities. These visits will be conducted as often as needed, but at least annually.

Once the restoration project has been implemented, all projects will be monitored at least once every five years through an onsite visit. The site will be monitored through offsite aerial imagery or remote sensing methods the other 4 years. Certain circumstances may also warrant more frequent onsite visits than the minimum 1 in 5 year requirement. Onsite visits must occur as described below in circumstances that include but are not limited to:

- Projects that have active compatible use authorizations (CUA) will have annual onsite visits for the first 2 years of the CUA to ensure compliance with and effectiveness of the CUA activity.

- Projects should have an onsite visit after each significant weather event or other potentially damaging event, including but not limited to flooding, forest fire, or other major storms.

- Projects will have onsite monitoring at least 2 consecutive years following a complete change in ownership.

- Projects will have onsite monitoring for at least 2 consecutive years following a documented violation.

During the monitoring process, the evaluator will record observations based on the questions found on the *NRCS Wetlands Reserve Program (WRP) Monitoring Worksheet*. A link to the worksheet can be found in the supporting documentation. The WRP Monitoring Worksheet aims to ensure restoration requirements are being met, evaluate progress, determine what restoration repairs or enhancements may be needed, and to maintain contact with the landowner. Photographs should also be taken to ensure accurate observation points. A summary of the general monitoring observations during a site visit is found below. Each implementing agency uses this checklist below for field verification:

- Is the landowner present during the review?
- Has the landowner changed?
- Is the restoration boundary clearly marked and identifiable?
- Are the contract and agreement conditions being met?
- Are restoration practices being properly operated and maintained? (If not, what maintenance is needed? Fill in maintenance practice and cost worksheet.)
- Is the planned hydrology present? (ie. saturation or inundation. If no, what actions are needed?)
- Are maximum wildlife habitat objectives being achieved? (e.g. adequate hydrology, nesting cover, etc.)
- Are planned vegetation restoration goals being achieved (e.g. is desired vegetation being established, are invasive or noxious species a problem)? (If no, what modifications are necessary?)
- Are restoration practices being properly operated and maintained? (If no, what maintenance is needed?)
- Are there opportunities to enhance wildlife habitat components?
- Does the landowner have any concerns or suggestions for improvement of the project site?
- Identify concerns or suggestions from partners involved with the restoration and management of the restoration project.
- Additional observations or comments.

These practices will continue to be inspected once every five years while still in the initial lifespan and inspection dates will be updated in the database. Once the practice is no longer in its lifespan, the state will inspect the possibility of hiring a seasonal employee through DNREC's Wetland Assessment and Monitoring Program to inspect existing practices and update the inspection dates in the database upon successful functional verification.

A more in depth summary of the protocol for verification of wetland restoration practices can be found in the NRCS Manual Title 440 – Part 514.66 – Wetland Reserve Program: http://directives.sc.egov.usda.gov/RollupViewer.aspx?hid=17111

The observations made during the verification process will utilize a similar verification sheet as NRCS: http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=28984.wba

Verification Team

BMPs are inspected and verified by trained NRCS, conservation district and state personnel. The appropriate staff will be trained in person to ensure the verification protocol is being followed and the correct information is being collected and reported back to the responsible agency. Special training and certification requirements can also be found in Delaware's QAPP section A8 – Special Training/certification. There will be no certification requirement beyond the initial training for those collecting data. The verification collectors will call the project-sponsoring organization if questions arise about the specific project.

Documentation of Verification

Wetland Restoration data are requested on an annual or more frequent basis from numerous agencies that implement, track, and/or maintain wetland restoration practice data. BMPs are inspected and entered into databases by trained NRCS, USFWS, or DNREC staff. Each Agency has separate verification databases and maintains files for implemented projects. These data are provided to the Quality Assurance Officer annually for Chesapeake Bay progress submissions. An outline of practice data submissions can be found in section B10 of Delaware's QAPP. Additionally, in 2010, an agreement (Basinwide 1619 Agreement) was reached to have federal agencies, such as the USDA's NRCS and FSA, report practices directly to the USGS for CBP modeling rather than have jurisdictions report on their behalf. DNREC –DWS-NPS maintains a restoration database that captures restoration practices like wetland restoration, tree plantings, forest buffers, and grass buffers. These practices are compiled from various projects throughout DNREC. More information can be found in Section B10.1 of Delaware's QAPP.

Guidance and documentation on the data collection and verification systems can be found in NRCS's Title 440 Part 514 – Wetland Reserve Program, as well as in Delaware's approved QAPP.

Independent Verification

The chosen system allows for verification by the agency responsible for implementation, with the possibility of hiring additional conservation district staff that would be responsible for

practice verification. In addition, the permitting authority provides post construction approval upon project completion.

2.3.2.3 Data Validation for Stream and Wetland Restoration

Quality Assurance
Since all (100%) of stream restoration practices are inspected every year for the first 3 years and then once every 5 years and/or after major storm events and all (100%) of wetland restoration practices are inspected every 5 years or more, there is a consistent visual field check to see that the BMPs are still in place and functioning properly. These data are provided to DNREC-DWS-NPS for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only be permitted to review their own data.

The data are entered into the agricultural Excel template for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres, feet) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year. See QAPP Section B10.1 for specific stream restoration BMP submittal methodology.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry
DNREC –DWS-NPS maintains a restoration database that captures restoration practices like wetland restoration, tree plantings, forest buffers, and grass buffers. These practices are compiled from various projects throughout DNREC. The restoration database links DNREC BMPs to NRCS practice codes. These practices are incorporated into Delaware's NPS BMP Database for progress submissions. DNREC contracted with Tetra Tech, Inc. to develop a data tracking and reporting tool for the State of Delaware (Delaware's NPS BMP Database) to streamline the processes, improve tracking, and reduce the need for contractor support. DNREC will continue to work with Tetra Tech to make adjustments where needed. The system is mapped to provide the data required to NEIEN and to CBP.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. This spreadsheet includes credit durations for each BMP type approved by the Ag Workgroup on May 21, 2015. The lifespan, or credit duration, of most stream restoration practices is 10 years. The lifespan of wetland restoration is 15 years. The code in the DE NPS BMP Database has been modified so that the

lifespan/credit duration is added to the implementation date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has been passed, that BMP will be tagged as "retired".

Double counting is avoided by submitting data by the primary funding source or the primary implementing agency. For example, BMP implementation data that is cost-shared with NRCS is submitted by NRCS. Non-cost shared data are submitted by the state or conservation districts.

Training for entering data into DE NPS BMP Database has been provided by webinar in the past (2013) and an additional face to face training will occur at DNREC in late 2015. Tetra Tech will conduct the training to review use of the database and any updates to the database since the original training. The NPS BMP Database also contains a link to the user's manual. There will be no "certification" required to enter data. However, the person entering data will receive some training on how to use the database and enter data properly. DNREC will likely have an O&M contract with Tetra Tech to address any issues with the NPS BMP Database in the future and to provide any additional training if necessary (e.g., if there have been significant updates).

As of 2019, the previous DE NPS BMP Database that was created by Tetra Tech developed terminal errors and no longer functioned as designed. The contractor no longer supported the maintenance of the DE NPS BMP Database, and therefore, Delaware's NPS Program had to explore alternative options for managing and submitting Delaware's BMP data. DNREC-DWS-NPS Program contracted with KCI Technologies to develop a BMP Tracking Tool and Database Application to be completed before December 1, 2019.

External Data

Data are provided from external government agencies as mentioned above. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

Historic data were provided by DNREC and NRCS. Data quality assurance and data entry were conducted the same way as in the past (as discussed in the above sections).

BMP Performance

During the visual field assessment of all stream and wetland restoration BMPs every 1 to 5 years, the BMPs are checked for signs of failure. If a stream restoration BMP is not performing up to its standards and specifications it is repaired if funding is available. If funding is not available, the BMP is removed from the database and will no longer be reported to NEIEN. To date, most stream restoration projects are completed on tax ditches that have a permitted easement for maintenance by the tax ditch organization, which is a governmental subdivision of the state. The implementing agency will work with the landowner to achieve compliance if a wetland restoration BMP is not performing up to its standards and specifications. If compliance cannot be achieved, the BMP is removed from the database.

Stream and Wetland Restoration Verification and Validation Summary

Stream restoration data are collected by both DNREC and NRCS following the *Rapid Stream Restoration Monitoring Protocol* methodology established by the Chesapeake Bay Field Office and U.S. Fish and Wildlife Service (June 2014). The *Rapid Stream Restoration Monitoring Protocol* can be found at the following location: http://www.fws.gov/chesapeakebay/Stream/StreamsPDF/Restoration%20Monitoring%20Protocol%20FINAL%20%206-30-14.pdf

Wetland restoration data are collected by both DNREC and NRCS following the NRCS methodology for collecting and monitoring wetland restorations as part of the WRP. The WRP manual can be found here: http://directives.sc.egov.usda.gov/RollupViewer.aspx?hid=17111. This methodology is approved by the CBP workgroup as well as NRCS and the state agencies reporting wetland restorations. All wetland restorations will be monitored using the standard WRP monitoring worksheet:

D2.4 Stormwater

This section of the verification protocol represents the BMP groupings for urban stormwater. Table F-4 in Appendix F provides a sector-specific checklist of Delaware BMP verification protocol components and maps them to the relevant QAPP sections where they are documented.

2.4.1 BMP Groups

Wetponds and Wetlands, Infiltration Practices, Filtering Practices, Bioretention, and Bioswales

Wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales were grouped together because they all follow the same verification and validation protocol. Table B10.3.1 in Section B.10 of this QAPP provides definitions for each of these BMP types. Details regarding verification and validation procedures for these five practices are contained in Table D2.4.1.1 and summarized in the following sections.

Erosion and Sediment Control

Erosion and sediment control practices were grouped in their own section because they follow a slightly different verification and validation protocol than wet ponds and wetlands; infiltration practices; filtering practices; bioretention; and bioswales. Erosion and sediment control practices are temporary, while the other BMPs have a much longer lifespan. Table B10.3.1 provides definitions for each of these BMP types. Details regarding verification and validation procedures for erosion and sediment control practices are contained in Table D2.4.2.1 and summarized in the following sections.

Street Sweeping

Street sweeping only covers a very small portion of the land in Delaware's portion of the Chesapeake Bay watershed. Delaware Department of Transportation (DelDOT) only has permit requirements for street sweeping in New Castle County, not in the Chesapeake Bay watershed portions of Kent or Sussex counties. Although DelDOT does report their street sweeping results on an annual basis, it does not represent a significant reduction of sediment and nutrients in the watershed. Individual cites and/or townships also conduct street sweeping, but the data are not typically collected and reported to the state or the Bay Program. Details regarding verification and validation procedures for street sweeping are contained in Table D2.4.3.1 and summarized in the following sections.

2.4.1.1 Table – Stormwater

Stormwater Protocol Design Table: Wetponds and Wetlands, Infiltration Practices, Filtering Practices, Bioretention, and Bioswales

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Source sector	Structural	Visual Assessment: On-site	100% of All Tracked and Reported at project closeout	Regulatory agency Self	Meets specs Visual functioning Location	Periodic inspections based on O&M plan (owner inspection) every 3-5 years – Section 7.3 of the DSSR	No – 100% inspected	Maintenance inspection report given to owner (delegated agency). Owners shall comply (Sections 7.3.3 and 7.4.1)	Not currently. They're all still there.	QA Plan in place. Program checked and amended to ensure. Tri-annual reviews with delegated agencies (a few sites randomly picked to review)

Table 2.4.2.1 Stormwater Protocol Design Table: Erosion and Sediment Control

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
High	Source sector	Structural Management	Visual Assessment: On-site	100% of All Tracked and Reported – at project initiation (100% of all projects > 1 acre)	Regulatory agency Self Independent party	Meets specs Visual functioning	Weekly while under active construction	N/A (100%)	Compliance assistance Enforcement when needed	No longer needed after project closeout	QA Plan in place. Program checked and amended to ensure.

Table 2.4.3.1 Stormwater Protocol Design Table: Street Sweeping

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low/Moderate	Source sector	Stormwater management	Targeted monitoring	1-3 years	Self	Location	NA	NA	NA	NA	QA Plan in place.

2.4.1.2 Data Verification

Method

One hundred percent of all wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales are inspected by visual on-site inspection every 3 to 5 years and one hundred percent of all erosion and sediment control practices are inspected by visual on-site inspection at the project initiation and then weekly during active construction based on the operation and maintenance (O&M) plan required by DNREC's sediment and stormwater regulations. See: http://regulations.delaware.gov/AdminCode/title7/5000/5101.shtml . The inspection frequencies recommended in the regulations are shorter than the maximum inspection frequencies in this BMP Verification Plan. The O&M Plan identifies the required maintenance for stormwater management systems. All of these BMPs must meet state standards and specifications. The data on the wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales are collected for several years (life of the BMP) to determine if the BMPs are functioning properly, while erosion and sediment control practices are collected during active construction until project closeout.

An implementation date is collected and reported for all of these BMPs. This is especially true with the more recent data (post 2008) since 2009 marked the beginning of the use of the statewide MudTracker database to track urban stormwater BMPs. All of the elements required for CBP model application are currently being reported. Further elements for enhanced BMPs will be collected in the future. All BMPs currently reported have also been approved by CBP for inclusion in the model application.

The CBP's Urban Stormwater Workgroup recommended that the CBP develop BMP removal efficiencies for street sweeping. In March 2011, an Expert Panel came up with a set of recommendations for street sweeping, which is a CBP-approved credit. A description of the CBP's street sweeping recommendations can be found at this link: http://chesapeakestormwater.net/bay-stormwater/urban-stormwater-workgroup/urban-street-sweeping/. Delaware's Department of Transportation (DelDoT) and the city of Laurel follows these recommendations for street sweeping in the Chesapeake Bay watershed.

According to the CBP's recommendations, localities can use one of two methods to compute the projected nutrient reduction associated with street sweeping: 1) the mass loading approach and 2) the qualifying street lanes approach.

The preferred method is the mass loading approach and this is the approach that Delaware uses. The mass of street dirt collected during street sweeping operations is measured (in tons) at the landfill or ultimate point of disposal. The mass is then multiplied by factors to determine sediment and nutrient reduction credits.

Using the qualifying street lanes approach the locality reports the number of qualifying lane miles they have swept during the course of the year. This is then converted into total acres swept. The pre-sweeping annual nutrient load for the swept acres is defined using the Simple Method (Schueler, 1987). The locality would multiply the total acres swept by the annual nutrient load to arrive at a baseline load. The baseline load is adjusted to determine the load reduction associated with street sweeping. This methodology is described in greater detail in the Expert Panel's

March 2011 memo: http://chesapeakestormwater.net/bay-stormwater/urban-stormwater-workgroup/urban-street-sweeping/

The sediment and nutrient reductions only apply to a street sweeping program conducted by a municipality that has the following characteristics:

- An urban street with a high average daily traffic volume located in commercial, industrial, central business district, or high intensity residential setting

- Streets are swept at a minimum frequency of 26 times per year (every 2 weeks), although a municipality may want to bunch sweepings in the spring and fall to increase water quality impact.

- The reduction is based on the sweeping technology in use, with lower reductions for mechanical sweeping and higher reductions for vacuum assisted or regenerative air sweeping technologies.

- Localities need to document the length of lane miles swept using their traditional routes

Verification Team

The wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales are inspected by regulatory agencies. The BMP inspectors are trained DNREC or delegated agency employees, such as county conservation district employees. These employees will have completed DNREC Blue Card Training for Certified Construction Reviewer certification. Inspections of erosion and sediment control practices are conducted by regulatory agencies, self-inspection, and by independent third party inspectors who have completed the DNREC Certified Construction Reviewer (CCR) training. Training is ongoing as all new personnel are trained in the collection of BMP data; however, there is no "certification requirement" for staff collecting BMP data. If any of the data collectors have questions they contact DNREC's Sediment and Stormwater Program.

Currently, the only street sweeping conducted, in Delaware, which meets Chesapeake Bay Program standards are done through DelDOT staff.

Documentation of Verification

Wetponds and Wetlands, Infiltration Practices, Filtering Practices, Bioretention, and Bioswales

Data regarding the location of each wetpond and wetland, infiltration practice, filtering practice, bioretention area, and bioswale, their visual functioning, and whether or not the practice is meeting standards and specifications (Lucas 2005) are recorded in written files as well as in the MudTracker database. The MudTracker database is where all state stormwater data are collected. MudTracker is currently used by DNREC, Kent County Conservation District (KCD) and Sussex County Conservation District (SCD). It is expected that New Castle County Conservation District (NCCD) will be integrated in the future as well. New Castle County has its own Hansen database for tracking BMPs.

All wetpond and wetland, infiltration practice, filtering practice, bioretention area, and bioswale data are recorded using a maintenance inspection checklist. The maintenance inspection checklists can be found here: http://www.dnrec.delaware.gov/swc/Drainage/Pages/BMP-Maintenance-Review-Checklists.aspx

Erosion and Sediment Control

Data regarding the visual functioning of an erosion and sediment control practice and whether or not the practice is meeting standards and specifications (in the current Delaware Erosion and Sediment Control Handbook) are also recorded in written files, as well as in the MudTracker database and in CCR reports. The URL below contains a link to the list of NOIs for stormwater discharges associated with construction activities under a NPDES general permit: http://apps.dnrec.state.de.us/noi/

All erosion and sediment control practice data are recorded using a construction inspection checklist. The construction inspection checklists for various BMPs can be found here: http://www.dnrec.delaware.gov/swc/Drainage/Pages/BMP-Construction-Checklists.aspx

Street Sweeping data are recorded by DelDOT and housed in an internal database. DNREC records data from the Town of Laurel's street sweeping program into the NPS BMP database.

Independent Verification

Each delegated agency is subject to a triennial review by DNREC's Sediment and Stormwater Program for each of their delegated elements related to stormwater BMPs, including maintenance inspections. A list of delegated agencies is available at the following link: http://www.dnrec.delaware.gov/swc/Drainage/Pages/DelegatedAgencies.aspx. Some of the delegated agencies include the Delaware Department of Transportation (DelDoT), and New Castle, Kent, and Sussex County Conservation Districts.

2.4.1.3 Data Validation

Quality Assurance

Since all (100%) of wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales are inspected every 3-5 years and all (100%) of erosion and sediment control practices are tracked and reported at the project initiation and then inspected weekly until project closeout, there is a consistent visual field check to see that the BMPs are still in place and functioning properly. These data are provided to DNREC-DWS-NPS for inclusion in Delaware's existing NPS BMP Database and submission to the CBP through NEIEN.

DelDOT reports all street sweeping weights to the Quality Assurance Officer to be included in Delaware's NPS BMP database. DNREC records mileage for the Town of Laurel's street sweeping program and data are handled by the Quality Assurance Officer and stored in the NPS BMP database.

The DE NPS BMP Database is an online database that serves as a means of reporting and tracking BMPs in the state of Delaware. The use of this tool allows for a more streamlined approach for generating reports needed for water quality assessment and monitoring purposes. This database is used to submit data for inclusion in the Chesapeake Bay Watershed Model. Individual organizations are responsible for entering their practices with their provided login information and are only be permitted to review their own data.

The data are entered into the urban Excel template for upload into the NPS BMP Database. To confirm that the correct information has been copied into the templates from the raw data, the total area (e.g., acres) or numbers for each BMP type are summed and compared to the original dataset to be sure there were no errors in translating the data. Data are also compared to previous years' submissions to see if numbers are consistent (i.e., no extreme increases or decreases in acreage or count). The methodology for entering data for each BMP type is recorded every year so that the same methodology is consistently used year to year. See QAPP Section B10.3 for specific urban BMP submittal methodology.

The BMP progress data are submitted to CBP every year by DNREC.

Data Entry

Data are collected and entered into the MudTracker database by DNREC or Delegated Agency staff or an independent external party (i.e., contract employee). Urban stormwater and street sweeping data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP. In the future, it is expected that the data in MudTracker will be formatted into an XML file that will be linked to the required fields in the NEIEN template.

The lifespan or credit duration of each BMP is also entered in the template based on the *CreditDurations05222015.xlxs* spreadsheet provided by CBP. This spreadsheet includes credit durations for each BMP type approved by the Urban Stormwater Workgroup on March 17, 2015. Erosion and Sediment Control BMPs will have a lifespan only during construction. Once the project is closed out of the NOI database, then the E&S BMP reaches the end of its life. Street sweeping BMPs will be reported in lane miles annually and pounds. All other BMPs will remain until replaced with another BMP or the site is developed.

Double counting is unlikely to occur for these stormwater practices because they are being provided by one agency (DNREC) and there are no cost-share practices.

Training for entering data into DE NPS BMP Database has been provided by webinar in the past (2013) and an additional face to face training will occur at DNREC in late 2015. Tetra Tech will conduct the training to review use of the database and any updates to the database since the original training. The NPS BMP Database also contains a link to the user's manual. There will be no "certification" required to enter data. However, the person entering data will receive some training on how to use the database and enter data properly. DNREC will likely have an O&M

contract with Tetra Tech to address any issues with the NPS BMP Database in the future and to provide any additional training if necessary (e.g., if there have been significant updates).

As of 2019, the previous DE NPS BMP Database that was created by Tetra Tech developed terminal errors and no longer functioned as designed. The contractor no longer supported the maintenance of the DE NPS BMP Database, and therefore, Delaware's NPS Program had to explore alternative options for managing and submitting Delaware's BMP data. DNREC-DWS-NPS Program contracted with KCI Technologies to develop a BMP Tracking Tool and Database Application to be completed before December 1, 2019.

External Data

This is not applicable to these stormwater BMPs as there are no external data collected. All data for wet ponds and wetlands; infiltration practices; filtering practices; bioretention; bioswales; and erosion and sediment control are provided by DNREC's Sediment and Stormwater Program. The data are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

DelDOT is a delegated agency, but street sweeping is conducted as part of their MS4 permit, not as a delegated element.

Historic Data Verification

Historic data were provided by DNREC's Sediment and Stormwater Program. Data quality assurance and data entry were conducted the same way as in the past (as discussed in the above sections).

BMP Performance

During the visual field assessment of all wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales every 3 to 5 years, the BMPs are checked for signs of failure by DNREC and/or one of the Delegated Agencies. If a BMP is not performing up to its standards and specifications, the maintenance inspection report is provided to owner who has been designated on the Operation and Maintenance Plan as being responsible for maintenance of the stormwater management facilities. The Owner of the stormwater management system shall comply with the conditions of the maintenance review within the timeframe specified by the Department or Delegated Agency.

During the weekly visual field assessment of all erosion and sediment control practices, the BMPs are checked for signs of failure through Owner self-inspections or by CCRs. One of the conditions of the Construction General Permit is weekly inspections. If the site does not require a CCR to perform this function, the owner must keep a log of weekly self-inspections by a responsible person, typically the job foreman. DNREC and/or delegated agencies conduct periodic oversight inspections to verify the accuracy of the inspection reports. If a BMP is not performing up to its standards and specifications, compliance assistance is provided and enforcement is applied when necessary according to Regs 7.3.3 The Owner of the stormwater management system shall comply with the conditions of the maintenance review within the timeframe specified by the Department or Delegated Agency; and Regs 7.4.1 The Department may seek enforcement action against an Owner deemed negligent in fulfilling the requirements

of Section 7 of these regulations. If corrective measures have not been taken by the next inspection cycle, the BMP credit would be downgraded.

2.4.3 Urban Nutrient Management and Industrial Stormwater

Urban nutrient management follows the same protocol as agricultural nutrient management and is included in the agriculture verification protocol section (Section D2.1). Section D1 of the QAPP discusses that verification protocols for additional BMPs with lower anticipated contributions to the overall load reductions will be developed but at a slower pace, given the reduced reliance on these practices to Delaware's reduction strategy. For stormwater, this practice includes industrial stormwater. The design matrix table for industrial stormwater is included in Table 2.4.3.1 but additional details for industrial stormwater BMPs are not included in this verification protocol. Both of these practices only cover a very small portion of the land in Delaware's portion of the Chesapeake Bay watershed and do not result in a significant reduction to nutrients or sediment to the Bay (see watermelon charts in Appendix G). Also note that Delaware Department of Transportation (DelDOT) only has permit requirements for street sweeping in New Castle County, not in the Chesapeake Bay watershed portions of Kent or Sussex counties. Although DelDOT does report their street sweeping results on an annual basis, it does not represent a significant reduction of sediment and nutrients in the watershed. Individual cites and/or townships also conduct street sweeping, but the data are not typically collected and reported to the state or the Bay Program.

2.4.3.1 Table - Industrial Stormwater

Stormwater Protocol Design Table: Industrial Stormwater

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low	Source sector	Structural Management (SWIP)	Targeted onsite visual assessment Targeted monitoring	100% of All Tracked and Reported at start of business operation	Regulatory agency Self Independent party	Water quality data Visual functioning Location	Annually	No	Compliance assistance Enforcement when needed	As long as business is operating. No tracking of lifespan.	QA Plan in place.

2.4.3.2 Stormwater Verification and Validation Summary and Future Plans

Both groups of stormwater BMPs (1. wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales and 2. erosion and sediment control) already have BMP verification procedures in place that are fully operational and routinely carried out through the state of Delaware's current sediment and stormwater regulations, which can be found at the following location:

http://regulations.delaware.gov/AdminCode/title7/5000/5101.shtml

Stormwater verification data are collected by DNREC Sediment and Stormwater staff and their delegated agencies, such as the New Castle, Kent, and Sussex County conservation districts and DelDOT.

Stormwater BMP maintenance checklists for wetponds and wetlands, infiltration practices, filtering practices, bioretention, and bioswales can be found at the following link:

http://www.dnrec.delaware.gov/swc/Drainage/Pages/BMP-Maintenance-Review-Checklists.aspx

The construction inspection checklists for various BMPs can be found here:
http://www.dnrec.delaware.gov/swc/Drainage/Pages/BMP-Construction-Checklists.aspx

A list of NOIs for stormwater discharges associated with construction activity under a NPDES general permit can be found at the following link:

http://apps.dnrec.state.de.us/noi/

Additional information regarding the Sediment Stormwater program can be found at:
http://www.dnrec.delaware.gov/swc/pages/sedimentstormwater.aspx

Delaware's methodology for street sweeping can be found at:
http://chesapeakestormwater.net/bay-stormwater/urban-stormwater-workgroup/urban-street-sweeping/

Wastewater Sector Verification Protocol

D2.5 Wastewater

This section of the verification protocol represents the BMP groupings for wastewater practices. Table F-5 in Appendix F provides a sector-specific checklist of Delaware BMP verification protocol components and maps them to the relevant QAPP sections where they are documented.

2.5.1 Septic Connections, Septic Denitrification, Septic Pumping

These three wastewater BMPs (septic connections, septic denitrification, septic pumping) were grouped together because they all follow the same verification and validation protocol. Details regarding verification and validation procedures for these three practices are contained in Table D2.5.1.1 and summarized in the following sections.

2.5.1.1 Table - Septic Connections, Septic Denitrification, Septic Pumping

Table B-3. Jurisdictional Wastewater Protocol Design Table: Onsite Wastewater

A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low	Structural/ Multi Year Assessment	Septic Pumping (Conventional systems)	Regulatory Requirement	Per State Regulations as described in Permit Conditions. (Once every 3 Years or 30% solids capacity)	Licensed Service Provider (Class F Liquid Waste Hauler)	Class F Pump-out Reports	Upon Complaint	100% of complaints received	Yes – meet with landowner	1/3 years	Written Reports – working on a process to improve the process to database
Low	Structural/ Multi Year Assessment	Septic Connections to Sewer	Targeted	Once	Regulatory Agency (County/ City/ Political Subdivision /Utility)	Septic System Abandonment Report from County/WWTP owner/Licensee	Upon Complaint	100% of complaints received	Yes – meet with landowner	Perpetual	Onsite Database
Low	Structural/ Multi Year Assessment	Advanced Onsite Treatment Systems	Targeted	Per State Regulations	Licensed Service Provider	Inspection Reports	Upon Complaint	100% of complaints received	Yes – meet with landowner /follow up system inspection	25 Years (approved lifespan of advanced treatment system)	Written Inspection Reports/tracked in database Inspections are performed twice/year.

2.5.1.2 Data Verification

Method

The Delaware Onsite Wastewater Program, through regulations, requires that onsite septic systems be installed and inspected by certified installers and inspectors (Section 4.0, Delaware Onsite Wastewater Regulations). Existing small on-site treatment systems that are less than 2,500 gallons per day are inspected at the transfer of a property by DNREC licensed Class H System Inspector. Upon completion of an inspection the completed inspection form is sent to the Department for review and placed in the program data base. If a system receives an unsatisfactory report then property owner or buyer is required to bring the system into compliance by repairing or replacing the system (Section 5.4.6.3, Delaware Onsite Regulations). A permit is required for repair or replacement and is issued by the Department. An additional inspection is required to ensure proper installation or repair. If a cesspool or seepage pit is discovered during an inspection, the system is required to be replaced within one year of the property transfer in accordance with section 3.31.12 of Delaware's Onsite Wastewater Regulations.

All large and community on-site treatment systems over 2,500 gallons per day are required to have a licensed operator and are inspected at least once a year. (Section 6.5.3.2.3 operating permit conditions; Section 6.7 General Operation and Maintenance Requirements and 6.7.2.2.4 Monitoring Program of Delaware Onsite Wastewater Regulations).

Onsite systems are required to be pumped on a triennial basis by licensed Class F Liquid Waste Haulers (Section 4.1.6, Delaware Onsite Wastewater Regulations) with pumpouts reported to the Onsite Wastewater Program at DNREC for tracking.

All new and/or replacement systems within 1000 feet of tidal waters in the watershed are also required to have septic denitrification systems/advanced treatment installed by Licensed Class E certified installers and follow an operation and maintenance program. Septic abandonments and connections to central systems are reported by the service provide and/or county.

Septic connections, pumpouts and denitrification systems are tracked in the Delaware Environmental Network (DEN). All of the elements required for CBP model application are currently being reported. Septic Pumpout data collection is currently tracked through paper report submittal, however mobile and electronic data collection is being developed for enhanced real-time collection and reporting. All BMPs currently reported have also been approved by CBP for inclusion in the model application.

Verification Team

Septic pumpouts and installation of advanced treatment/denitrification systems are required by regulation to be installed/performed by licensed professionals. Septic haulers, inspectors, installers receive certification and licenses in accordance with regulations and most must receive ongoing training.

Documentation of Verification

Data regarding the location of each BMP, pump out records and system types are recorded in written files as well as in the DEN.

2.5.1.3 Data Validation

Quality Assurance

All septic inspections for property transfers are required to be performed by licensed Class H Inspectors. Each of these inspections includes a pumpout performed by licensed Class F Wastehaulers. Once completed report is submitted to the Department for review and entry into database. In addition DNREC Groundwater Discharges Section staff conduct inspections/audits of systems to ensure compliance by licensed professionals. Staff also respond to any complaints or concerns by system owners.

Data Entry

Data are collected and entered into the DEN by regulatory agency staff or an independent external party (i.e., contract employee). Wastewater data are provided to NPS to input into the DE NPS BMP Database using the NEIEN input template with the correct NEIEN BMP names (see QAPP Section B10 for additional details on the parties involved in data submission to NEIEN). DE's NPS BMP Database is mapped to provide the data required to NEIEN and the CBP. In the future, it is expected that the data in DEN may be formatted into an XML file that will be linked to the required fields in the NEIEN template.

Double counting is unlikely to occur for these wastewater practices because they are being provided by one agency (DNREC) and there are no cost-share practices.

Training for entering data into DE NPS BMP Database has been provided by webinar in the past (2013) and an additional face to face training will occur at DNREC in late 2014 or early 2015. Tetra Tech will conduct the training to review use of the database and any updates to the database since the original training. The NPS BMP Database also contains a link to the user's manual. There will be no "certification" required to enter data. However, the person entering data will receive some training on how to use the database and enter data properly. DNREC will likely have an O&M contract with Tetra Tech to address any issues with the NPS BMP Database in the future and to provide any additional training if necessary (e.g., if there have been significant updates).

As of 2019, the previous DE NPS BMP Database that was created by Tetra Tech developed terminal errors and no longer functioned as designed. The contractor no longer supported the maintenance of the DE NPS BMP Database, and therefore, Delaware's NPS Program had to explore alternative options for managing and submitting Delaware's BMP data. DNREC-DWS-NPS Program contracted with KCI Technologies to develop a BMP Tracking Tool and Database Application to be completed before December 1, 2019.

External Data

This is not applicable to these wastewater BMPs as there are no external data collected. All data for onsite septic systems are provided by DNREC's Groundwater Discharges Section. The data

are checked to be sure that they have been provided for the correct time period and that all necessary fields for NEIEN have been included.

Historic Data Verification

In 2013, DNREC and DNREC Groundwater Discharges group updated GIS coverage for onsite sewer connections in the Chesapeake Bay watershed (DNREC QAPP 2015, Appendix E). This project focused on data verification for reporting purposes. Data were verified by DNREC Groundwater Discharges staff and updated in the DEN database for onsite systems.

BMP Performance

Advanced Treatment/Denitrification systems are required to have an operations and maintenance contract and/or be performed by certified O&M provider. Inspection reports are required to be submitted to DNREC staff for tracking and reporting. System owners are provided with an inspection report and may become certified to provide O&M on their systems.

State or local authorities will verify, track and report proper installation and operation and maintenance (O&M) of on-site BMP systems. Verification may also occur through inspections performed by a certified design professional. Delaware does not require annual inspections for shallow placed pressure dosed, or elevated sand mound systems because they are confident in the performance of these technologies based on decades of experience. Additionally, there are other requirements in place, such as an inspection of any on-site system when a property is sold, that act as sufficient verification mechanisms for these technologies.

The design and installation of onsite BMP systems will be performed and reported by certified service providers and verified in the permitting process. All construction of on-site BMP systems are inspected by DNREC and system designer. Certificate of Satisfactory Completion is not issued until specific conditions and requirements are met which includes an O&M contract with a certified service provider.

The maintenance and inspection of on-site BMP systems will be conducted and reported annually by certified providers and tracked by the authorities. For some technologies, state or local authorities may stipulate an inspection frequency that is less than annual. I/A (Nitrogen removal) systems less than or equal to 2,500 GPD. Systems permitted after 2/1/2007 inspected every 6 mos. by certified service provider. Systems installed prior to 2/1/2007 do not have to follow O&M requirements, and are inspected by DNREC every three years. On-site systems must also be inspected when a property is sold.

Tracking and reporting through databases managed by state agencies. Delaware will maintain its own tracking database.

Reference:

Delaware's Revised Septic System Regulations (effective Jan. 11, 2014). Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Water, Groundwater Discharges, Section 7 Delaware Code Chapter 60, Delaware Regulations Governing the Design, Installation, Operation of On-Site Wastewater Treatment and Disposal System (amended Jan. 11, 2014).

http://www.dnrec.delaware.gov/wr/Information/GWDInfo/Pages/GWDS%20Design%20Install%20Operate%20Info%20For%20Proposed%20Wastewater%20Treatment%20Regulations.aspx.

2.5.2 Wastewater Treatment Facilities

Delaware has four significant wastewater treatment facilities which discharge to land and surface waters with in the Delaware Chesapeake Bay Watershed:

- Bridgeville Wastewater Treatment Plant. NPDES Permit effective April 1, 2014. Currently operating within TMDL permit limits (as of November 2015), however facility is old and requires immediate upgrade.
- Seaford Wastewater Treatment Plant – NPDES permit effective November 1, 2015. Facility is currently operating within TMDL permit limits (as of Nov 2015). Seaford's permit includes an approved trade agreement with Invista.
- Invista Wastewater Treatment Plant – NPDES permit effective November 1, 2015. Facility is operating within TMDL permit limits (as of November 2015). Invista's permit includes an approved trading agreement with Seaford.
- Laurel Wastewater Treatment Plant – NPDES permit has been administratively extended while permit is revised. New permit is expected to be issued in early 2016. Laurel is operating within current permit limits and within expected new TMDL limits.

2.5.2.1 Table – Wastewater Treatment Facilities

Table B-3. Jurisdictional Wastewater Protocol Design Table: Wastewater Treatment Facilities											
A. BMP Priority	B. Data Grouping	C. BMP Type	D. Initial Inspection (is the BMP there?)				E. Follow-up Check			F. Lifespan/ Sunset (Is the BMP no longer there?)	G. Data QA, Recording & Reporting
			Method	Frequency	Who Inspects	Documentation	Follow-up Inspection	Statistical Sub-Sample	Response if Problem		
Low	Wastewater	Treatment Technology	DMRs, Annual Reports	Monthly DMRs	DNREC	Monthly DMRs, Annual Reports	DNREC conducts annual inspection of each facility as well as data review	NA – All BMPs are inspected per state regulation	Enforcement action	NA – Annual BMP	DNREC conducts annual inspection of each facility. DNREC also reviews data and quality assurance review of data generated by the facility. Each facility has quality assurance procedures and protocols in place.

Methodology

Facilities conduct monitoring and monthly reporting of flows and loads via DMRs. In addition, (a) annual loading reports are also submitted where trading or general permit conditions apply to a facility, and/or; (b) annual WIP reporting also applies. Reports are submitted to DNREC's Surface Water Discharges Section.

NPDES permits and CFR 40 dictates procedures and protocols for monitoring flows and pollutants, sampling protocol and data collection. Each facility is required to participate in annually in a DMR quality assurance analysis with DNREC Surface Water Discharges Section and EPA. As part of the QA study, each facility analyzes a blind sample and submits data to an EPA approved provider. The provider provides a report card to EPA and the Department. If an unacceptable report card is received, then the facility may be required to make corrective actions and retest.

DNREC also conducts an annual inspection of each facility as well as a data review and quality assurance review of data generated by the facility. Each facility has quality assurance procedures and protocols in place. Any issues identified by the annual inspection may require corrective action and DNREC Compliance and Enforcement staff provide follow up as needed to ensure compliance with the permit conditions and limits.

2.5.3 Combined Sewer Overflows (CSOs)

Delaware has recently identified one CSO in the Town of Laurel. The town, through inspection and testing, has identified one section of the community which has storm drains connected to the wastewater treatment plant system. During heavy rain events (greater than 2 inch event) there is a possibility for discharge to occur. The Town of Laurel has a plan in place to separate the sewer system at five locations within town to prevent untreated overflows to the local waters. Construction is expected to begin by September 2016 and completed by May 2017.

• Construction Verification: properly designed, installed, and maintained by the certified service providers. The project has been designed by certified engineers and reviewed by DNREC staff engineers. Permits for construction will be obtained as part of the construction plan and will require regular inspections during the construction period. Sussex Conservation District will approve the construction site stormwater plan and conduct inspections.

• Post construction monitoring and inspection. The Town of Laurel Public Works Department will be responsible for long term maintenance and will enter into contracts with certified providers as required. Sussex Conservation District may provide additional inspections as needed.

• Existing compliance and enforcement procedures. The Town of Laurel is currently in compliance with their NPDES permit. Any enforcement action required will be conducted by the DNREC Division of Water Surface Water Discharges Section and/or EPA.

• Tracking and reporting. – Laurel is and will continue to track and report wastewater system flow in compliance with their NPDES permit. Discharge of Pollution is required to be reported to DNREC in accordance with state law.

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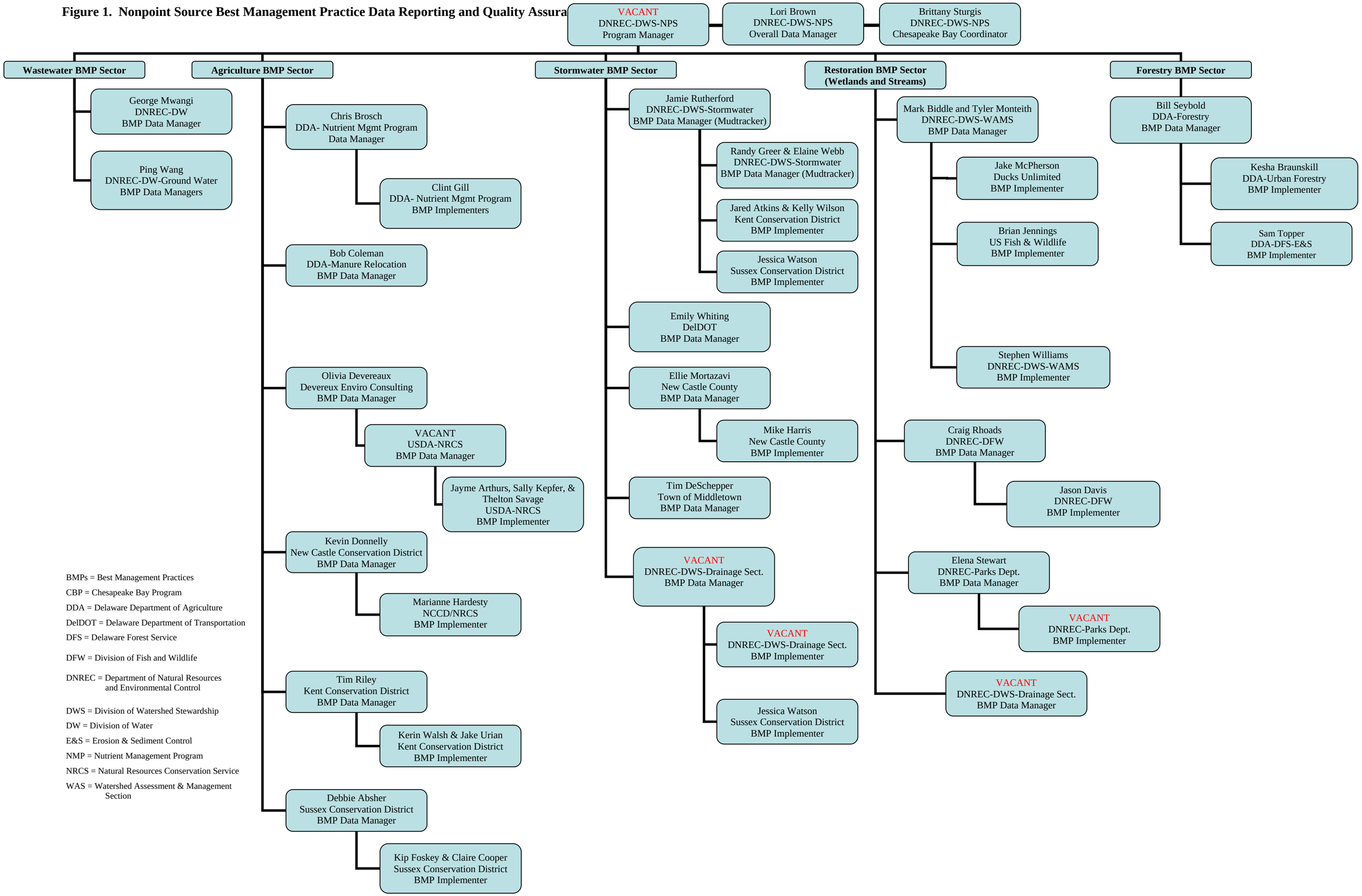
NRCS (Natural Resources Conservation Service). 2012. Delaware Quality Assurance Plan and Corrective Action Plan FY2012. Dover, DE.

NWA (Nanticoke Watershed Alliance). May 2015. *Quality Assurance Project plan for Nanticoke Watershed Alliance's Water Quality Monitoring Program Chemical and Physical Properties*, Vienna, MD.

H.R. 6124 (110th): Food, Conservation, and Energy Act (Farm Bill) of 2008.

Figure 1. Nonpoint Source Best Management Practice Data Reporting and Quality Assura



BMPs = Best Management Practices
CBP = Chesapeake Bay Program
DDA = Delaware Department of Agriculture
DelDOT = Delaware Department of Transportation
DFS = Delaware Forest Service
DFW = Division of Fish and Wildlife
DNREC = Department of Natural Resources and Environmental Control
DWS = Division of Watershed Stewardship
DW = Division of Water
E&S = Erosion & Sediment Control
NMP = Nutrient Management Program
NRCS = Natural Resources Conservation Service
WAS = Watershed Assessment & Management Section

Appendices

Appendix A: BMP Assessment for Delaware

REPORT

DELAWARE STATEWIDE BEST MANAGEMENT PRACTICES DATABASE ASSESSMENT

- Division of Soil & Water Conservation
- Division of Water Resources

URS

1200 Philadelphia Pike
Wilmington, DE 19809
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January 25, 2008

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In the spring of 2007, URS was contracted by the Delaware Department of Natural Resources and Environmental Control (DNREC) to perform an assessment of Best Management Practice (BMP) data collection throughout the state. The objective of the assessment was to determine how best to combine statewide BMP data into a single system that could be used within DNREC, and possibly externally to assist in the tracking and maintenance of BMPs. The project initially began with the Division of Soil and Water Conservation, and was soon expanded to include the Division of Water Resources. While this effort involved two separate contracts, the results are presented in this joint report due to the similarities between the two efforts.

During the summer and early fall of 2007, URS met with Delegated Agencies of the Division of Soil and Water Conservation and organizations that report BMP information to the Division of Water Resources. A standard questionnaire was used during each interview (Appendix 1) and results were tabulated in a Microsoft Access database for review and reporting purposes. Focused on the overall objective of the assessment, the questionnaire contained four sections and was designed to achieve the following:

1) Determine the types of BMP information currently collected throughout the state.
2) Determine how BMP information is stored and maintained.
3) Identify restrictions, limitations, and concerns regarding the sharing of data.
4) Identify what hardware and software is currently in use by managers of BMP information.

Interview results from each meeting are contained Appendix 2 of this report. The Points of Contact of the Soil and Water Conservation Delegated Agencies are identified in Table 1. Table 2 identifies the Points of Contact of Reporting Agencies for the Water Resources portion of the project.

In a general sense, BMPs that fall under the oversight of one of the Delegated Agencies of the Division of Soil and Water Conservation tend to be project related and are physical features that can be visited in the field and inspected. These BMPs include, but are not limited to, wet ponds, dry ponds, infiltration trenches / basins, filter strips, bio-retention areas, bio-swales, sand filters, sediment forebays, and check dams. In most cases these BMPs are inspected on a regular basis. The method of data storage does vary significantly from Delegated Agency to Delegated Agency however.

Each Delegated Agency, with the exception of the City of Wilmington, was interviewed. Numerous attempts were made to meet with representatives from the City, however a meeting was unable to be scheduled.

BMPs that fall under the oversight of the Division of Water Resources tend to be programmatic and geographic in nature. These BMPs are less likely to be discrete features that can be located in the field and do not lend themselves to a regular inspection program. Instead, these BMPs consist of the collection and tracking of information regarding the use and condition of lands throughout the state, and lend themselves to the

creation of Geographic Information Systems (GIS) shapefiles. Example BMPs include the tracking of manure management plans, the monitoring of forest preservation plans, and the monitoring of groundwater discharges and agricultural land use.

For purposes of this report, the results of the interview process are presented in two sections, one for the Division of Soil and Water Conservation and one for the Division of Water Resources. While the findings are similar, this format will allow each Division to better assess its BMP data collection process, requirements and needs.

TABLE 1: Points of Contact (Soil and Water Conservation)

Reporting Agency	POC: Primay POC: Secondary	Phone: Primary POC Phone: Secondary POC	Email: Primary POC Email: Secondary POC
City of Newark	Mike Sistek Kelley Dinsmore	(302) 366-7040 (302) 366-7040	pwoperations@newark.de.us kdinsmore@newark.de.us
DelDOT	Vince Davis Wendy Polasko	(302) 760-2180 (302) 760-2542	Vince.Davis@state.de.us Wendy.Polasko@state.de.us
DNREC	Jamie Rutherford	(302) 739-9921	Jamie.Rutherford@state.de.us
Kent Conservation District	Jared Adkins	(302) 741-2600	Jared.adkins@state.de.us
New Castle Conservation District	Don Nichols	(302) 832-3100	N/A
New Castle County	Mike Harris Ellie Mortazavi	(302) 395-5806 (302) 395-5802	MHarris@nccde.org EMortazavi@nccde.org
Sussex Conservation District	Jessica Watson	(302) 856-7219	Jessica.Watson@state.de.us
Town of Middletown	Morris Deputy	(302) 378-9120	mdeputy@middletownde.org

TABLE 2: Points of Contact (Water Resources)

Reporting Agency	POC: Primay POC: Secondary	Phone: Primary POC Phone: Secondary POC	Email: Primary POC Email: Secondary POC
Delaware Department of Agriculture: Forest Service	Glenn Gladders	(302) 698-4553	Glenn.gladders@state.de.us
Delaware Department of Agriculture: Nutrient Mgmnt Comm	Steve Hollenbeck	(302) 698-4500	Steven.hollenbeck@state.de.us
Delaware Department of Agriculture: Nutrient Mgmnt Plans	Bob Coleman	(302) 698-4556	Robert.coleman@state.de.us
DNREC: 319 Program	Mark Hogan	(302) 739-9922	Mark.hogan@state.de.us
DNREC: Coastal Program	Marcia Fox	(302) 739-9282	Marcia.fox@state.de.us
DNREC: Groundwater Discharges	Dave Schepens Ron Graeber	(302) 739-9948 (302) 739-9948	Dave.schepens@state.de.us Ronald.Graeber@state.de.us
Kent Conservation District	Tim Riley Paula Long	(302) 741-2600 (302) 741-2600	Timothy.riley@state.de.us Paula.long@state.de.us
NCCD (NRCS)	Marianne Hardesty	(302) 832-3100	Marianne.hardesty@de.usda.gov
Perdue Agricycle	Heather Comegys Wayne Hudson	(302) 943-2732 (410) 543-3919	Heather.comegys@perdue.com Wayne.hudson@perdue.com
Sussex Conservation District	Debbie Absher	(302) 856-3990	Debbie.Absher@de.nacdnet.net

Division of Soil & Water Conservation

Existing BMP Data

To gain an understanding of the types of BMP data currently collected, Delegated Agencies were asked to describe the types of BMPs that they maintain, whether the BMPs are regularly inspected, and the inspection periodicity. All but two of the Delegated Agencies, the Town of Middletown and the Sussex Conservation District, maintain an inventory of their BMPs. The Town of Middletown has a planner on staff and has set as a goal the development of a BMP inventory. The Sussex Conservation District is currently working with DNREC to develop a project tracking database that will have as a component a BMP inventory.

The type of data collected varies widely and only three of the Delegated Agencies inspect BMPs on a regular basis (typically yearly). DelDOT currently maintains two sets of inspection data. The first (structure) is data that is static, and not expected to change. This includes classification, dimensions, material, etc. The second (inspection) is expected to change over time, and a historical record is maintained.

Historical data provides a valuable history of not only the performance of a BMP but also changes in BMP condition over time. All but three of the Delegated Agencies maintain some from of historical data, however in many cases it is not maintained in an electronic format. The City of Newark for instance stores BMP data in a Microsoft Excel spreadsheet, and only maintains current data in an electronic format. Historical inspection reports are maintained by the City in a paper format. As a comparison, DelDOT stores historical data electronically, and does not overwrite any data.

An inventory, along with historical records, provides valuable data for the assessment of BMP condition and performance; however, this does not provide a complete picture of the individual BMP. Spatial data, combined with photographs, provide a convenient means to locate BMPs and review them without having to go into the field. Spatial data allows an individual to locate a BMP in relation to it's surroundings and better assess the area that it treats. Digital photographs provide a visual record of conditions at the time of inspection and aid in identifying trends in BMP condition and performance over time. Only four of the Delegated Agencies maintain spatial data and photographs. As with other data, there is variation between the Delegated Agencies in how they collect spatial data and tie photos to the overall inventory. DelDOT surveys the perimeter of each BMP while New Castle County, the Kent Conservation District, and the City of Newark survey the outlet of the BMP. Finally, not all inventories have photos directly linked to inspection data.

Table 3 summarizes the data collected by the Delegated Agencies.

Storage, Display and Maintenance of Data

In order to develop a composite BMP database, DNREC must know not only what data is collected, but also how it is stored. In addition, each Delegated Agency is a stakeholder in the BMP data process and will play a role in how the composite database is maintained

and updated. For this reason, attention was paid to the concerns of each Delegated Agency regarding the maintenance of BMP data.

Depending on the Delegated Agency, BMP data is stored in paper format, spreadsheets, one of several database systems, and in one case, Hansen. Only three Delegated Agencies link BMP data to a Graphical User Interface (GUI). In each case, an ESRI software product is used. It is important to note that although different software and database systems are in use, it will be possible to combine all the electronic data into a single database. The key is to have an electronic format, either as a database, spreadsheet or shapefile to allow for the conversion of data.

The final format of a composite BMP system will impact how data is maintained by the individual Delgated Agencies. When asked their preference for data maintenance (in-house or by an outside entity) there was near unanimous agreement that data should be maintained and updated locally and then forwarded to DNREC for inclusion in the composite BMP system. The two main concerns are network security and data integrity. Each Delegated Agency maintains their own computer network and from a security perspective would not be willing allow outside entities access. In addition, each Delegated Agency feels that they have the greatest understanding of their BMPs and inspection processes and thus prefer to maintain control of their data. There was little hesitation in terms of providing DNREC with periodic data updates for a composite BMP database.

Table 4 summarizes the storage, display and maintenance of BMP data.

Data Sharing

There is little concern among the Delegated Agencies about sharing Soil and Water Conservation BMP data. While some feel that a Freedom of Information Act (FOIA) request might be needed, the only real limitation is the resources needed to pull data together. There was some concern that the size of files, especially if digital photographs are included, could pose a problem with data transfer. There are a variety of alternatives available for the transfer of large data files, thus it is not likely that this will be a problem.

When asked how they envision shared BMP data in a composite system being used, a variety of items were mentioned including:

- A planning tool to help determine maintenance needs
- Support of watershed assessments
- PCS / TMDL development
- A tool to help monitor and assess BMP performance, and what other areas are doing

Table 5 summarizes the perceived issues involved with the sharing of BMP data.

Hardware and Software

Although the Division of Soil and Water Conservation initially intends to use the composite BMP database for internal purposes only, the possibility of it being made available to the Delegated Agencies does exist. In addition, the Delegated Agencies will be tasked with provided data updates to the composite system on a regular basis. For this reason, it is important to have an understanding of the comfort level each stakeholder has with key software and the IT resources that they have in place. The final portion of the interview focused on these areas and the results are summarized in Table 6.

Recommendations

BMP data collected by Delegated Agencies of the Division of Soil and Water relates to a common set of structures that are located in the field. For this reason, it will be beneficial to standardize data collection, processing and reporting. During the interview process it became apparent that specific guidance from DNREC would be desirable. This guidance would help to ensure that common data is collected allowing BMPs data collected and maintained by different Delegated Agencies to be compared and displayed in a common format.

To achieve this, the following steps should be taken:

1. *Develop a standard set of inspection forms to be used by each Delegated Agency.*
2. *Standardize the method by which photographs and spatial data is collected.*
3. *Develop a standard format for the storage of BMP data.*
4. *Develop a standard export format for BMP data to allow easy assimilation into the composite database.*

Each step is discussed in greater detail below.

1. *Develop a standard set of inspection forms to be used by each Delegated Agency.*

The nine Delegated Agencies all have the same requirements in terms of BMP maintenance and data collection. There is, however, a significant variation in the way each has chosen to implement their individual BMP monitoring program. In order to bring data from each Delegated Agency together it will have to be standardized. Not only does each need to look at a given BMP and ask the same questions, the answer needs to be standardized as well. The development of a standard set of BMP inspection forms will accomplish this.

Many of the Delegated Agencies have developed inspection forms that they are comfortable working with. While they do vary from one another, there is commonality which should be used as a starting point in the development of a common inspection form. By starting with existing forms, not only will changes be minimized, but the best aspects of each can be maintained and the individual Delegated Agencies will be more involved in the process and thus be able to add the value of their own experiences.

In addition to the different forms currently in use, there are differences in the depth of inspection. The development of a common inspection form implies the establishment of a minimum standard for inspection. While it is important to establish inspection requirements, it may not be reasonably feasible to achieve them right away. It would be reasonable to set an inspection standard, with a regular periodicity, and expect that the required level of data be collected within one inspection cycle. As an example the inclusion of the specific watershed that a BMP resides in could be accomplished over the next inspection cycle. Additional data, such as the drainage area served by a BMP should also be added as time and resources allow.

Finally, to minimize subjectivity and increase standardization, pre-defined selection lists should be established for each inspection point. This will ensure that data collected throughout the state can be compared regardless of who performed the inspection or where and when it occurred. In addition, set selection lists will add validity to condition assessments making sure that good is good and fair is fair.

2. *Standardize the method by which photographs and spatial data is collected.*

Currently available GPS survey equipment makes the collection of spatial data easy and reasonably cost-effective. Within a few seconds, a point can be located in the field, surveyed and added to a shapefile. The issue is what to actually survey in the field. While it is quite feasible to walk the perimeter of a pond and the line of a swale and actually survey the shape of the feature, this does not represent what many of the Delegated Agencies have done. To balance usefulness of data with cost of collection, the outfall of each BMP should be used as the survey point.

The outfall will locate the BMP in relation to its surroundings and provide a point to tie inspection data with photographs for a complete Graphical User Interface. In addition, many of the Delegated Agencies have already surveyed the outfall of their BMPs making this a reasonable common point. The survey of additional points such as drainage into the BMP, defects and the shape should not, however, be discouraged.

A series of photographs of each BMP should be collected to include landscape photos to show the overall BMP and its surroundings. Key features including the outfall and any defects should also be photographed. By numbering each photo with the unique identifier of the BMP, the photos and inspection data will be able to be linked in the final database.

3. *Develop a standard format for the storage of BMP data.*

BMP data is stored in different formats by the various Delegated Agencies. It is not necessary to require each to change to a common program (for example Microsoft Access). Instead, the data structure and naming of fields and columns must be standardized to allow data from different Delegated Agencies to be converted and stored in a common database. With each Delegated Agency maintaining BMP data, using the

same data structure processes to upload data into a common database can be put in place and common report formats developed.

4. *Develop a standard export format for BMP data to allow easy assimilation into the composite database.*

With standard data collection practices in place and a standardized data storage structure developed, processes can then be created to streamline the export and subsequent combination of BMP data. Data, once in an electronic format, can be converted from one format to another. In order to work with the greatest common factor, data should initially be delivered to DNREC in a Microsoft Excel format. Whether a Delegated Agency chooses to store data as a shapefile, or one of many database formats, an Excel file can be created and used to load data into the composite BMP database.

In addition to a standard export file, standard reports can be developed for submission to DNREC. Standard reporting has the potential to simplify the reporting process for the Delegated Agencies and will provide data to DNREC in a regular format allowing for comparison of different BMPs.

TABLE 3: Existing BMP Data (Soil and Water Conservation)

Organization	BMPs Maintained	Inventory	BackGround Data	Regular Inspection	Inspection Frequency	Historical Data	Spatial Data	Photos
City of Newark	Mostly extended detention basins, also have some ponds, bio-swales, bio-retention, sand filters, grass filter strips and structural BMPs. Some meet pre '91 regulations and some meet post '91 regulations.	Yes	No	Yes	Yearly	Yes	Yes	Yes
DelDOT	Wet ponds, dry ponds, infiltration trenches / basins, filter strips, bio-retention areas, bio-swales, sand filters, sediment forebays, check dams.	Yes	Yes	Yes	Under Development	Yes	Yes	Yes
DNREC	DNREC has statewide responsibility for all state and federal projects (Schools, Post Offices, etc) as well as remediation sites and contaminated sites.	Yes	No	No	N/A	Yes	No	No
Kent Conservation District	Stormwater BMPs (ponds, infiltration, bio-infil, sand filters, etc). County, Municipal and private BMPs fall under the KCD (all of Kent County except for federal and state facilities)	Yes	No	Yes	Yearly	Yes	Yes	Yes
New Castle Conservation District	Provide E&S review for 9 municipalities (all except Wilmington, Newark & Middletown). Existing BMPs are a grey area because a lot of the responsibility lies with HOAs or the Town / City	Yes	No	No	N/A	No	No	No
New Castle County	Sand Filters, Infiltration, Bio-retention, Bio-swales, Recharge Basins, Underground Detention, Wetlands, and Ponds.	Yes	No	Yes	Yearly	Yes	Yes	Yes
Sussex Conservation District	The SCD does not maintain SW practices, they provide inspection services and technical support. SCD maintains a listing of projects by name, when approved. Plans would then need to be pulled to see what BMPs might be on a given site.	No	No	No	N/A	No	No	No

TABLE 3: Existing BMP Data (Soil and Water Conservation)

Organization	BMPs Maintained	Inventory	BackGround Data	Regular Inspection	Inspection Frequency	Historical Data	Spatial Data	Photos
Town of Middletown	Dry ponds, wet ponds, infiltration ponds, some structural (underground systems) swales, bio-retention	No	No	No	N/A	No	No	No

TABLE 4: BMP Data Storage (Soil and Water Conservation)

Organization	How Data Is Stored	Where Data is Stored	Data Maintained By	Linked To GUI	GUI Software	Future Data Maintenance
City of Newark	Excel spreadsheets (inspection data) ARC 8.3 (mapping)	Shared City network drive	Data: Mike Sistek & Kelley Dinsmore. Network: IT	Yes	ArcView 8.3	Would like to be able to make changes locally. Local update and storage w/ periodic updates made to DNREC
DelDOT	Oracle	DelDOT server in Dover	DelDOT OIT	Yes	ESRI based	DelDOT would prefer to maintain their data
DNREC	MS Access. It is being migrated to SQL server	DNREC Server	DNREC IT	No	N/A	DNREC would prefer to maintain data themselves.
Kent Conservation District	MS Access	KCD server in Dover	KCD Program Staff	No	N/A	No preference, as long as the data is accessible.
New Castle Conservation District	Paper project files	NCCD building	Don Nichols	No	N/A	No Comments
New Castle County	Hansen: General descriptive information. Oracle based GUI for specific BMP information.	NCC Government center	NCC IT staff	Yes	ArcView 9.x	In house data management has several advantages, but for technical problems an outside player would be helpful.
Sussex Conservation District	MS Access	SCD building in Georgetown	In house staff member with DNREC IT support	No	N/A	SCD would prefer to input and maintain the data, if there are problems then they can go to IT. They would want to be able to control their data
Town of Middletown	Paper files	Town building		No	N/A	Prefer to maintain BMP information locally (both inspections and the data) then upload to a separate system (outside of the Town's) for sharing and distribution. Security is the main concern (along with data integrity).

TABLE 5: BMP Data Sharing Limitations (Soil and Water Conservation)

Organization	Sharing Limitations	How to Obtain BMP Data	Possible Stakeholder Use
City of Newark	Connecting into City computers is not likely to occur. The City connects to the web through U of D, although a new system is in discussion.	Just ask. The spreadsheets and inspection forms were readily shared for this project. The photos and mapping files are too big to easily share.	Making all BMP data available to residents could cause problems. Perhaps make basic data available to all (locations and types) but specifics on condition and maintenance should not be shared. Newark is focused on what they own and maintain thus little interest in data out of Newark, except maybe for City fringe areas.
DelDOT	A data request can be made, and DelDOT will determine the need. A FOIA request may be needed.	Ask. DelDOT would be able to release the data, although a spreasheet with basic data would liklely be provided first.	A planning tool to help determine maintenance needs. Display aerial photos and the user could look to see general data (approx size, year built, flow, drainage areas).
DNREC	There are limits on who can gain access (security). There are possible FOIA requirements as well due to the presence of correspondence.	Make a formal request, identify the data desired and DNREC would try to supply it.	Mainly internal requests, used for watershed assessments.
Kent Conservation District	None really exist	Request the data from the program manager	Not quite sure at this point
New Castle Conservation District	Has never been an issue. Nobody has ever really requested data from the NCCD. Sharing with state agencies is not an issue.	NCCD has not received any requests, however NCCD does reply to complaints.	NCCD does not feel that what the NCCD does lends itself to a computer application. NCCD focus is construction regulation. Once the BMP is built, maint & resp. falls to the HOA or town / city.
New Castle County	FOIA is a driver. The County likes to be consistent with distribution. Sharing with another government agency is not a problem. Many BMPs are owned by an HOA or Maint. Corp so there could be some privacy issues.	Make a FOIA request, there is a County employee who processes them	It would be helpful to have DelDOTs drainage collection system relative to the BMPs available. That would help with TMDLs as stakeholders. NCC could see private groups using the system to look for work opportunities, and that could pose a headache for maintenance corps.
Sussex Conservation District	Don't really have any issues sharing BMP data with other agencies. SCD would not mind working with Mosquito Control to get a better idea of which BMPs are breeding mosquitos, and which are not	FOIA request	In support of PCS / TMDLs with info provided on nutrient loading and removal rates. Simplification of the reporting process. If data is made available to all who need it, less time may need to be spent generating reports.
Town of Middletown	Do not want to let people into their network. Just ask (FOIA) and the data can be provided. Middletown is autonomous and does not share data in a digital format.	Just ask	Provide the ability to see what others are doing, and how BMPs are performing. Look at maintenance practices and a comparison of facilities, this will help determine if Middletown is keeping up.

TABLE 6: Software (Soil and Water Conservation)

Organization	Comfortable with MS Access	Comfortable with GIS Software	Current Software in Use	IT Staff	IT Staff Size
City of Newark	Yes	Yes	Excell & ArcView 8.3	Yes	2 people
DelDOT	Yes	Yes	ESRI	Yes	70 - 80 people
DNREC	Yes	Yes	Access, some GIS for individual cases	Yes	
Kent Conservation District	Yes	Yes	MS Access, some GIS	No	Rely on DNREC IT
New Castle Conservation District	No	No	Currently not tracking data electronically	No	N/A
New Castle County	Yes	Yes	Hansen, vb.net, Oracle	Yes	15-30 people
Sussex Conservation District	Yes	Yes	MS Access	No	N/A
Town of Middletown	Yes	No	Currently not tracking data electronically.	Yes	1 full-time professional

Division of Water Resources

Existing BMP Data

To gain an understanding of the types of BMP data currently collected and forwarded to the Division of Water Resources, Reporting Agencies were asked to describe the types of BMPs that they maintain, whether the BMPs are regularly inspected, and the inspection periodicity. All but two of the Agencies, the Delaware Department of Agriculture (DDA): Forest Service and the Kent Conservation District reported having some type of BMP inventory. The DDA Forest Service did state, however, that BMP data is maintained on forest specific BMPs.

BMP data reported to the Division of Water Resources tends to be both programmatic and geographic in nature. The BMPs are programmatic in that they involve rules and regulations related to the use of land. Permits are granted, land use designations are made and it is data that is collected and stored. The data is geographic in that a permit is good for a specific parcel of land, a preservation plan sets aside specific land. Examples include forest preservation plans, agricultural cover crop data, and nutrient management planning. As a result, background information in terms of areas served, waste removal, and physical location is typically available.

The inspection frequency of BMPs varies widely and is dependent on the type of BMP. Many of the practices are programmatic and do not lend themselves to physical inspection. As an example it would be somewhat impractical from a resource perspective to visit each farm in Sussex County to assess the use of cover crops. Therefore, in some cases, inspections occur at the time a permit or application is submitted, while in other cases inspections are random and might even be administrative in nature.

Historical data provides a valuable history of not only the performance of a BMP but also changes in BMP condition over time. Each Reporting Agency interviewed maintains some form of historical data, however, there is some variation in the amount of historical data maintained, with the majority having historical data back to 2001.

An inventory, along with historical records, provides valuable data for the assessment of BMP condition and performance. However, this does not provide a complete picture of the individual BMP. Spatial data, combined with photographs provide a convenient means to locate BMPs and review them without having to go into the field.

Spatial data is particularly important when looking at the relationship of various programs and how they can combine to affect overall water quality in an area. The ability to view forest preservation plans, crop rotation and cover plans along with the location of more physical BMPs (i.e. ponds) greatly enhances the ability to assess, plan and manage various BMP practices. All but three of the interviewees reported having spatial BMP data. The three that do not maintain spatial data relate to agricultural land use that brings into question privacy issues. This is discussed in a later section on data sharing.

Only DNREC's Groundwater Discharge section and the New Castle and Kent Conservation Districts report having photos of BMPs. These agencies maintain more "physical" BMPs that can specifically be visited in the field. It would not be practical to maintain photos of every farm or track of forest in a preservation plan.

The Kent and Sussex Conservation Districts use the NRCS Toolkit to track BMP data and the Performance Review System (PRS) to generate reports. These are systems developed by the NRCS to track and maintain data on a national level. While it is not known at this time if DNREC would be allowed direct access to the system, it may be possible for reports to be generated and forwarded to the Division of Water Resources in an electronic format. This will need to be explored further with the local NRCS office in Delaware

Table 7 summarizes BMP data collected that is reported to the Division of Water Resources.

Storage, Display and Maintenance of Data

In order to develop a composite BMP database, DNREC must know not only what data is collected, but also how it is stored. In addition, each Reporting Agency is a stakeholder in BMP data process and will play a role in how the composite database is maintained and updated. For this reason, attention was paid to the concerns of each Reporting Agency regarding the maintenance of BMP data.

Depending on the Agency, BMP data is stored in paper format, spreadsheets, one of several database systems and in the case of the Kent and Sussex Conservation Districts, the NRCS Toolkit and PRS. Four of the 10 Agencies interviewed link BMP data to a Graphical User Interface (GUI), with two using ESRI software and two using PRS and Toolkit. It is important to note that although different software and database systems are in use, it will be possible to combine all the electronic data into a single database. The key is to have an electronic format, either as a database or spreadsheet, to allow for the conversion of data.

The final format of a composite BMP system will impact how data is maintained by the individual Reporting Agencies. When asked their preference for data maintenance (in-house or by an outside entity) there was near unanimous agreement that data should be maintained and updated locally and then forwarded to DNREC for inclusion in the composite BMP system. The two main concerns are network security and data integrity. Each agency maintains their own computer network and from a security perspective would not be willing to allow outside entities access. In addition, each Reporting Agency feels that they have the greatest understanding of their BMPs and inspection processes and prefer to maintain control of their data. There was little hesitation about providing DNREC with periodic data updates for a composite BMP database.

Table 8 summarizes the storage, display and maintenance of BMP data.

Data Sharing

Much of the BMP data is currently being reported to DNREC, thus there is little concern over sharing data with government agencies. If the data is to be made public, certain privacy issues will arise. A large amount of the BMP data is collected on agricultural practices and can thus be linked to individual farms and farmers. While data specific to a farm should be protected, there is general agreement that if data is provided on a watershed basis, and individual farmers are masked, then the data can be shared. In any case, a Freedom of Information Act (FOIA) request will likely be required.

Perdue Agricycle has an additional concern in that their list of farms served and the amount of product processed is also a client list. From a business perspective, they would not like to see their client list made public. They did agree, however, that if data about farms served is provided on a watershed basis, the issue would be avoided.

When asked how they envision BMP data in a composite system being used, a variety of items were mentioned including:

- An aid in the development of reports to DNREC. The system could consolidate information to simplify the reporting process.
- Support watershed assessments.
- Provide a data clearing house so data could be downloaded direct, instead of having to make a request to DNREC.
- Support the TMDL / PCS process by providing relevant data.

Table 9 summarizes the perceived issues involved with the sharing of BMP data.

Hardware and Software

Although it is initially intended that the Division of Water Resources will use the composite BMP database for internal purposes only, the possibility for it being made available to the general public does exist. In addition, the Reporting Agencies will be tasked with providing data updates to the composite system on a regular basis. For this reason, it is important to have an understanding of the comfort level each stakeholder has with key software and the IT resources that they have in place. The final portion of the interview focused on these areas and the results are summarized in Table 10.

Recommendations

Combining the BMP data collected and reported to the Division of Water Resources will be more complicated than for the Division of Soil and Water Conservation. There are three reasons for this:

- There is much more variation in the types of data collected. Some of the data is geographic in nature and is collected and maintained in a shapefile format. This

is the case for many of the forestry and crop management programs. Other data is collected in a tabular format and is stored in spreadsheets and data tables. This is the case for the nutrient management programs.

- Much of the BMP data relates to agricultural practices and there are concerns in the agricultural community with associating data with individual farms and farmers.
- Data that is collected and maintained by the Conservation Districts is managed within the NRCS Toolkit and Performance Review Systems (PRS). These systems are not integrated with state systems and further work will be required to determine what types of reports and data can be provided to DNREC.

With these limitations in mind, there are some steps that can be taken by DNREC to begin the process of developing a composite BMP database.

1. *Ensure that all available shapefile data is sent to DNRECs 319 Program*
2. *Encourage the attribution of watershed information to agricultural data*
3. *Work with the NRCS to determine what data can be released and what format it can be provided in.*

Each step is discussed in greater detail below.

1. *Ensure that all available shapefile data is sent to DNRECs 319 Program.*

Currently much of the BMP data that exists in shapefile format either resides with or is forwarded to DNRECs 319 Program. In addition to shapefile data for agricultural BMPs and forest preservation areas, the 319 Program also collects nutrient management data from the Department of Agriculture. The 319 Program could thus serve as the starting point in an effort to bring various BMP datasets together. By integrating data from DNRECs Groundwater Discharges Section and the NRCS it would be possible to create a multi-layed GIS that could be used to relate the various practices together and develop a more holistic view of water resource practices throughout the state.

2. *Encourage the attribution of watershed information to agricultural data.*

Privacy issues will likely remain a concern for as long as site specific data is collected on individual farms. While there is concern about releasing specific data on farms there is much less concern with making general data available. For example, the fact that there are 1,500 acres of farm land covered by nutrient management plans in a watershed would be acceptable, identifying the farms by name and address would not be. By tracking crop rotation, manure generation and other agricultural items at the watershed level, DNREC will be able to monitor and manage issues affecting water quality while the privacy of the agricultural community is maintained.

To accomplish this, a standard watershed breakdown must first be established. Next, watershed data must be made a part of the various data sets for the various agricultural BMPs. In this way DNREC will be able to track the number of manure capture devices

in watershed X, the acres of cover crop and watershed Y and the number of farms using manure recycling in watershed Z.

3. *Work with the NRCS to determine what data can released and what format it can be provided in.*

The Conservation Districts, in coordination with the NRCS, collect a significant amount of data within the state. This information is then stored and managed using the NRCS Toolkit and Performance Review System. As of this report, there was not a lot of interaction between the NRCS and DNREC. To make use of this data, DNREC must engage the NRCS, determine what data is available, how it is stored and how it might be made available to DNREC.

With these initial steps in place, it will be possible to begin the integration of the various data sets and create a composite system to review all Water Resources BMP data in a single location. The challenge will continue to be that, unlike the Soil and Water Conservation BMPs that are all of a similar type, the Water Resources BMPs each represent a different program, with its own unique objectives and data sets.

TABLE 7: Existing BMP Data (Water Resources)

Organization	BMPs Maintained	Inventory	BackGround Data	Regular Inspection	Inspection Frequency	Historical Data	Spatial Data	Photos
Delaware Department of Agriculture: Forest Service	Forest Stewardship Plans (shapefiles); Timber Harvest Permitting (shapefiles); Urban Forestry Program (small component) reported as points vs areas because the areas are small (even though several trees might have been planted). All data is reported to DNREC's 319 Program.	No	Yes	No	N/A	Yes	Yes	No
Delaware Department of Agriculture: Nutrient Mgmnt Comm	Poultry manure tracking. Poultry is the main contributor in DE. Manure shipping is tracked in an Access database. Shipping permits are submitted, the data is put into the d/b and later exported to Excel. In-state shipments are tracked by watershed. Out of state the source is tracked by watershed but not the destination.	Yes	Yes	Yes	As apps are submitted	Yes	No	No
Delaware Department of Agriculture: Nutrient Mgmnt Plans	Nutrient Management Plan Program. All farms greater than 10 acres, or 8 animal units (~30,000 chicken) must submit a NMP. DDA reimburses farmers for the cost of the plans. Plans run in 3 year cycles, either 1 3-year plan, or 3 1-year plans.	Yes	Yes	Yes	Random admin. Reviews	Yes	No	No
DNREC: 319 Program	Cover Crop data (Kent & Sussex counties), CREP (Conservation Reserve Enhancement Program), Livestock BMPs (manure storage, incinerators, composters, animal waste handling, etc), Conservation reserve program.	Yes	Yes	Yes	Varies by program	Yes	Yes	No
DNREC: Coastal Program	The coastal program is a federal program that operates a little outside of the state agencies. They do not maintain any BMP data, and have turned tracking over to other groups.							
DNREC: Groundwater Discharges	On site waste water systems of all sizes (incl. spray irrigation): Over 80,000 on site septic systems, Several hundred > 2,500 gpd; Underground injection control program.	Yes	Yes	Yes	>2500 gpd: yearly	Yes	Yes	Yes

TABLE 7: Existing BMP Data (Water Resources)

Organization	BMPs Maintained	Inventory	BackGround Data	Regular Inspection	Inspection Frequency	Historical Data	Spatial Data	Photos
Kent Conservation District	The KCD does not really maintain BMP data on programs of their own. Instead, they support farmers that are tasked with meeting requirements. The data then goes to the appropriate agency to track.	No	Yes	Yes	varies by BMP	Yes	Yes	Yes
NCCD (NRCS)	Cover Crop Data, Horse Pastures and loading, No till Data, Some cost share from SWM, Some riparian buffers in urban areas, Filter Strips, Some E&S measures at the edge of Ag lands, Fragmites Control.		No	No	On construction & randomly	Yes	Yes	Yes
Perdue Agricycle	Tracks of the amount of waste taken from sites and the ultimate destination whether in or out of state. They serve most of the Kent and Sussex farming community (~1,400 farms.) PA does not have data on nutrient management plans, or if they are current. PA is told yes or no on if a plan exists, but not the expiration date.	Yes	Yes	No	N/A	Yes	No	No
Sussex Conservation District	SCD provides technical and financial assistance, they are not regulatory.	Yes	Yes	Yes	---		Yes	No

TABLE 8: BMP Data Storage (Water Resources)

Organization	How Data Is Stored	Where Data is Stored	Data Maintained By	Linked To GUI	GUI Software	Future Data Maintenance
Delaware Department of Agriculture: Forest Service	ARCView 9.2 & Access. Data is joined to the shapefiles.	Dover network & desktop.	Glenn Gladders	Yes	ARCView 9.2 and Access	Glenn would prefer to maintain and store the data locally.
Delaware Department of Agriculture: Nutrient Mgmnt Comm	MS Access	DDA Network	Steve Hollenbeck	No	N/A	Centralized data storage would work better, with local updating and maintenance.
Delaware Department of Agriculture: Nutrient Mgmnt Plans	MS Access & Excel	DDA network	Bob Coleman and Judy Burnes	No	N/A	DDA would prefer to maintain the data and provide updates as needed.
DNREC: 319 Program	ESRI with MS Access back-up	DNREC Network. Data on local drive.	DNREC IT	Yes	ArcGIS 9.x	Maintain in house, share the data.
DNREC: Coastal Program						
DNREC: Groundwater Discharges	MS Access, Adabase, file folders. Data being migrated to SQL server.	Dover & Georgetown	Groundwater Discharges section staff.	No	N/A	Dave would prefer for his group to manage and maintain the data, then upload it to a master system.
Kent Conservation District	File folders.	District facility	KCD staff	No	N/A	---
NCCD (NRCS)	Performance Review System (NRCS computer system).	National Server	NRCS IT	Yes	PRS/Toolkit	NRCS will maintain their data, then have it pulled. NRCS will not upload.
Perdue Agricycle	Exel spreadsheet	Perdue Agricycle facility	Perdue Agricycle staff	No	N/A	Perdue Agricycle would prefer internal management of data, especially since it is sensitive to the business practice and protection of customer base.
Sussex Conservation District	PRS & Toolkit	National server	NRCS IT	Yes	PRS/Toolkit	SCD would input data and maintain it. Problems go to IT, SCD wants to maintain control on their data.

TABLE 9: BMP Data Sharing Limitations (Water Resources)

Organization	Sharing Limitations	How to Obtain BMP Data	Possible Stakeholder Use
Delaware Department of Agriculture: Forest Service	The only requests for data come from the 319 program. It is reported at the watershed level. Individual land owners are masked in the report.	Likely no real issue with sharing data, but would like to know more. Individual names associated with data do not need to be made public.	To provide a method of mapping and reporting to DNREC.
Delaware Department of Agriculture: Nutrient Mgmnt Comm	None identified, the data is already sent to the 319 Program on a regular basis.	Ask Steve Hollenbeck. Data is already sent to the 319 Program on a regular basis.	Looking at data on a watershed basis.
Delaware Department of Agriculture: Nutrient Mgmnt Plans	Likely would need to remove names due to privacy concerns.	For DNREC and other state agencies they can call the NMC and ask for a report. For members of the general public, it would likely involve a FOIA request.	General watershed information. Bob does not see a need for individual farm info and acreage to be available, but tracking of the number of acreage in a watershed could be helpful.
DNREC: 319 Program	Mark does not like to give up point data for structural BMPs (privacy issue) however descriptive information is not a problem. Gov't groups: data sharing is not an issue.	Just ask Mark Hogan.	DNREC perform daily updates. An outside source would connect in to retrieve data and put it into a database that others can use. Thus, instead of going to Mark, parties would just go to the database.
DNREC: Coastal Program			
DNREC: Groundwater Discharges	No real restrictions. Tend to follow the lead of DNREC Water Resources. Sharing data with state agencies is not too big an issue.	Make a FOIA request. If the request for data is too large, the applicant may be asked to narrow it down.	Access based system with information to support the project at hand.
Kent Conservation District	Privacy issues: farmers ID. FOIA request likely needed. If personal information is stripped out, it is ok to let the data go.	Likely see Mark Hogan (DNREC 319 Program), as the paper folders do not contain summary data.	Possibly adding photographs to the overall system.
NCCD (NRCS)	Specifics to a farm, by name or location is an issue, Can't give financial data, On a watershed basis, there are no issues with sharing data.	---	Tracking the acceptance of conservation practices, Calculations on nutrient management practice impacts, Input for state reports that need to be submitted.
Perdue Agricycle	Perdue Agricycle is concerned about what type of data is potentially made public as it is essentially a customer list. Data on manure removal on a watershed basis would not be as much of a problem as the customer base is masked.	It would depend on who it is, government agency would be ok. From a business perspective it really depends.	The end users (customers) are growing in number, and PA wants to protect that data. Identify how many growers are signed up as generators and end uses. Identify how many are growers / generators and not end users.

TABLE 9: BMP Data Sharing Limitations (Water Resources)

Organization	Sharing Limitations	How to Obtain BMP Data	Possible Stakeholder Use
Sussex Conservation District	Privacy issues with farmers. Don't mind sharing data but don't want to be too specific. Maps that are not to specific (ie don't tag BMPs to a parcel, but rather say there of XX of BMP YY in a watershed) would be ok.	FOIA request	Providing information for PCS & TMDLs, Simplify the reporting process by making data available to all who would need it.

TABLE 10: Software (Water Resources)

Organization	Comfortable with MS Access	Comfortable with GIS Software	Current Software in Use	IT Staff	IT Staff Size
Delaware Department of Agriculture: Forest Service	Yes	Yes	ARCView 9.2 & Access.	Yes	2 people
Delaware Department of Agriculture: Nutrient Mgmnt Comm	Yes	No	MS Access & Excel	Yes	2 people
Delaware Department of Agriculture: Nutrient Mgmnt Plans	Yes	No	MS Access & Excel	Yes	2 People
DNREC: 319 Program	Yes	Yes	ArcView 9.x & MS Access	Yes	Separate Department
DNREC: Coastal Program					
DNREC: Groundwater Discharges	Yes	Yes	Some Access, some Adabase	Yes	Separate Department
Kent Conservation District			---		---
NCCD (NRCS)	Yes	Yes	PRS & Toolkit	Yes	USDA IT
Perdue Agricycle	Yes	No	Excel	Yes	Corporate IT staff
Sussex Conservation District	Yes	Yes	PRS & Toolkit. Excel (state revolving funds)	Yes	USDA IT

Appendix 1

DNREC Best Management Practice (BMP) Assessment Questionnaire

Organization: **Phone Number:**

Point of Contact: **E-mail address:**

I. Existing BMP Information

1. What types of BMPs do you maintain?

2. Do you have an inventory listing each BMP? Is there inspection / description data associated with the listing?

3. Is background information on the BMPs (areas served, nutrient reduction observed, etc) available?

4. Are the BMPs inspected on a regular schedule?

5. How is the BMP data updated?

6. Is historical data maintained?

7. Do you have spatial (location) data for each BMP?

    a. What format is the spatial data in?

    b. What type of locational information is available (lat / long, state plane, address, etc)?

8. Have the BMPs been photographed?

    a. If so, how are the photos catalogued and associated with BMP data?

II. Data / Information storage

1. What format is BMP data stored in?

2. Where (physically) is the data stored?

3. Who is responsible for storing and maintaining the data?

4. If BMP data is stored in an electronic format, is the data linked into a Graphical User Interface (GUI)?

   a. Is so, what software is used? version?

   b. What programming language (if any) was used in building the GUI?

   c. Who built the GUI?

5. In terms of future data maintenance, would you prefer to house and maintain BMP data yourself, or have an outside entity store and maintain it?

III. Data Sharing

1. What requirements or limitations do you have in place to control the distribution and sharing of data?

2. How would an interested party go about getting a copy of your BMP data?

3. How do you envision stakeholders / end users accessing and retrieving BMP information?

IV. Hardware / Software

1. Are you comfortable using MS Access? ESRI (or other) GIS software?

2. What software are you currently using to track BMP data?

3. Do you have an IT staff? If so, how large is it?

Appendix 2

Interview Summary

Organization City of Newark

Primary POC: Mike Sistek ***Phone:*** (302) 366-7040 ***Email:*** pwoperations@newark.de.us

Secondary POC: Kelley Dinsmore ***Phone:*** (302) 366-7040 ***Email:*** kdinsmore@newark.de.us

Exisiting BMP Information

BMPs Maintained:

Mostly extended detention basins, also have some ponds, bio-swales, bio-retention, sand filters, grass filter strips and structural BMPs. Some meet pre '91 regulations and some meet post '91 regulations.

Inventory: Yes ***Inventory Comments:*** sorted by private vs Newark & pre and post 1991

Background Data: No ***Regular Inspections:*** Yes ***Inspection Frequency:*** Yearly

How data is updated: Inspectors update the master spreadsheet each year following the inspection.

Historical Data: Yes ***Historical Data Comments:*** Spreadsheet has current data. Paper records maintained.

Spatial Data: Yes ***Spatial data format:*** Typically the outfall is GPSd. DE State Plane.

Photos: Yes ***How photos are catalogued:*** Linked using a common structure ID

Data and Information Storage

Storage Format: Excel spreadsheets (inspection data) ARC 8.3 (mapping)

Storage Location: Shared City network drive ***Maintained By:*** Data: Mike Sistek & Kelley Dinsmore. Network: IT

Data Linked To a GUI: Yes ***GUI Software:*** ArcView 8.3

GUI Language: --- ***GUI Built By:*** Kelley Dinsmore

Thoughts on Future Data Maintenance:

Would like to be able to make changes locally. Local update and storage w/ periodic updates made to DNREC

Data Sharing

Data Sharing Limitations: Connecting into City computers is not likely to occur. The City connects to the web through U of D, although a new system is in discussion.

How to Obtain Data: Just ask. The spreadsheets and inspection forms were readily shared for this project. The photos and mapping files are too big to easily share.

Thoughts on Stakeholder Use:

Making all BMP data available to residents could cause problems. Perhaps make basic data available to all (locations and types) but specifics on condition and maintenance should not be shared. Newark is focused on what they own and maintain thus little interest in data out of Newark, except maybe for City fringe areas.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** 2 people

Current Software: Excell & ArcView 8.3

Interview Summary

Organization DelDOT

Primary POC: Vince Davis ***Phone:*** (302) 760-2180 ***Email:*** Vince.Davis@state.de.us

Secondary POC: Wendy Polasko ***Phone:*** (302) 760-2542 ***Email:*** Wendy.Polasko@state.de.us

Exisiting BMP Information

BMPs Maintained:

Wet ponds, dry ponds, infiltration trenches / basins, filter strips, bio-retention areas, bio-swales, sand filters, sediment forebays, check dams.

Inventory: Yes ***Inventory Comments:*** ---

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** Under Development

How data is updated: Consultants submit design data in the same format as the inventory. DelDOT has two sets of data. The first (structure) is data that is static, and not expected to change. This includes classification, dimensions, material, etc. The second (inspection) is expected to change over time, and a historical record is maintained.

Historical Data: Yes ***Historical Data Comments:*** No data will be overwritten.

Spatial Data: Yes ***Spatial data format:*** DE State Plane

Photos: Yes ***How photos are catalogued:*** By BMP # and sorted by year.

Data and Information Storage

Storage Format: Oracle

Storage Location: DelDOT server in Dover ***Maintained By:*** DelDOT OIT

Data Linked To a GUI: Yes ***GUI Software:*** ESRI based

GUI Language: JAVA, SDE ***GUI Built By:*** GeoDecisions

Thoughts on Future Data Maintenance:

DelDOT would prefer to maintain their data

Data Sharing

Data Sharing Limitations: A data request can be made, and DelDOT will determine the need. A FOIA request may be needed.

How to Obtain Data: Ask. DelDOT would be able to release the data, although a spreasheet with basic data would liklely be provided first.

Thoughts on Stakeholder Use:

A planning tool to help determine maintenance needs. Display aerial photos and the user could look to see general data (approx size, year built, flow, drainage areas).

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** 70 - 80 people

Current Software: ESRI

Interview Summary

Organization DNREC

Primary POC: Jamie Rutherford ***Phone:*** (302) 739-9921 ***Email:*** Jamie.Rutherford@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

DNREC has statewide responsibility for all state and federal projects (Schools, Post Offices, etc) as well as remediation sites and contaminated sites.

Inventory: Yes ***Inventory Comments:*** Tied to project database. It lists what BMPs are on what site.

Background Data: No ***Regular Inspections:*** No ***Inspection Frequency:*** N/A

How data is updated: Regular updates do not occur.

Historical Data: Yes ***Historical Data Comments:*** Paper Records

Spatial Data: No ***Spatial data format:*** N/A

Photos: No ***How photos are catalogued:*** N/A

Data and Information Storage

Storage Format: MS Access. It is being migrated to SQL server

Storage Location: DNREC Server ***Maintained By:*** DNREC IT

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

DNREC would prefer to maintain data themselves.

Data Sharing

Data Sharing Limitations: There are limits on who can gain access (security). There are possible FOIA requirements as well due to the presence of correspondence.

How to Obtain Data: Make a formal request, identify the data desired and DNREC would try to supply it.

Thoughts on Stakeholder Use:

Mainly internal requests, used for watershed assessments.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:***

Current Software: Access, some GIS for individual cases

Interview Summary

Organization Kent Conservation District

Primary POC: Jared Adkins ***Phone:*** (302) 741-2600 ***Email:*** Jared.adkins@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Stormwater BMPs (ponds, infiltration, bio-infil, sand filters, etc). County, Municipal and private BMPs fall under the KCD (all of Kent County except for federal and state facilities)

Inventory: Yes ***Inventory Comments:*** ---

Background Data: No ***Regular Inspections:*** Yes ***Inspection Frequency:*** Yearly

How data is updated: The Access database is updated / verified with each inspection.

Historical Data: Yes ***Historical Data Comments:*** Some data is only available on the field form

Spatial Data: Yes ***Spatial data format:*** UTM (BMP location) Lat/Long (projects)

Photos: Yes ***How photos are catalogued:*** They are stored in an electronic project file, however they are not linked to the database.

Data and Information Storage

Storage Format: MS Access

Storage Location: KCD server in Dover ***Maintained By:*** KCD Program Staff

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

No preference, as long as the data is accessible.

Data Sharing

Data Sharing Limitations: None really exist

How to Obtain Data: Request the data from the program manager

Thoughts on Stakeholder Use:

Not quite sure at this point

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** No

Comfortable wth GIS Software: Yes ***IT Staff Size:*** Rely on DNREC IT

Current Software: MS Access, some GIS

Interview Summary

Organization New Castle Conservation District

Primary POC: Don Nichols ***Phone:*** (302) 832-3100 ***Email:*** N/A

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Provide E&S review for 9 municipalities (all except Wilmington, Newark & Middletown). Existing BMPs are a grey area because a lot of the responsibility lies with HOAs or the Town / City

Inventory: Yes ***Inventory Comments:*** No inventory, however an annual report is sent to DNREC.

Background Data: No ***Regular Inspections:*** No ***Inspection Frequency:*** N/A

How data is updated: No inventory to update

Historical Data: No ***Historical Data Comments:*** N/A

Spatial Data: No ***Spatial data format:*** N/A

Photos: No ***How photos are catalogued:*** N/A

Data and Information Storage

Storage Format: Paper project files

Storage Location: NCCD building ***Maintained By:*** Don Nichols

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

No Comments

Data Sharing

Data Sharing Limitations: Has never been an issue. Nobody has ever really requested data from the NCCD. Sharing with state agencies is not an issue.

How to Obtain Data: NCCD has not received any requests, however NCCD does reply to complaints.

Thoughts on Stakeholder Use:

NCCD does not feel that what the NCCD does lends itself to a computer application. NCCD focus is construction regulation. Once the BMP is built, maint & resp. falls to the HOA or town / city.

Hardware and Software

Comfortable with MS Access: No ***IT Staff:*** No

Comfortable wth GIS Software: No ***IT Staff Size:*** N/A

Current Software: Currently not tracking data electronically

Interview Summary

Organization New Castle County

Primary POC: Mike Harris ***Phone:*** (302) 395-5806 ***Email:*** MHarris@nccde.org

Secondary POC: Ellie Mortazavi ***Phone:*** (302) 395-5802 ***Email:*** EMortazavi@nccde.org

Exisiting BMP Information

BMPs Maintained:

Sand Filters, Infiltration, Bio-retention, Bio-swales, Recharge Basins, Underground Detention, Wetlands, and Ponds.

Inventory: Yes ***Inventory Comments:*** Inspection and Description data does is maintained

Background Data: No ***Regular Inspections:*** Yes ***Inspection Frequency:*** Yearly

How data is updated: There is a physical folder for each BMP that has plans, photos, historical inspections. Data is collected on laptops and uploaded wirelessly.

Historical Data: Yes ***Historical Data Comments:*** Back to 2004

Spatial Data: Yes ***Spatial data format:*** Typically the outfall of the structure

Photos: Yes ***How photos are catalogued:*** Not directly linked to BMP data

Data and Information Storage

Storage Format: Hansen: General descriptive information. Oracle based GUI for specific BMP information.

Storage Location: NCC Government center ***Maintained By:*** NCC IT staff

Data Linked To a GUI: Yes ***GUI Software:*** ArcView 9.x

GUI Language: vb.net & Oracle ***GUI Built By:*** NCC Staff

Thoughts on Future Data Maintenance:

In house data management has several advantages, but for technical problems an outside player would be helpful.

Data Sharing

Data Sharing Limitations: FOIA is a driver. The County likes to be consistent with distribution. Sharing with another government agency is not a problem. Many BMPs are owned by an HOA or Maint. Corp so there could be some privacy issues.

How to Obtain Data: Make a FOIA request, there is a County employee who processes them

Thoughts on Stakeholder Use:

It would be helpful to have DelDOTs drainage collection system relative to the BMPs available. That would help with TMDLs as stakeholders. NCC could see private groups using the system to look for work opportunities, and that could pose a headache for maintenance corps.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** 15-30 people

Current Software: Hansen, vb.net, Oracle

Interview Summary

Organization Sussex Conservation District

Primary POC: Jessica Watson ***Phone:*** (302) 856-7219 ***Email:*** Jessica.Watson@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

The SCD does not maintain SW practices, they provide inspection services and technical support. SCD maintains a listing of projects by name, when approved. Plans would then need to be pulled to see what BMPs might be on a given site.

Inventory: No ***Inventory Comments:*** Project tracker, not a BMP tracker, not NPDES driven.

Background Data: No ***Regular Inspections:*** No ***Inspection Frequency:*** N/A

How data is updated: The database itself is not updated. Individual reports are saved as word documents.

Historical Data: No ***Historical Data Comments:*** Maintenance reports and approved plans are saved.

Spatial Data: No ***Spatial data format:*** N/A

Photos: No ***How photos are catalogued:*** N/A

Data and Information Storage

Storage Format: MS Access

Storage Location: SCD building in Georgetown ***Maintained By:*** In house staff member with DNREC IT support

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

SCD would prefer to input and maintain the data, if there are problems then they can go to IT. They would want to be able to control their data

Data Sharing

Data Sharing Limitations: Don't really have any issues sharing BMP data with other agencies. SCD would not mind working with Mosquito Control to get a better idea of which BMPs are breeding mosquitos, and which are not

How to Obtain Data: FOIA request

Thoughts on Stakeholder Use:

In support of PCS / TMDLs with info provided on nutrient loading and removal rates. Simplification of the reporting process. If data is made available to all who need it, less time may need to be spent generating reports.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** No

Comfortable wth GIS Software: Yes ***IT Staff Size:*** N/A

Current Software: MS Access

Interview Summary

Organization Town of Middletown

Primary POC: Morris Deputy ***Phone:*** (302) 378-9120 ***Email:*** mdeputy@middletownde.org

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Dry ponds, wet ponds, infiltration ponds, some structural (underground systems) swales, bio-retention

Inventory: No ***Inventory Comments:*** A BMP inventory is a priority. Getting flooded by new development.

Background Data: No ***Regular Inspections:*** No ***Inspection Frequency:*** N/A

How data is updated: Currenlty not updated.

Historical Data: No ***Historical Data Comments:*** N/A

Spatial Data: No ***Spatial data format:*** N/A

Photos: No ***How photos are catalogued:*** N/A

Data and Information Storage

Storage Format: Paper files

Storage Location: Town building ***Maintained By:***

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

Prefer to maintain BMP information locally (both inspections and the data) then upload to a separate system (outside of the Town's) for sharing and distribution. Security is the main concern (along with data integrity).

Data Sharing

Data Sharing Limitations: Do not want to let people into their network. Just ask (FOIA) and the data can be provided. Middletown is autonomous and does not share data in a digital format.

How to Obtain Data: Just ask

Thoughts on Stakeholder Use:

Provide the ability to see what others are doing, and how BMPs are performing. Look at maintenance practices and a comparison of facilities, this will help determine if Middletown is keeping up.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: No ***IT Staff Size:*** 1 full-time professional

Current Software: Currently not tracking data electronically.

Interview Summary

Organization Delaware Department of Agriculture: Forest Service

Primary POC: Glenn Gladders ***Phone:*** (302) 698-4553 ***Email:*** Glenn.gladders@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Forest Stewardship Plans (shapefiles); Timber Harvest Permitting (shapefiles); Urban Forestry Program (small component) reported as points vs areas because the areas are small (even though several trees might have been planted). All data is reported to DNREC's 319 Program.

Inventory: No ***Inventory Comments:*** Forest specific BMPs related to Timber Permits are tracked.

Background Data: Yes ***Regular Inspections:*** No ***Inspection Frequency:*** N/A

How data is updated: As permits are issued data is entered into the database. Once a year the data is rolled up to look for items that were not entered and then the data is archived.

Historical Data: Yes ***Historical Data Comments:*** Back to 2005

Spatial Data: Yes ***Spatial data format:*** ARCView 9.2, DE State Plane

Photos: No ***How photos are catelogued:*** N/A

Data and Information Storage

Storage Format: ARCView 9.2 & Access. Data is joined to the shapefiles.

Storage Location: Dover network & desktop. ***Maintained By:*** Glenn Gladders

Data Linked To a GUI: Yes ***GUI Software:*** ARCView 9.2 and Access

GUI Language: N/A ***GUI Built By:*** Glenn Gladders

Thoughts on Future Data Maintenance:

Glenn would prefer to maintain and store the data locally.

Data Sharing

Data Sharing Limitations: The only requests for data come from the 319 program. It is reported at the watershed level. Individual land owners are masked in the report.

How to Obtain Data: Likely no real issue with sharing data, but would like to know more. Individual names associated with data do not need to be made public.

Thoughts on Stakeholder Use:

To provide a method of mapping and reporting to DNREC.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** 2 people

Current Software: ARCView 9.2 & Access.

Interview Summary

Organization Delaware Department of Agriculture: Nutrient Mgmnt Comm

Primary POC: Steve Hollenbeck ***Phone:*** (302) 698-4500 ***Email:*** Steven.hollenbeck@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Poultry manure tracking. Poultry is the main contributor in DE. Manure shipping is tracked in an Access database. Shipping permits are submitted, the data is put into the d/b and later exported to Excel. In-state shipments are tracked by watershed. Out of state the source is tracked by watershed but not the destination.

Inventory: Yes ***Inventory Comments:*** Tracking of manure shipping

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** As apps are submitted

How data is updated: Data is updated as applications or claims (as the state approves funding) are submitted.

Historical Data: Yes ***Historical Data Comments:*** Back to 2001.

Spatial Data: No ***Spatial data format:*** Sources change over time.

Photos: No ***How photos are catelogued:*** N/A

Data and Information Storage

Storage Format: MS Access

Storage Location: DDA Network ***Maintained By:*** Steve Hollenbeck

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

Centralized data storage would work better, with local updating and maintenance.

Data Sharing

Data Sharing Limitations: None identified, the data is already sent to the 319 Program on a regular basis.

How to Obtain Data: Ask Steve Hollenbeck. Data is already sent to the 319 Program on a regular basis.

Thoughts on Stakeholder Use:

Looking at data on a watershed basis.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: No ***IT Staff Size:*** 2 people

Current Software: MS Access & Excel

Interview Summary

Organization Delaware Department of Agriculture: Nutrient Mgmnt Plans

Primary POC: Bob Coleman ***Phone:*** (302) 698-4556 ***Email:*** Robert.coleman@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Nutrient Management Plan Program. All farms greater than 10 acres, or 8 animal units (~30,000 chicken) must submit a NMP. DDA reimburses farmers for the cost of the plans. Plans run in 3 year cycles, either 1 3-year plan, or 3 1-year plans.

Inventory: Yes ***Inventory Comments:*** Database with farm and farmer info.

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** Random admin. Reviews

How data is updated: At the time of the application, data is updated.

Historical Data: Yes ***Historical Data Comments:*** Back to 2001

Spatial Data: No ***Spatial data format:*** N/A

Photos: No ***How photos are catelogued:*** N/A

Data and Information Storage

Storage Format: MS Access & Excel

Storage Location: DDA network ***Maintained By:*** Bob Coleman and Judy Burnes

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

DDA would prefer to maintain the data and provide updates as needed.

Data Sharing

Data Sharing Limitations: Likely would need to remove names due to privacy concerns.

How to Obtain Data: For DNREC and other state agencies they can call the NMC and ask for a report. For members of the general public, it would likely involve a FOIA request.

Thoughts on Stakeholder Use:

General watershed information. Bob does not see a need for individual farm info and acreage to be available, but tracking of the number of acreage in a watershed could be helpful.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: No ***IT Staff Size:*** 2 People

Current Software: MS Access & Excel

Interview Summary

Organization DNREC: 319 Program

Primary POC: Mark Hogan ***Phone:*** (302) 739-9922 ***Email:*** Mark.hogan@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Cover Crop data (Kent & Sussex counties), CREP (Conservation Reserve Enhancement Program), Livestock BMPs (manure storage, incinerators, composters, animal waste handling, etc), Conservation reserve program.

Inventory: Yes ***Inventory Comments:*** GIS with an Access database with shapefiles for each program.

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** Varies by program

How data is updated: CREP: Ongoing process; Cover Crop: Data updated once a year; Livestock: updated once every six months. Data is provided to Mark, and he updates the GIS / database.

Historical Data: Yes ***Historical Data Comments:*** Back to about 1999

Spatial Data: Yes ***Spatial data format:*** Shapefiles, ArcGIS. DE State Plane

Photos: No ***How photos are catelogued:*** N/A

Data and Information Storage

Storage Format: ESRI with MS Access back-up

Storage Location: DNREC Network. Data on local drive. ***Maintained By:*** DNREC IT

Data Linked To a GUI: Yes ***GUI Software:*** ArcGIS 9.x

GUI Language: N/A ***GUI Built By:*** Glenn Gladders

Thoughts on Future Data Maintenance:

Maintain in house, share the data.

Data Sharing

Data Sharing Limitations: Mark does not like to give up point data for structural BMPs (privacy issue) however descriptive information is not a problem. Gov't groups: data sharing is not an issue.

How to Obtain Data: Just ask Mark Hogan.

Thoughts on Stakeholder Use:

DNREC perform daily updates. An outside source would connect in to retrieve data and put it into a database that others can use. Thus, instead of going to Mark, parties would just go to the database.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** Separate Department

Current Software: ArcView 9.x & MS Access

Interview Summary

Organization DNREC: Coastal Program

Primary POC: Marcia Fox ***Phone:*** (302) 739-9282 ***Email:*** Marcia.fox@state.de.us

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

The coastal program is a federal program that operates a little outside of the state agencies. They do not maintain any BMP data, and have turned tracking over to other groups.

Inventory: ***Inventory Comments:***

Background Data: ***Regular Inspections:*** ***Inspection Frequency:***

How data is updated:

Historical Data: ***Historical Data Comments:***

Spatial Data: ***Spatial data format:***

Photos: ***How photos are catelogued:***

Data and Information Storage

Storage Format:

Storage Location: ***Maintained By:***

Data Linked To a GUI: ***GUI Software:***

GUI Language: ***GUI Built By:***

Thoughts on Future Data Maintenance:

Data Sharing

Data Sharing Limitations:

How to Obtain Data:

Thoughts on Stakeholder Use:

Hardware and Software

Comfortable with MS Access: ***IT Staff:***

Comfortable wth GIS Software: ***IT Staff Size:***

Current Software:

Interview Summary

Organization DNREC: Groundwater Discharges

Primary POC: Dave Schepens ***Phone:*** (302) 739-9948 ***Email:*** Dave.schepens@state.de.us

Secondary POC: Ron Graeber ***Phone:*** (302) 739-9948 ***Email:*** Ronald.Graeber@state.de.us

Exisiting BMP Information

BMPs Maintained:

On site waste water systems of all sizes (incl. spray irrigation): Over 80,000 on site septic systems, Several hundred > 2,500 gpd; Underground injection control program.

Inventory: Yes ***Inventory Comments:*** Some file folders, some MS Access, some Adabase

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** >2500 gpd: yearly

How data is updated: Field techs perform inspections and update the database. Some is done remotely in the field, some in the office. Report forms are entered into the "non-haz" database.

Historical Data: Yes ***Historical Data Comments:*** ---

Spatial Data: Yes ***Spatial data format:*** Only on larger systems, DE State Plane.

Photos: Yes ***How photos are catelogued:*** In general, photos are not linked to the data.

Data and Information Storage

Storage Format: MS Access, Adabase, file folders. Data being migrated to SQL server.

Storage Location: Dover & Georgetown ***Maintained By:*** Groundwater Discharges section staff.

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

Dave would prefer for his group to manage and maintain the data, then upload it to a master system.

Data Sharing

Data Sharing Limitations: No real restrictions. Tend to follow the lead of DNREC Water Resources. Sharing data with state agencies is not too big an issue.

How to Obtain Data: Make a FOIA request. If the request for data is too large, the applicant may be asked to narrow it down.

Thoughts on Stakeholder Use:

Access based system with information to support the project at hand.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** Separate Department

Current Software: Some Access, some Adabase

Interview Summary

Organization Kent Conservation District

Primary POC: Tim Riley ***Phone:*** (302) 741-2600 ***Email:*** Timothy.riley@state.de.us

Secondary POC: Paula Long ***Phone:*** (302) 741-2600 ***Email:*** Paula.long@state.de.us

Exisiting BMP Information

BMPs Maintained:

The KCD does not really maintain BMP data on programs of their own. Instead, they support farmers that are tasked with meeting requirements. The data then goes to the appropriate agency to track.

Inventory: No ***Inventory Comments:*** ---

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** varies by BMP

How data is updated: No real updates, as things don't really change that much.

Historical Data: Yes ***Historical Data Comments:*** ---

Spatial Data: Yes ***Spatial data format:*** ---

Photos: Yes ***How photos are catelogued:*** Stormwater BMPs only.

Data and Information Storage

Storage Format: File folders.

Storage Location: District facility ***Maintained By:*** KCD staff

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

Data Sharing

Data Sharing Limitations: Privacy Issues: farmers ID. FOIA request likely needed. If personal information is stripped out, it is ok to let the data go.

How to Obtain Data: Likely see Mark Hogan (DNREC 319 Program), as the paper folders do not contain summary data.

Thoughts on Stakeholder Use:

Possibly adding photographs to the overall system.

Hardware and Software

Comfortable with MS Access: ***IT Staff:***

Comfortable wth GIS Software: ***IT Staff Size:*** ---

Current Software: ---

Interview Summary

Organization NCCD (NRCS)

Primary POC: Marianne Hardesty ***Phone:*** (302) 832-3100 ***Email:*** Marianne.hardesty@de.usda.gov

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

Cover Crop Data, Horse Pastures and loading, No till Data, Some cost share from SWM, Some riparian buffers in urban areas, Filter Strips, Some E&S measures at the edge of Ag lands, Fragmites Control.

Inventory: ***Inventory Comments:*** Can only pull data at the HUC 8 level. Reporting mechanism:PRS.

Background Data: No ***Regular Inspections:*** No ***Inspection Frequency:*** On construction & randomly

How data is updated: Data is entered into Toolkit / PRS by field office.

Historical Data: Yes ***Historical Data Comments:*** In Toolkit, does not migrate to PRS.

Spatial Data: Yes ***Spatial data format:*** Lat/Long

Photos: Yes ***How photos are catelogued:*** Some have been photographed.

Data and Information Storage

Storage Format: Performance Review System (NRCS computer system).

Storage Location: National Server ***Maintained By:*** NRCS IT

Data Linked To a GUI: Yes ***GUI Software:*** PRS/Toolkit

GUI Language: N/A ***GUI Built By:*** NRCS

Thoughts on Future Data Maintenance:

NRCS will maintain their data, then have it pulled. NRCS will not upload.

Data Sharing

Data Sharing Limitations: Specifics to a farm, by name or location is an issue, Can't give financial data, On a watershed basis, there are no issues with sharing data.

How to Obtain Data: ---

Thoughts on Stakeholder Use:

Tracking the acceptance of conservation practices, Calculations on nutrient management practice impacts, Input for state reports that need to be submitted.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** USDA IT

Current Software: PRS & Toolkit

Interview Summary

Organization Perdue Agricycle

Primary POC: Heather Comegys ***Phone:*** (302) 943-2732 ***Email:*** Heather.comegys@perdue.com

Secondary POC: Wayne Hudson ***Phone:*** (410) 543-3919 ***Email:*** Wayne.hudson@perdue.com

Exisiting BMP Information

BMPs Maintained:

Tracks of the amount of waste taken from sites and the ultimate destination whether in or out of state. They serve most of the Kent and Sussex farming community (~1,400 farms.) PA does not have data on nutrient management plans, or if they are current. PA is told yes or no on if a plan exists, but not the expiration date.

Inventory: Yes ***Inventory Comments:*** Information to build a service map exists, it is sensitive business infor

Background Data: Yes ***Regular Inspections:*** No ***Inspection Frequency:*** N/A

How data is updated: PA weighs trucks when they deliver to the plant, that data is used to track loading. Grower info (data about the farm) is updated at time of service.

Historical Data: Yes ***Historical Data Comments:*** Back to 2001

Spatial Data: No ***Spatial data format:*** Database has farm addresses.

Photos: No ***How photos are catelogued:*** N/A

Data and Information Storage

Storage Format: Exel spreadsheet

Storage Location: Perdue Agricycle factility ***Maintained By:*** Perdue Agricycle staff

Data Linked To a GUI: No ***GUI Software:*** N/A

GUI Language: N/A ***GUI Built By:*** N/A

Thoughts on Future Data Maintenance:

Perdue Agricycle would prefer internal management of data, especially since it is sensitive to the business practice and protection of customer base.

Data Sharing

Data Sharing Limitations: Perdue Agricycle is concerned about what type of data is potentially made public as it is essentially a customer list. Data on manure removal on a watershed basis would not be as much of a problem as the customer base is masked.

How to Obtain Data: It would depend on who it is, government agency would be ok. From a business perspective it really depends.

Thoughts on Stakeholder Use:

The end users (customers) are growing in number, and PA wants to protect that data. Identify how many growers are signed up as generators and end uses. Identify how many are growers / generators and not end users.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: No ***IT Staff Size:*** Corporate IT staff

Current Software: Excel

Interview Summary

Organization Sussex Conservation District

Primary POC: Debbie Absher ***Phone:*** (302) 856-3990 ***Email:*** Debbie.Absher@de.nacdnet.net

Secondary POC: ***Phone:*** ***Email:***

Exisiting BMP Information

BMPs Maintained:

SCD provides technical and financial assistance, they are not regulatory.

Inventory: Yes ***Inventory Comments:*** Reports are made to the EPA on a watershed basis, there is a list of in

Background Data: Yes ***Regular Inspections:*** Yes ***Inspection Frequency:*** ---

How data is updated: Data is entered into PRS and the NRCS Customer Toolkit.

Historical Data: ***Historical Data Comments:***

Spatial Data: Yes ***Spatial data format:*** site not BMP specific. DE State Plane.

Photos: No ***How photos are catelogued:*** N/A

Data and Information Storage

Storage Format: PRS & Toolkit

Storage Location: National server ***Maintained By:*** NRCS IT

Data Linked To a GUI: Yes ***GUI Software:*** PRS/Toolkit

GUI Language: N/A ***GUI Built By:*** NRCS

Thoughts on Future Data Maintenance:

SCD would input data and maintain it. Problems go to IT, SCD wants to maintain control on their data.

Data Sharing

Data Sharing Limitations: Privacy issues with farmers. Don't mind sharing data but don't want to be too specific. Maps that are not to specific (ie don't tag BMPs to a parcel, but rather say there of XX of BMP YY in a watershed) would be ok.

How to Obtain Data: FOIA request

Thoughts on Stakeholder Use:

Providing information for PCS & TMDLs, Simplify the reporting process by making data available to all who would need it.

Hardware and Software

Comfortable with MS Access: Yes ***IT Staff:*** Yes

Comfortable wth GIS Software: Yes ***IT Staff Size:*** USDA IT

Current Software: PRS & Toolkit. Excel (state revolving funds)

Appendix B: Irrigated Land Methodology

Irrigated Land Area Update Methodology – Summer 2013

Work Group:

DNREC: Bryan Bloch, Tyler Monteith, Regina Kukola
UD Extension Office: James Adkins (adkins@udel.edu)

Objective:

The acreage of irrigated land was calculated in July 2010 based on Google Earth Imagery by James Adkins. This project was an update to this dataset based on 2012 imagery in ArcGIS.

Methodology:

- An original dataset of irrigated land was established based on 2010 imagery by James Adkins
    - Polylines were drawn to identify irrigation systems on Delaware lands
    - These polylines were converted to polygon features in ArcGIS in order to calculate the acreage of these areas
    - These polygons were labeled as "July 3/4 2010" in the Imagery field of the databse
- As an update, a new data layer was created using 2012 imagery to track more current irrigation area
    - A grid was overlaid on the 2012 state land imagery to establish easier areas of examination (figure 1)
    - The 2010 data set of polygons was pulled in for reference
    - At a 1:4000 scale, each grid area was examined to determine where current irrigation practices existed
        - Irrigation practices that were still in existence from the 2010 set were copied to the 2012 Irrigation layer (the "July 3/4 2010" in the Imagery field remained to allow for a query of 2010 data and newly created 2012 data)
        - New irrigation practices not found in the 2010 layer were created as new polygon features. These were tagged with "2012" in the Imagery field to

allow for a query of new data
    - A "Source" field was created to indicate who inputted the data (figure 3)
    - Some of the original 2010 data was adjusted via clipping/cutting tools in order to eliminate overlapping polygons
- A geometry calculation was run in order to update the acreage of irrigated land based on the 2012 update.

Reporting:

- The updated geodatabase of 2012 irrigated land was sent to James Adkins at the UD Extension office at the end of August
- This data will be submitted as part of the Chesapeake Bay Submissions

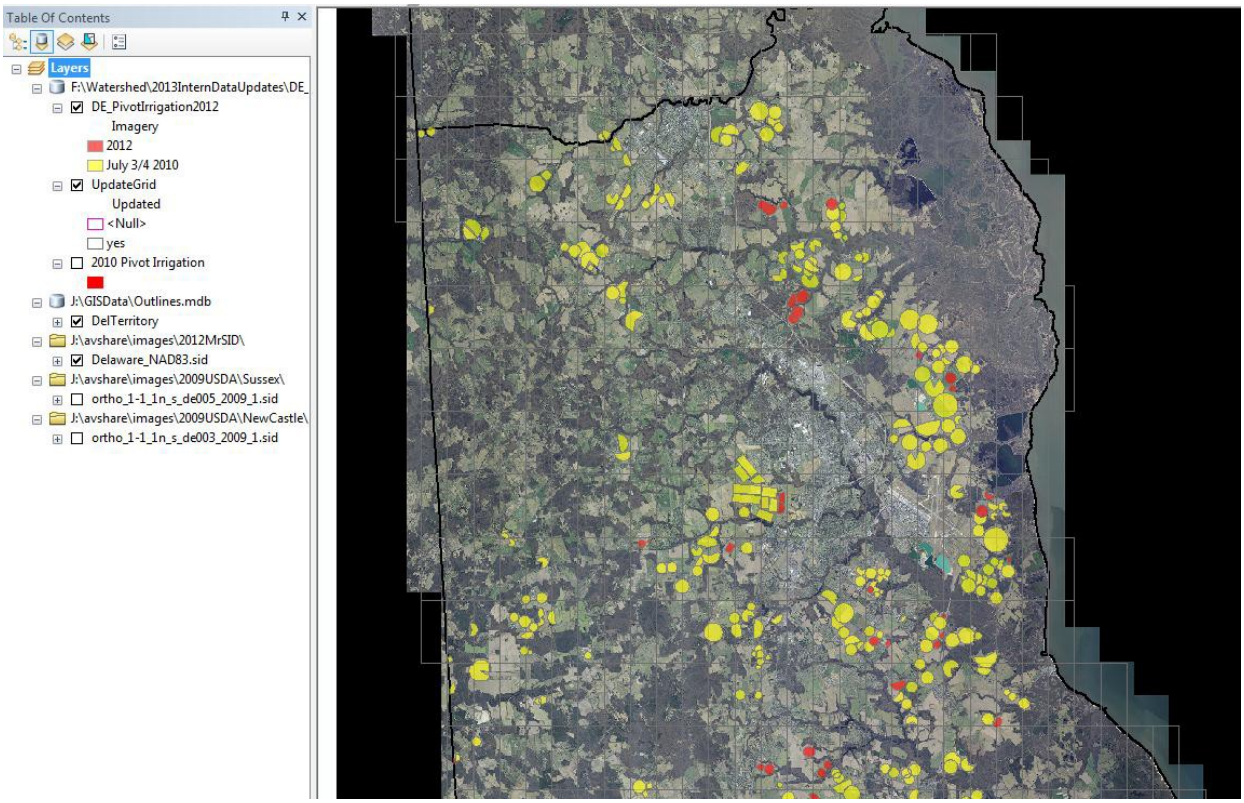


Figure 1. ArcMap layers of 2010 and 2012 irrigation areas overlaid on 2012 imagery, as seen at a county level scale.

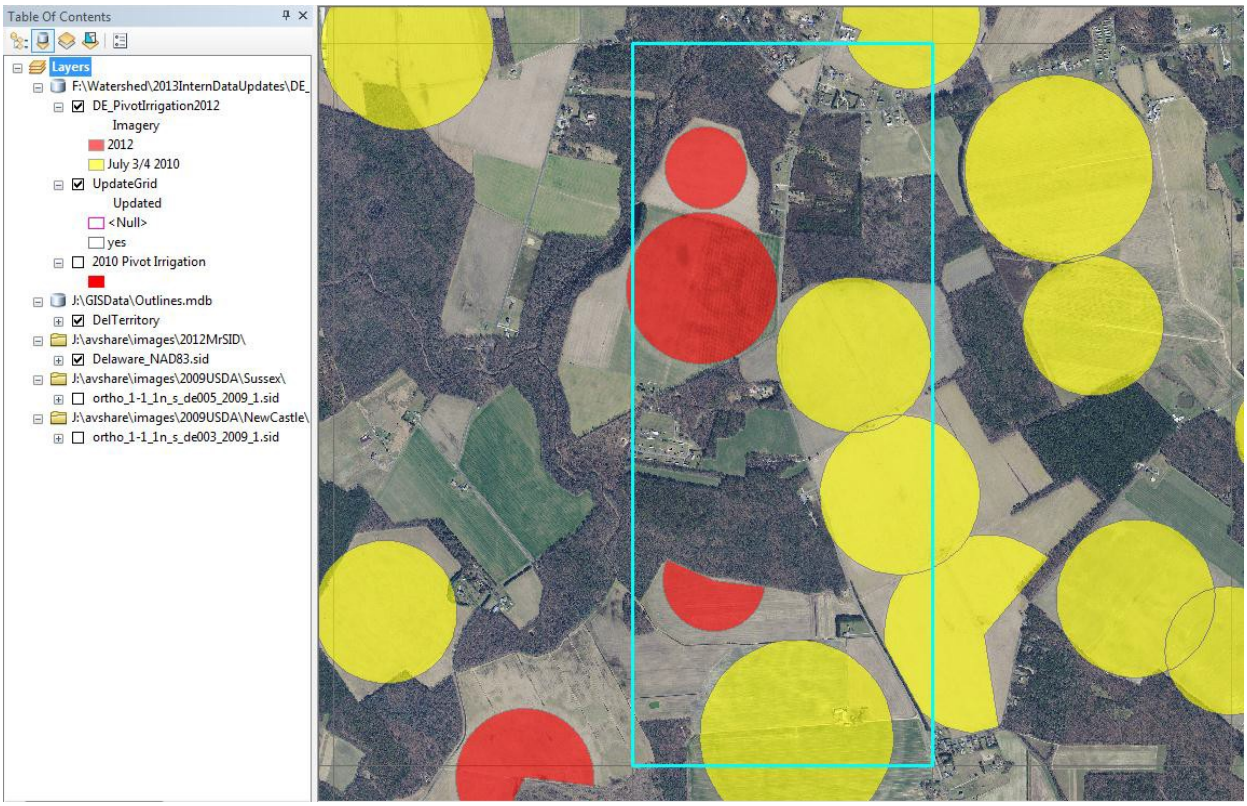


Figure 2. ArcMap layers of 2010 and 2012 irrigation areas overlaid on 2012 imagery, as seen as a single grid for identification.

DE_PivotIrrigation2012

OBJECTID *	SHAPE *	Name	Acres	Imagery	Source
210	Polygon	4-00-05900-01-3900-00001	73.920111	2012	Tyler Monteith DNREC
211	Polygon	4-00-05900-01-3900-00001	19.935138	2012	Tyler Monteith DNREC
1075	Polygon	43000500000800	24.414754	2012	Tyler Monteith DNREC
1274	Polygon	43001000001100	34.824472	2012	Tyler Monteith DNREC
1266	Polygon	43001200000600	78.534268	2012	Tyler Monteith DNREC
1271	Polygon	43001200001700	22.257856	2012	Tyler Monteith DNREC
1446	Polygon	43001500001400	8.307385	2012	Regina Kukola DNREC
1403	Polygon	43001600005300	9.157029	2012	Regina Kukola DNREC
1395	Polygon	43001700000800	46.009661	2012	Regina Kukola DNREC
1401	Polygon	43002000000800	34.639432	2012	Regina Kukola DNREC
1549	Polygon	43002000002900	27.819366	2012	Regina Kukola DNREC
1394	Polygon	43002100000900	23.365799	2012	Regina Kukola DNREC
2324	Polygon	43200500001700	9.491977	2012	Tyler Monteith DNREC
2310	Polygon	43200500002100	26.436543	July 3/4 2010	Tyler Monteith DNREC
2309	Polygon	43200500002101	12.528447	July 3/4 2010	Tyler Monteith DNREC
2533	Polygon	43201000001102	19.223816	2012	Tyler Monteith DNREC
2501	Polygon	43201000002109	7.632534	2012	Tyler Monteith DNREC
2514	Polygon	43201000002400	14.954527	2012	Tyler Monteith DNREC
2553	Polygon	43201100001800	14.051841	July 3/4 2010	Tyler Monteith DNREC
2551	Polygon	43201100001802	10.585684	July 3/4 2010	Tyler Monteith DNREC
2554	Polygon	43201100002100	15.489202	July 3/4 2010	Tyler Monteith DNREC
2549	Polygon	43201100002500	8.716343	July 3/4 2010	Tyler Monteith DNREC
2550	Polygon	43201100002500	7.158534	July 3/4 2010	Tyler Monteith DNREC
2552	Polygon	43201100002500	9.481264	July 3/4 2010	Tyler Monteith DNREC
2548	Polygon	43201100003300	40.830238	July 3/4 2010	Tyler Monteith DNREC
2544	Polygon	43201100004500	49.211055	2012	Tyler Monteith DNREC

Figure 3. The attribute table of the 2012 irrigation layer showing the imagery year used, acreage, and source of who inputted the data.

Appendix C: Water Control Structure Methodology

Report for Water Control Structures Project – Summer 2013

Team Members:

Bryan Bloch (Initial Database Creation and GIS work)

Regina Kukola (Site Prioritization, Site Visit Scheduling, Field Work) Tyler Monteith (Field Work, GIS work for updated GPS points)

Ryan Hendry (Field Work)

Contact info:

Delaware Dept. of Natural Resources and Environmental Control Division of Watershed Stewardship; Watershed Assessment Section 302-739-9939

Objective:

The purpose of this project was to update a database of water control structures (WCS) from the Sussex County Conservation District (SCD). These structures were implemented and funded by the SCD and therefore, have been verified in the past. This project focused on data verification for reporting purposes. Primarily, we were interested in ground-truthing the GPS data for the structures. Our goal for the summer was to visit all 42 WCS listed in the database that were located within the Chesapeake Bay Basin.

Summary:

Water control structures provide controlled drainage to tax ditches in agricultural fields throughout the state of Delaware. Controlling water drainage from fields has important water quality implications. Discharge waters from fields with drainage control have been observed contain significantly less nitrates than discharge waters from fields with uncontrolled drainage. There are two mechanisms for this reduction in nitrate concentrations: 1. Water control structures reduce the total output of water leaving a field by 20 to 30% on average, and 2. the installation of water control structures raises the water table, and increases denitrification, which results in lower nitrate concentration in drainage waters (Osmund et al. 2002). All the structures discussed in this project report were funded by the Sussex County Conservation District.

By using a database supplied by the SCD and an ArcMap of the SCD database created by Bryan Bloch, we were able to create a list of 42 WCS in the Chesapeake Bay Basin in Sussex County that we needed to ground truth with GPS data. We met with Kip Foskey, a Planner at the SCD. He provided us with contact information for the private landowners that owned the land on which the 42 WCS were located. We called these private

landowners to get their permission to visit the WCS. Of 23 landowners, we were able to successfully contact 20: 17 landowners were willing to give us permission to enter their properties this August, 2 were willing to give us permission after their summer crop seasons were over, and 1 did not give us permission this summer.

The 17 landowners that gave us permission to visit their properties owned 21 of the 42 WCS in the Chesapeake Basin in Sussex County. We attempted to visit a total of 21 WCS over 4 field days in August and were able to successfully locate and obtain GPS information for 16 WCS. We then created a GIS document containing the GPS data we had collected.

If we contact landowners who were willing to allow us access in the fall or winter later this year, we can increase our site visits from 21 to 34. Also, Senior Conservation Planner, Kip Foskey (302-856-3990, ext. 114,kip.foskey@de.nacdnet.net) is trying to get in touch with the 3 landowners we were not able to contact this summer. If these landowners give us permission to enter their property, we could increase our site visits by 5. The only landowner who did not give us permission to enter their property wanted to talk to Kip about our visit first. There is a chance that he might decide to allow us access to his 3 WCS after speaking with Kip.

The focus of this summer was to get information for all of the WCS in the Chesapeake Bay Basin. However, by repeating our methodology, information could be obtained for WCS statewide. If this methodology were to be repeated, we would recommend getting in touch with landowners ASAP and setting up field days to visit sites at least 2-3 weeks in advance to when phone calls are first made. Successfully making contact with landowners frequently took multiple calls, sometimes over the span of several weeks.

Contents of Expanded Narrative:

Expanded Narrative:

Late June – Met with SCD to discuss project

We met with Chip and Director of Agriculture Programs, Debbie Absher (302-856-3990, ext. 110; Debbie.Absher@de.nacdnet.net) from the Sussex County Conservation District to discuss the project**. All of the**

water control structures were on private land, so we needed to contact the land owners individually to ask for permission to visit the structure. They showed us a paper filing system of information about the water control structures and landowner contact information in the District's office. Debbie suggested that working with a planner from the Conservation District would be the easiest way to get access to the water control structures on private land. Consulting the paper database ended up not being necessary, because **we were able to obtain contact information for landowners from Kip Foskey, the SCD Planner with whom we collaborated.**

Mid July – Obtained ArcMap version of SCD Database

We consulted with Bryan Bloch about the map he created from the Sussex County Conservation District's water control structure database. (J:\ChesBayProj\WCS\WCSMap1). The sum for the entire county was 169. Debbie and Bryan could only locate 114 of the 169 (SCD_WCS

layer). The number is low because some of the properties were located and point placed on the property but not the individual WCS's since some properties have multiple WCS on them or location was not found at all. Bryan also went through the database to try and aerially determine the location of some structures. In the SCD_WCSMap1 attribute table field named "20" any point that reads Bryan Bloch was moved from its original location to a place that appeared more likely to have a water control structure by Bryan. Points that read original were not moved from their initial locations. For points that have read either "Bryan Bloch – check" or "original- check", Bryan was not able to determine the placement of the structure aerially.

Mid July – Developed Prioritization system for visiting WCS

From Bryan's work, we were able to determine the HUCs of the different WCS. We created a system to prioritize our visits of the structures, because we knew it would logistically be very difficult to visit every WCS in the database by the end of summer. Our prioritized list of WCS can be found at (F:\Watershed\2013InternDataUpdates\WCS_Verification\WCS priorities). A key to understanding the color coding in the document is below:

1st Priority – In the Chesapeake Bay and Bryan was unable to aerially infer structure's location
2nd Priority – In the Chesapeake Bay and Bryan was able to aerially infer structure's location
3rd Priority – Outside the Chesapeake Bay and Bryan was unable to aerially infer structure's location
4th Priority – Outside the Chesapeake Bay and Bryan was able to aerially infer structure's location

Our goal for the summer was to ground truth all of our 1st and 2nd priority structures (N = 42).

Mid July to End of July - Contacted Debbie Absher from SCD to obtain contact info for SCD planner to assist with contacting landowners, and Debbie provided contact info for SCD planner Kip Foskey.

In mid-July, we contacted Debbie for contact information for a SCD planner to assist us in gaining permission to WCS on private landowners' properties. Due to state fair, she was unable to supply us with contact information for a SCD planner until the end of July.

Early August – Met with Kip to discuss contacting landowners

At the SCD office, Kip was able to supply us with Sussex Count mapping system maps of the different WCS. He also provided us with phone numbers of the landowners with WCS in the Chesapeake Bay Basin. An updated spreadsheet that reflects this contact info that Kip gave us can be found at F:\Watershed\2013InternDataUpdates\WCS_Verification\WCS information. (Note: WCS outside of the Chesapeake Basin are hidden rows. Rows without color fill are WCS we were able to visit.)

Early August – Began contacting Landowners to visit WCS

Overall, landowners were very willing to allow us to come on their property and take GPS data points. However, there were a few landowners we were either unable to reach or could not give us access:

- We are still waiting on permission from WCS 6 owner.
- We attempted to contact WCS 8 owner on 8/2, 8/5, 8/14, 8/19, and 8/26 with no response
- We attempted to call WCS 13 owner on 8/2, 8/5, 8/14, 8/19, and 8/26 with no response
- We attempted to call WCS #17 owner on 8/2, 8/5, 8/13, 8/19, 8/21, 8/26
- WCS 17 is currently not accessible because of soy bean planting. In November, it will be accessible, and the owner would be willing to schedule a time for someone to come out to the WCS
- WCS 2 & 5 are currently not accessible because of corn planting. Once harvested, the owner would be willing to schedule a time for someone to come out to the WCS. This should be a higher priority because the SCD database has both properties listed as having 6 separate WCS each.

August – Visited WCS & Results (the data used to create these graphs is in WCS information.xls):

Overall, **we spent 4 days in the field visiting a total of 21 WCS**. Most commonly, we weren't able to visit sites because of accessibility issues due to plantings (Fig. 1).

We were able to obtain GPS data points for 16 of the 21 sites we visited (Fig. 2).

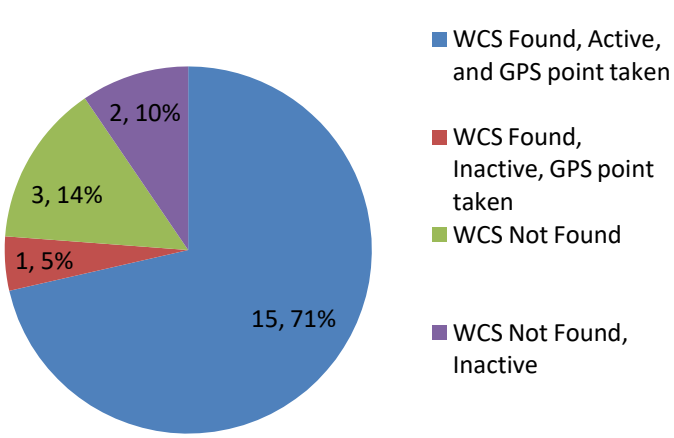


Figure 1: Pie Graph showing successful data point collection

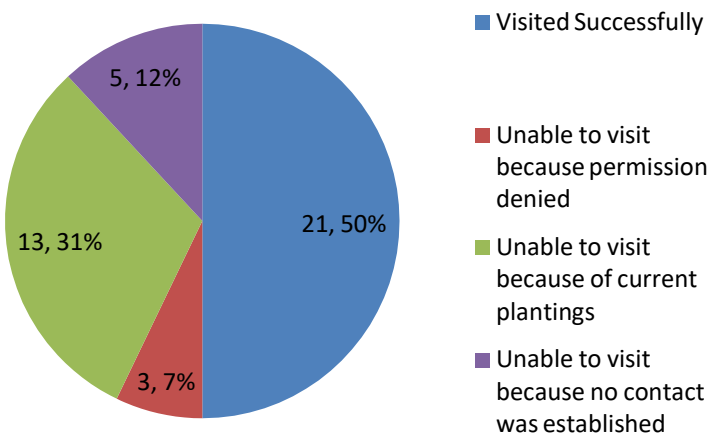


Figure 2: Pie Graph showing successful site visits

References:

Osmond, D.L., J.W. Gilliam and R.O. Evans. 2002. Riparian Buffers and Controlled Drainage to Reduce Agricultural Nonpoint Source Pollution, North Carolina Agricultural Research Service Technical Bulletin 318, North Carolina StateUniversity, Raleigh, NC.

Appendix D: Forest Harvesting Methodology

Forestry Harvested Area Update Methodology – Summer 2013

Work Group:

DNREC: Bryan Bloch, Tyler Monteith, Regina Kukola
Forest Service: Sam Topper (sam.topper@state.de.us)

Objective:

The purpose of this project was to update forest harvest area data collected by the Delaware Forest Service to include ArcGIS coverage through the digitization of harvested forest areas. The digitization of these harvest areas are then linked to an Access database containing all permit information, creating a spatial reference. These files are located on a server at the Redden State Forest Office. This will also allow for the reporting of these harvests for inclusion in the Chesapeake Bay Model.

Methodology:

- Examined the current status of harvested forest areas comparing the contents of the Access Database (containing all information on the harvest permits) to the attribute table of the DDAForest_HarvestArea layer (containing the shapefiles of harvested areas already in existence)
    - Permits were categorized as being in the Access database but without a shapefile (our main task), those in both the Access File and had a shapefile (what is up-to-date), and those that had a shapefile but did not exist in the Access database (DDA's task to update)
    - An excel file of the Access Database can be found at (F:)Watershed/2013InternDataUpdates/TimberHarvestPermits/Harvest_permits
- Shapefiles were created for harvest permits in Access Database
    - Identified all permit numbers lacking shapefiles
    - Used the hard copy of the harvest permit for reference. These documents were housed in the Forest Service office in Redden State Forest.
    - Used information from the permit and ArcMap layers in order to spatially locate the harvested area including:
        - Parcel/tax ID, Forest cover, historic aerial photography, hardcopy map of harvested area, nearest intersection, etc., as seen in figure 2.
    - Started an editing session in ArcMap using DDAForest_HarvestArea as the target and outlined the harvested area as identified in permit, using a scale of

approximately 1:4,000

- Once that shapefile was created, the attribute table for that shapefile was edited to include information on the updated shapefile, as seen in figure 3.
    - LinkField was added, composed of capital letter county followed by 4 digit year, 2 digit month, and 2 digit day based from the permit (ex. S20130701)
        - This field links the shapefile to the Access Database and automatically populates the remaining fields
    - Forester Initials – initials of forester responsible for the permit, found in permit
    - Year of permit
    - County permit was issued
    - Date that the shapefile was entered (day/month/year)
    - Username of person entering the data
    - The acres field will be populated through a calculated geometry calculator function after all shapefiles have been created
- Once all possible shapefiles were created, the calculate geometry tool was used in order to calculate the acreage of each harvested area for reporting purposes
- HUC12 codes were determined by importing a HUC12 data layer to do an intersect for determining which HUC12 each shape file was located in
    - Once determined, these locations were joined to the DDAForest_HarvestArea layer

- Some permits lacked sufficient information to effectively locate harvested area
    - A "nearest intersection" field was used to attempt to identify the harvested area
        - Some fields were able to be estimated based on size and historical land imagery changes between years
        - For those with too vague of descriptions, HUC12 Codes were generated
            - A list of HUC Codes for these parcels can be found at (F:)Watershed/2013InternDataUpdates/TimberHarvestPermits/Forestry_HUC_codes
        - 51 files were unable to, at minimum, determine a HUC code due to lack of sufficient information, as seen in figure 4.
- 12 permit shapefiles (.5% of all permits) were found in the DDAForest_harvestarea GIS layer, but do not exist in the Access Database.
    - A list of these permits was created and given to the Sam Topper for them to correct
    - Since the files exist as shapefiles in GIS, it will not affect our results
- An excel file of the progress of the project containing a list of permits divided by county, and the status of those parcels is located

(F:)Watershed/2013InternDataUpdates/TimberHarvestPermits/Forestry_database_progress

Reporting:

For our purpose of reporting these practices for inclusion in the Bay Model, the template found at (F:)\Watershed\Chesapeake Bay\ContractorSupport\Tetra Tech\FY12 Deliverables\NEIEN methodology\2012_NEIEN Data.zip was used as a reference for the information needed for reporting, as seen in figure 5. A final version of the reporting spreadsheet can be found at (F:)Watershed/2013InternDataUpdates/TimberHarvestPermits/Timber_harvest_parcel_submission. The general template was mirrored, as mentioned above. Some parcels were located in multiple HUCs. For these, the portion of acreage in each corresponding HUC was calculated and reported in the Measure_value column. For fields that we were unable to create a shapefile, but were able to locate the associated HUC, the acreage reported came from the "Treated Area" recorded on the harvesting permit. The date located in the "BMP_EVENT_STATUS_CODE_DATE" column came from the implementation date found on the original harvest permits. If no implementation date was on the permit, the date that the permit was processed was used.

Figure 1: The ArcMap layer "DDAForest_HarvestArea" contains the shapefiles of harvested forest, indicated by the red outlines.

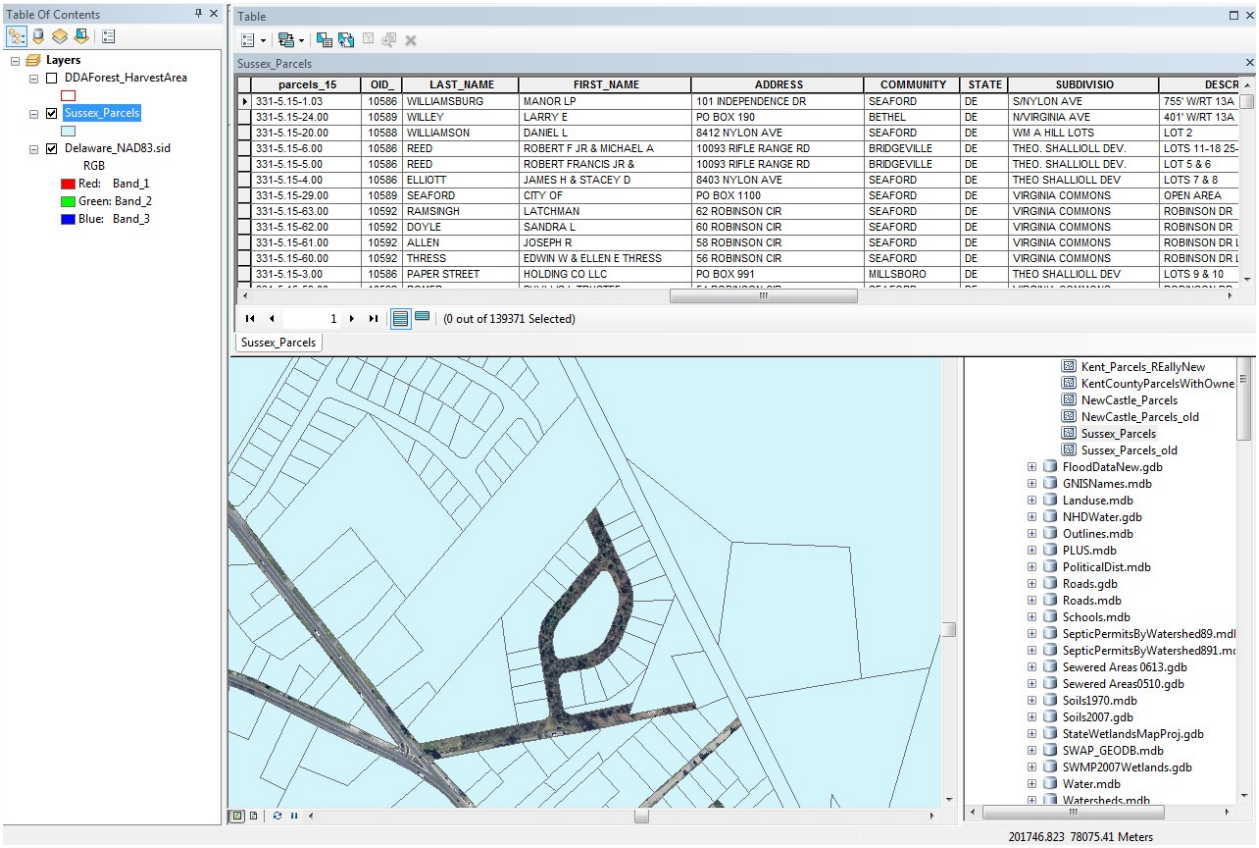
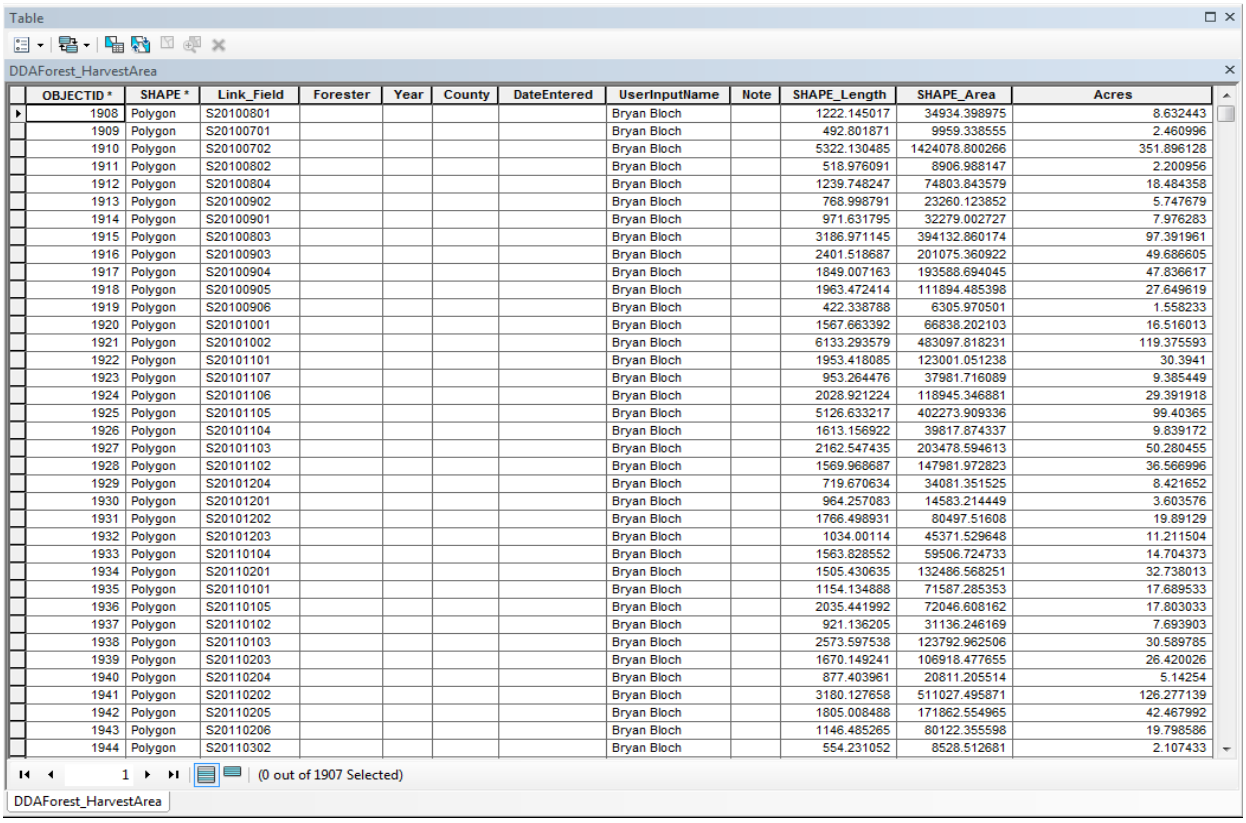


Figure 2: ArcMap layers including county parcels and historic aerial photography were used to locate the harvested area.



Table

DDAForest_HarvestArea

OBJECTID *	SHAPE *	Link_Field	Forester	Year	County	DateEntered	UserInputName	Note	SHAPE_Length	SHAPE_Area	Acres
1908	Polygon	S20100801					Bryan Bloch		1222.145017	34934.398975	8.632443
1909	Polygon	S20100701					Bryan Bloch		492.801871	9959.338555	2.460996
1910	Polygon	S20100702					Bryan Bloch		5322.130485	1424078.800266	351.896128
1911	Polygon	S20100802					Bryan Bloch		518.976091	8906.988147	2.200956
1912	Polygon	S20100804					Bryan Bloch		1239.748247	74803.843579	18.484358
1913	Polygon	S20100902					Bryan Bloch		768.998791	23260.123852	5.747679
1914	Polygon	S20100901					Bryan Bloch		971.631795	32279.002727	7.976283
1915	Polygon	S20100803					Bryan Bloch		3186.971145	394132.860174	97.391961
1916	Polygon	S20100903					Bryan Bloch		2401.518687	201075.360922	49.686605
1917	Polygon	S20100904					Bryan Bloch		1849.007163	193588.694045	47.836617
1918	Polygon	S20100905					Bryan Bloch		1963.472414	111894.485398	27.649619
1919	Polygon	S20100906					Bryan Bloch		422.338788	6305.970501	1.558233
1920	Polygon	S20101001					Bryan Bloch		1567.663392	66838.202103	16.516013
1921	Polygon	S20101002					Bryan Bloch		6133.293579	483097.818231	119.375593
1922	Polygon	S20101101					Bryan Bloch		1953.418085	123001.051238	30.3941
1923	Polygon	S20101107					Bryan Bloch		953.264476	37981.716089	9.385449
1924	Polygon	S20101106					Bryan Bloch		2028.921224	118945.346881	29.391918
1925	Polygon	S20101105					Bryan Bloch		5126.633217	402273.909336	99.40365
1926	Polygon	S20101104					Bryan Bloch		1613.156922	39817.874337	9.839172
1927	Polygon	S20101103					Bryan Bloch		2162.547435	203478.594613	50.280455
1928	Polygon	S20101102					Bryan Bloch		1569.968687	147981.972823	36.566996
1929	Polygon	S20101204					Bryan Bloch		719.670634	34081.351525	8.421652
1930	Polygon	S20101201					Bryan Bloch		964.257083	14583.214449	3.603576
1931	Polygon	S20101202					Bryan Bloch		1766.498931	80497.51608	19.89129
1932	Polygon	S20101203					Bryan Bloch		1034.00114	45371.529648	11.211504
1933	Polygon	S20110104					Bryan Bloch		1563.828552	59506.724733	14.704373
1934	Polygon	S20110201					Bryan Bloch		1505.430635	132486.568251	32.738013
1935	Polygon	S20110101					Bryan Bloch		1154.134888	71587.285353	17.689533
1936	Polygon	S20110105					Bryan Bloch		2035.441992	72046.608162	17.803033
1937	Polygon	S20110102					Bryan Bloch		921.136205	31136.246169	7.693903
1938	Polygon	S20110103					Bryan Bloch		2573.597538	123792.962506	30.589785
1939	Polygon	S20110203					Bryan Bloch		1670.149241	106918.477655	26.420026
1940	Polygon	S20110204					Bryan Bloch		877.403961	20811.205514	5.14254
1941	Polygon	S20110202					Bryan Bloch		3180.127658	511027.495871	126.277139
1942	Polygon	S20110205					Bryan Bloch		1805.008488	171862.554965	42.467992
1943	Polygon	S20110206					Bryan Bloch		1146.485265	80122.355598	19.798586
1944	Polygon	S20110302					Bryan Bloch		554.231052	8528.512681	2.107433

1 (0 out of 1907 Selected)

DDAForest_HarvestArea

Figure 3: The DDAForest_HarvestArea attribute table containing the fields that need entering after a shapefile for the harvested area has been created.

O	P	Q	R	S	T	U	V	W
AcresTreated	TotalWoodlandAcres	County	Taxparcel	PropertyLocation	Clearcut	SelectionCut	Thinning	Other
15	15	Sussex		North of State road 363 and South of Road 362 near Bethany Beach	TRUE	FALSE	FALSE	FALSE
83.69999695	83.69999695	Sussex		Anderson's Corner, east of Route 5 just south of Harbeson	TRUE	FALSE	FALSE	FALSE
161	277	Sussex		South Side of C. R. 407, 1 mile south of Millsboro, DE T520 Houston	TRUE	FALSE	FALSE	FALSE
0	0	Sussex			FALSE	FALSE	FALSE	FALSE
9	9	Kent		East side of Route 15	FALSE	TRUE	FALSE	FALSE
46	204	Sussex		West of and fronting on C. R. 504, 2250 feet south of C. R. 508 Wright	TRUE	FALSE	FALSE	FALSE
20	20	Sussex		West side of US 13, just south of C. R. 454A	TRUE	FALSE	FALSE	FALSE
25	25	Sussex		West of Bethel, South side of Route 78	TRUE	FALSE	FALSE	FALSE
30	48	Sussex		North side of, but not fronting on C. R. 494, 6 miles west of Laurel	TRUE	FALSE	FALSE	FALSE
6.5	16	Sussex		North side of, but not fronting on C. R. 494, 6 miles west of Laurel	TRUE	FALSE	FALSE	FALSE
18	18	Kent		Southwest side of Burrsville Road	FALSE	TRUE	FALSE	FALSE
7.800000191	7.800000191	Kent		West side of C. R. 352 at owners residence	FALSE	TRUE	FALSE	FALSE
68	75	Sussex		C. R. 31, 2 miles west of RT 404	TRUE	FALSE	FALSE	FALSE
6	6	Sussex		Bridgeville/Federalsburg Road at Atlantic Cross Roads	TRUE	FALSE	FALSE	FALSE
10	0	Sussex	1-31-8-2	Intersection of C. R. 572 and 569	TRUE	FALSE	FALSE	FALSE
4	5	New Castle		Oak Hill School Road and Black Stallion Road	TRUE	FALSE	FALSE	FALSE
4.5	4.5	Kent		Irish Hill Road	FALSE	TRUE	FALSE	FALSE
17.10000038	17.10000038	Kent		North of C. R. 44	FALSE	TRUE	FALSE	FALSE
45	45	Sussex		T-551 Donovan East side of C. R. 246, app. 1000 feet north of C. R. 245	TRUE	FALSE	FALSE	FALSE
16	16	Sussex	231-19-13	German Road, both sides, just south of Old Furnace Road	FALSE	TRUE	FALSE	FALSE
30	92	Sussex		North of C. R. 244, off C. R. 246	TRUE	FALSE	FALSE	FALSE
27	119	Sussex		South side of C. R. 297 and east of C. R. 305	TRUE	FALSE	FALSE	FALSE
48	48	Sussex		South of State Route 24 and east of Whaleys Crossroads	FALSE	FALSE	TRUE	FALSE
15	55	Sussex		Route 30 and Route 252	FALSE	FALSE	TRUE	FALSE
12	30	Sussex		Route 30, one mile south of Route 9 on the east side of the road.	FALSE	TRUE	FALSE	FALSE
110	129	Sussex		Northeast and southwest sides of Road 320, 1,200 feet west of Road 295	TRUE	FALSE	FALSE	FALSE
19	19	Sussex		West side of C. R. 501, north of C. R. 515	TRUE	FALSE	FALSE	FALSE
15	15	Sussex		West of Route 62, north side of Route 451	FALSE	FALSE	TRUE	FALSE
140	140	Kent		East side of C. R. 279, north of Whitelysburg Road, west of Harrington	TRUE	FALSE	FALSE	FALSE
20	35	Kent		At owners Residence	FALSE	TRUE	FALSE	FALSE
9	10	Sussex		South of C. R. 407 near Dagsboro	TRUE	FALSE	FALSE	FALSE
12	0	Kent		Westville & Almshouse Roads, just west of Jenkins Airport	FALSE	TRUE	FALSE	FALSE
40	40	Kent		West of, but not joining Gravesend Road, approximately 1/2 mile north of th	FALSE	FALSE	TRUE	TRUE
14	14	New Castle			FALSE	TRUE	FALSE	FALSE
15	20	New Castle			FALSE	TRUE	FALSE	FALSE

Figure 4: Some parcels had missing information that made their location too vague to effectively locate, such as missing tax ID's or property location descriptions.

A	B	C	D	E	F	G
NPS_BMPNAME	NPS_BMP_MEASUREVALUE	NPS_BMP_MEASURENAME	NPS_BMP_MEASUREUNITCODE	NPS_BMP_MEASUREUNITNAME	HUC12_CODE	D_S_NAME
Tree Planting - these are old - see update tree planting spreadsheet	13.4	Area Planted	ACRE	Acres	020801090404	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	85.8	Area Planted	ACRE	Acres	020801090401	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	69.0	Area Planted	ACRE	Acres	020801090101	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	11.9	Area Planted	ACRE	Acres	020801090101	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	163.6	Area Planted	ACRE	Acres	020801090301	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	1.4	Area Planted	ACRE	Acres	020600050202	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	10.3	Area Planted	ACRE	Acres	020801090204	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	5.4	Area Planted	ACRE	Acres	020801090201	DDA_Forestry
Tree Planting - these are old - see update tree planting spreadsheet	17.2	Area Planted	ACRE	Acres	020801090201	DDA_Forestry
Forest Harvesting Practices	6.0	Acres	ACRE	Acres	020801090401	DDA_Forestry
Forest Harvesting Practices	30.0	Acres	ACRE	Acres	020801090202	DDA_Forestry
Forest Harvesting Practices	8.0	Acres	ACRE	Acres	020801090204	DDA_Forestry
Forest Harvesting Practices	14.0	Acres	ACRE	Acres	020801090205	DDA_Forestry
Forest Harvesting Practices	5.0	Acres	ACRE	Acres	020801110201	DDA_Forestry
Forest Harvesting Practices	43.0	Acres	ACRE	Acres	020801090201	DDA_Forestry
Forest Harvesting Practices	0.7	Acres	ACRE	Acres	020801090303	DDA_Forestry
Forest Harvesting Practices	39.0	Acres	ACRE	Acres	020801090402	DDA_Forestry
Forest Harvesting Practices	9.0	Acres	ACRE	Acres	020801090405	DDA_Forestry
Forest Harvesting Practices	10.0	Acres	ACRE	Acres	020801090405	DDA_Forestry
Forest Harvesting Practices	12.0	Acres	ACRE	Acres	020801090202	DDA_Forestry
Forest Harvesting Practices	14.0	Acres	ACRE	Acres	020801090406	DDA_Forestry
Forest Harvesting Practices	3.0	Acres	ACRE	Acres	020801090303	DDA_Forestry
Forest Harvesting Practices	26.0	Acres	ACRE	Acres	020801090205	DDA_Forestry
Forest Harvesting Practices	18.0	Acres	ACRE	Acres	020801090504	DDA_Forestry
Forest Harvesting Practices	33.0	Acres	ACRE	Acres	020600020401	DDA_Forestry
Forest Harvesting Practices	12.0	Acres	ACRE	Acres	020600020402	DDA_Forestry
Forest Harvesting Practices	23.0	Acres	ACRE	Acres	020600020401	DDA_Forestry
Forest Harvesting Practices	81.0	Acres	ACRE	Acres	020600050203	DDA_Forestry
Forest Harvesting Practices	159.0	Acres	ACRE	Acres	020600050205	DDA_Forestry
Forest Harvesting Practices	2.0	Acres	ACRE	Acres	020600050203	DDA_Forestry
Forest Harvesting Practices	9.0	Acres	ACRE	Acres	020600050202	DDA_Forestry
Forest Harvesting Practices	39.0	Acres	ACRE	Acres	020600050201	DDA_Forestry
Forest Harvesting Practices	11.0	Acres	ACRE	Acres	020600050201	DDA_Forestry
Forest Harvesting Practices	4.0	Acres	ACRE	Acres	020600050202	DDA_Forestry
Forest Harvesting Practices	4.0	Acres	ACRE	Acres	020600050202	DDA_Forestry
Forest Harvesting Practices	64.0	Acres	ACRE	Acres	020600020402	DDA_Forestry
Forest Harvesting Practices	4.0	Acres	ACRE	Acres	020801090301	DDA_Forestry
Forest Harvesting Practices	90.0	Acres	ACRE	Acres	020600050201	DDA_Forestry
Forest Harvesting Practices	35.0	Acres	ACRE	Acres	020600050201	DDA_Forestry

Figure 5: This file was used as the basis for what information was needed for reporting purposes to the Bay Program.

Appendix E: Septic Connection Methodology

Septic System Abandonment and Count for the Chesapeake Bay Geographic Information Systems Methodology – November 2013

Delaware Department of Natural Resources and Environmental Control

(DNREC) Watershed Assessment and Management Section (WAS): Bryan Bloch Groundwater Discharges Section (GWDS): Ron Graeber and Dave Schepens

Objective: The purpose of this project was to update the septic connection data collected by the Ground Water Discharges Section to include ArcGIS coverage. This analysis is based on the assumption that anyone paying for sewer service is using central sewer; therefore, anyone who pays for sewer should be connected to central sewer. Billing data was acquired from municipalities and cross-referenced with GWDS septic database - Delaware Environmental Network (DEN).

Methodology:

- Examined current data to compare septic counts within the Chesapeake Bay Watershed. Data used includes:
    - GWDS DEN query (including system abandonment reason connection to central sewer)
    - 2012 Imagery
    - Google Imaging Services
    - Municipal Sewer Districts/Area (06/2013)
    - Grid 1.5 mile X 1.5 mile (489 total cells to verify)
    - County parcels-vacant/non-vacant
    - Billing Addresses or Parcel Provided by
        - Bridgeville
        - Seaford
        - Sussex County
        - Kent County-EDU'S attached
            - Still in need of data from the following municipalities:

- Laurel
- Delmar
- New Castle
- Middletown
- Farmington
- Greenwood
- Harrington

- Linked municipal or county sewer billing data to tax parcels-geocoded addresses:
  - If EDU'S were attached to data that was amended to parcel attribute
    - If not, assumed dwelling was one EDU, or count of dwellings on one parcel

- Using the DEN onsite point data, areas within sewer billing area, assumed connected to central sewer. EDU data was attached.
- Points were created for those parcels found to be paying for sewer services and were not found in DEN. Using 2012 imagery, points were created on the sewer service parcels.
- These data will be compiled and submitted for inclusion in the 2013 Chesapeake Bay Submission.
- Some issues were encountered when analyzing the data but were rectified:
  - Some parcels did not completely match county/municipal data
  - Geocoding addresses made it tough at time to figure which dwelling was on sewer (Bridgeville)
  - Abandoned dwellings viewing with aerial imagery, use imagery and google and parcel data if applicable to determine vacant or not
  - Data has yet to be mapped from billing data from

some areas. DEN Issues:

1. The DEN database is used to track permits
2. Duplicates must be removed
3. Other permit statuses must be updated
4. Cannot determine if prior septic systems have been abandoned or connected to sewer.
5. can't assume a specific permit status since data has not been entered in completely for all parcels, so must look one by one or digitize)

Future Recommendations:

- The State of Delaware needs a central septic tracking database. Not just for permits but for septics, sewer connections, abandonments, and

pump-outs.

- Each septic record should be recorded with lat/long and number of EDU'S connected to sewer.
- GPS actual septic system location when installed or when a Class H inspection is done if applicable rather than a point being created based on the centroid of a given parcel.

Billing Contact Information:

Municipality	**Contact Name**	**Phone**	**Email**
Bridgeville	Jesse Savage- Town Manager April Buckler-Billing	302-337-7135	jsbridgeville@gmail.com abuckler@ddmg.net
Seaford	Sharon Drugash-Payroll Berley Mears-Director of Public Works	302-629-8307	sdrugash@seafordde.com
Sussex County	John Norris Buddy Lynch	Public Works 302-854-5396	blynch@sussexcountyde.gov
Kent County	Hans Medlar-Public Works Zach Lawson-GIS	302-744-2430	publicworks@co.kent.de.us Zach.Lawson@co.kent.de.us
Laurel	James Foskey-Public Works Jamie Smith- Operations Manager	302-875-2277	laurelpwd@comcast.net laurelop@comcast.net
Delmar			
New Castle			
Middletown			
Farmington			
Greenwood			
Harrington			

Appendix F: Mapping of Jurisdiction BMP Verification Protocol Components to the Relevant QAPP Sections

Table F-1. Mapping of Jurisdiction BMP Verification Protocol Components to the Relevant QAPP Sections – Agriculture.

Sector:	Agriculture	
	BMP Verification Component	**QAPP Section**
1	**BMP's Collected**	
	Type (structural, management, annual, etc.)	Verification Design Protocol Tables Cover Crops 2.1.1.1 Conservation Plans 2.1.2.1 Nutrient Management Plans 2.1.3.1 Manure Relocation 2.1.4.1 Conservation Tillage 2.1.5.1 Multi-Year Animal BMPs 2.1.6.1 Multi-Year Land BMPs 2.1.7.1
	BMP Funding/Cost shared (federal, state, NGO, non-cost shared)	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Distinct state standards/specifications	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Matching CBP BMP definition/efficiencies	Spreadsheet: NEIEN NPS BMP CBP Section 10.1.1
2	**Method/System of Verification/Assessment**	
	Description of methods/systems to be used	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Documentation of procedures used to verify BMPs	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2

		Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Instruction manual for system users	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
3	**Who Will Complete the Verification**	
	Qualification requirements	Cover Crops Conservation Plans Nutrient Management Plans Manure Relocation Conservation Tillage Multi-Year Animal BMPs Multi-Year Land BMPs
	Training requirements	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Certification requirements	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	CEU follow-up training requirements in the future	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
4	**Documentation of Verification Finding**	
	Date of installation	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2

	Location (lat/long if applicable)	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Level of reporting (watershed, HUC, county, sitespecific, etc.)	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Units (number, acres, length, etc.) needed for NEIEN	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Ownership (public, private)	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Documentation:	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Pictures	N/A
	Worksheets	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Multi-Year Animal BMPs 2.1.6.2
	Electronic Tool	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2

	Aerial Photos	N/A
	Maps	N/A
	Other	N/A
	Report Generator	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
5	**How Often Reviewed (Cycle of review)**	
	1-2 years	Verification Design Protocol Tables Cover Crops 2.1.1.1 Conservation Plans 2.1.2.1 Nutrient Management Plans 2.1.3.1 Manure Relocation 2.1.4.1 Conservation Tillage 2.1.5.1
	5 years	Verification Design Protocol Tables Multi-Year Animal BMPs 2.1.6.1 Multi-Year Land BMPs 2.1.7.1
	10 years	Verification Design Protocol Tables Multi-Year Animal BMPs 2.1.6.1 Multi-Year Land BMPs 2.1.7.1
	Other	N/A
6	**Independent Verification of Finding**	
	Is this a requirement?	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	Internal Independent	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2 Multi-Year Land BMPs 2.1.7.2
	External Independent	Cover Crops 2.1.1.2 Conservation Plans 2.1.2.2 Nutrient Management Plans 2.1.3.2 Manure Relocation 2.1.4.2 Conservation Tillage 2.1.5.2 Multi-Year Animal BMPs 2.1.6.2

		Multi-Year Land BMPs 2.1.7.2
	BMP Data Validation	
7	**Quality Assurance/Spot Checking**	
	Who-qualifications/training/certification	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Method to select BMP for follow-up check	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Method to select the number of BMPs to review	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Other	N/A
8	**Data Entry of BMP Implementation**	
	What is the system?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Who enters data (training/certification)?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Does the system connect to NEIEN?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3

		Multi-Year Land BMPs 2.1.7.3
	System in place prevent double counting	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
9	**External Provided Data Validation Meeting CBP Partnership Guidance**	
	Method to validate data	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Who will validate data (training/certification)?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
10	**Historic Data Verification**	
	System to re-certify or remove	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Who will verify historic data training/certification)?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Documentation of action	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3

	BMP Performance	
11	**Does state collect data to assess BMP Performance?**	
	System used to collect BMP performance data?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Who collects BMP performance data?	Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3
	Who analyzes collected data and report to CBP?	Figure 1 Cover Crops 2.1.1.3 Conservation Plans 2.1.2.3 Nutrient Management Plans 2.1.3.3 Manure Relocation 2.1.4.3 Conservation Tillage 2.1.5.3 Multi-Year Animal BMPs 2.1.6.3 Multi-Year Land BMPs 2.1.7.3

Source: Derived from Table 7 in CBP 2014.

Table F-2. Mapping of Jurisdiction BMP Verification Protocol Components to the Relevant QAPP Sections – Forestry

Sector:	Forestry	
	BMP Verification Component	**QAPP Section**
1	**BMP's Collected**	
	Type (structural, management, annual, etc.)	Tables D2.2.1.1 and D2.2.2.1 Verification Design Protocol
	BMP Funding/Cost shared (federal, state, NGO, non-cost shared)	Inspection fee. But may need additional database development funding with increasing data requirements.
	Distinct state standards/specifications	Section D2.2.1.2
	Matching CBP BMP definition/efficiencies	Spreadsheet: NEIEN NPS BMP CBP Data Flow (Appendix8.26_01032014)
2	**Method/System of Verification/Assessment**	
	Description of methods/systems to be used	Tables D2.2.1.1 and D2.2.2.1 - Verification Design Protocol
	Documentation of procedures used to verify BMPs	Section D2.2.1.2
	Instruction manual for system users	Section D2.2.1.2
3	**Who Will Complete the Verification**	
	Qualification requirements	Section D2.2.1.2
	Training requirements	Section D2.2.1.2
	Certification requirements	Section D2.2.1.2
	CEU follow-up training requirements in the future	Section D2.2.1.2
4	**Documentation of Verification Finding**	
	Date of installation	Section D2.2.1.2
	Location (lat/long if applicable)	Section D2.2.1.2 - see maintenance checklist
	Level of reporting (watershed, HUC, county, sitespecific, etc.)	Section D2.2.1.2 - see maintenance checklist
	Units (number, acres, length, etc.) needed for NEIEN	Section D2.2.1.2
	Ownership (public, private)	Section D2.2.1.2 - see maintenance checklist
	Documentation:	
	Pictures	n/a
	Worksheets	Section D2.2.1.2 - see maintenance checklist
	Electronic Tool	n/a

	Aerial Photos	n/a
	Maps	n/a
	Other	Section D2.2.1.2 - see maintenance checklist
	Report Generator	Section D2.2.1.2
5	**How Often Reviewed (Cycle of review)**	
	1-2 years	Tables D2.2.1.1 and D2.2.2.1 Verification Design Protocol
	5 years	Tables D2.2.1.1 and D2.2.2.1 Verification Design Protocol
	10 years	Tables D2.2.1.1 and D2.2.2.1 Verification Design Protocol
	Other	Tables D2.2.1.1 and D2.2.2.1 - Verification Design Protocol
6	**Independent Verification of Finding**	
	Is this a requirement?	Section D2.2.1.2
	Internal Independent	Section D2.2.1.2
	External Independent	Section D2.2.1.2
	BMP Data Validation	
7	**Quality Assurance/Spot Checking**	
	Who-qualifications/training/certification	Section D2.2.1.3
	Method to select BMP for follow-up check	Section D2.2.1.3
	Method to select the number of BMPs to review	Section D2.2.1.3
	Other	Section D2.2.1.3
8	**Data Entry of BMP Implementation**	
	What is the system?	Section D2.2.1.3
	Who enters data (training/certification)?	Section D2.2.1.3
	Does the system connect to NEIEN?	Section D2.2.1.3
	System in place prevent double counting	Section D2.2.1.3
9	**External Provided Data Validation Meeting CBP Partnership Guidance**	
	Method to validate data	Section D2.2.1.3
	Who will validate data (training/certification)?	Section D2.2.1.3
10	**Historic Data Verification**	
	System to re-certify or remove	Section D2.2.1.3
	Who will verify historic data training/certification)?	Section D2.2.1.3

	Documentation of action	Section D2.2.1.3
	BMP Performance	
11	**Does state collect data to assess BMP Performance?**	
	System used to collect BMP performance data?	Section D2.2.1.3
	Who collects BMP performance data?	Section D2.2.1.3
	Who analyzes collected data and report to CBP?	Section D2.2.1.3

Source: Derived from Table 7 in CBP 2014.

Table F-3. Mapping of Jurisdiction BMP Verification Protocol Components to the Relevant QAPP Sections – Restoration.

Sector:	Restoration	
	BMP Verification Component	**QAPP Section**
1	**BMP's Collected**	
	Type (structural, management, annual, etc.)	Tables D2.3.1.1 and D2.3.2.1 Verification Design Protocol
	BMP Funding/Cost shared (federal, state, NGO, non-cost shared)	Section D2.3.1.2 and D2.3.2.2
	Distinct state standards/specifications	Section D2.3.1.2 and D2.3.2.2
	Matching CBP BMP definition/efficiencies	Spreadsheet: NEIEN NPS BMP CBP Data Flow (Appendix8.26_01032014)
2	**Method/System of Verification/Assessment**	
	Description of methods/systems to be used	Tables D2.3.1.1 and D2.3.2.1 Verification Design Protocol
	Documentation of procedures used to verify BMPs	Section D2.3.1.2 and D2.3.2.2
	Instruction manual for system users	Section D2.3.1.2 and D2.3.2.2
3	**Who Will Complete the Verification**	
	Qualification requirements	Section D2.3.1.2 and D2.3.2.2
	Training requirements	Section D2.3.1.2 and D2.3.2.2
	Certification requirements	Section D2.3.1.2 and D2.3.2.2
	CEU follow-up training requirements in the future	Section D2.3.1.2 and D2.3.2.2
4	**Documentation of Verification Finding**	
	Date of installation	Section D2.3.1.2 and D2.3.2.2
	Location (lat/long if applicable)	Section D2.3.1.2 and D2.3.2.2
	Level of reporting (watershed, HUC, county, sitespecific, etc.)	Section D2.3.1.2 and D2.3.2.2
	Units (number, acres, length, etc.) needed for NEIEN	Section D2.3.1.2 and D2.3.2.2
	Ownership (public, private)	Section D2.3.1.2 and D2.3.2.2
	Documentation:	Section D2.3.1.2 and D2.3.2.2
	Pictures	N/A
	Worksheets	Section D2.3.1.2 and D2.3.2.2
	Electronic Tool	Section D2.3.1.2 and D2.3.2.2
	Aerial Photos	n/a
	Maps	n/a

	Other	n/a
	Report Generator	Section D2.3.1.2 and D2.3.2.2
5	**How Often Reviewed (Cycle of review)**	
	1-2 years	
	5 years	
	10 years	Tables D2.3.1.1 and D2.3.2.1 Verification Design Protocol
	Other	
6	**Independent Verification of Finding**	
	Is this a requirement?	Section D2.3.1.2 and D2.3.2.2
	Internal Independent	Section D2.3.1.2 and D2.3.2.2
	External Independent	Section D2.3.1.2 and D2.3.2.2
	BMP Data Validation	
7	**Quality Assurance/Spot Checking**	
	Who-qualifications/training/certification	Section 2.3.2.3
	Method to select BMP for follow-up check	Section 2.3.2.3
	Method to select the number of BMPs to review	Section 2.3.2.3
	Other	Section 2.3.2.3
8	**Data Entry of BMP Implementation**	
	What is the system?	Section 2.3.2.3
	Who enters data (training/certification)?	Section 2.3.2.3
	Does the system connect to NEIEN?	Section 2.3.2.3
	System in place prevent double counting	Section 2.3.2.3
9	**External Provided Data Validation Meeting CBP Partnership Guidance**	
	Method to validate data	Section 2.3.2.3
	Who will validate data (training/certification)?	Section 2.3.2.3
10	**Historic Data Verification**	
	System to re-certify or remove	Section 2.3.2.3
	Who will verify historic data training/certification)?	Section 2.3.2.3
	Documentation of action	Section 2.3.2.3
	BMP Performance	
11	**Does state collect data to assess BMP Performance?**	

	System used to collect BMP performance data?	Section 2.3.2.3
	Who collects BMP performance data?	Section 2.3.2.3
	Who analyzes collected data and report to CBP?	Section 2.3.2.3

Table F-4. Mapping of Jurisdiction BMP Verification Protocol Components to the Relevant QAPP Sections – Stormwater.

Sector:	Stormwater	
	BMP Verification Component	**QAPP Section**
1	**BMP's Collected**	
	Type (structural, management, annual, etc.)	Tables D2.4.1.1 and D2.4.2.2 Verification Design Protocol
	BMP Funding/Cost shared (federal, state, NGO, non-cost shared)	Inspection fee. But may need additional database development funding with increasing data requirements.
	Distinct state standards/specifications	Section D2.4.1 and D2.4.2
	Matching CBP BMP definition/efficiencies	Spreadsheet: NEIEN NPS BMP CBP Data Flow (Appendix8.26_01032014)
2	**Method/System of Verification/Assessment**	
	Description of methods/systems to be used	Tables D2.4.1.1 and D2.4.2.2 Verification Design Protocol
	Documentation of procedures used to verify BMPs	Section D2.4.1.2 and D2.4.2.2 and D2.4.3.2
	Instruction manual for system users	Section D2.4.1.2 and D2.4.2.2 and D2.4.3.2
3	**Who Will Complete the Verification**	
	Qualification requirements	Section D2.4.1.2 and D2.4.2.2 and D2.4.3.2
	Training requirements	Section D2.4.1.2 and D2.4.2.2 and D2.4.3.2
	Certification requirements	Section D2.4.1.2 and D2.4.2.2 and D2.4.3.2
	CEU follow-up training requirements in the future	Section D2.4.1.2 and D2.4.2.2 and D2.4.3.2
4	**Documentation of Verification Finding**	
	Date of installation	Section D2.4.1 and D2.4.2
	Location (lat/long if applicable)	Section D2.4 - see maintenance checklist
	Level of reporting (watershed, HUC, county, sitespecific, etc.)	Section D2.4 - see maintenance checklist
	Units (number, acres, length, etc.) needed for NEIEN	Section D2.4
	Ownership (public, private)	Section D2.4 - see maintenance checklist
	Documentation:	
	Pictures	n/a

	Worksheets	Section D2.4 - see maintenance checklist
	Electronic Tool	n/a
	Aerial Photos	n/a
	Maps	n/a
	Other	Section D2.4 - see maintenance checklist
	Report Generator	Section D2.4
5	**How Often Reviewed (Cycle of review)**	
	1-2 years	Tables D2.4.1.1 and D2.4.2.2 Verification Design Protocol
	5 years	Tables D2.4.1.1 and D2.4.2.2 Verification Design Protocol
	10 years	Tables D2.4.1.1 and D2.4.2.2 Verification Design Protocol
	Other	Tables D2.4.1.1 and D2.4.2.2 Verification Design Protocol
6	**Independent Verification of Finding**	
	Is this a requirement?	Section D2.4.1.2 and D2.4.2.2
	Internal Independent	Section D2.4.1.2 and D2.4.2.2
	External Independent	Section D2.4.1.2 and D2.4.2.2
	BMP Data Validation	
7	**Quality Assurance/Spot Checking**	
	Who-qualifications/training/certification	Section D2.4.1.3 and D2.4.2.3
	Method to select BMP for follow-up check	Section D2.4.1.3 and D2.4.2.3
	Method to select the number of BMPs to review	Section D2.4.1.3 and D2.4.2.3
	Other	Section D2.4.1.3 and D2.4.2.3
8	**Data Entry of BMP Implementation**	
	What is the system?	Section D2.4.1.3 and D2.4.2.3
	Who enters data (training/certification)?	Section D2.4.1.3 and D2.4.2.3
	Does the system connect to NEIEN?	Section D2.4.1.3 and D2.4.2.3
	System in place prevent double counting	Section D2.4.1.3 and D2.4.2.3
9	**External Provided Data Validation Meeting CBP Partnership Guidance**	
	Method to validate data	Section D2.4.1.3 and D2.4.2.3
	Who will validate data (training/certification)?	Section D2.4.1.3 and D2.4.2.3
10	**Historic Data Verification**	

	System to re-certify or remove	Section D2.4.1.3 and D2.4.2.3
	Who will verify historic data training/certification)?	Section D2.4.1.3 and D2.4.2.3
	Documentation of action	Section D2.4.1.3 and D2.4.2.3
	BMP Performance	
11	**Does state collect data to assess BMP Performance?**	
	System used to collect BMP performance data?	Section D2.4.1 and D2.4.2
	Who collects BMP performance data?	Section D2.4.1 and D2.4.2
	Who analyzes collected data and report to CBP?	Section D2.4.1 and D2.4.2

Table F-5. Mapping of Jurisdiction BMP Verification Protocol Components to the Relevant QAPP Sections – Wastewater.

Sector:	Wastewater	
	BMP Verification Component	**QAPP Section**
1	**BMP's Collected**	
	Type (structural, management, annual, etc.)	Tables D2.5.1.1 Verification Design Protocol
	BMP Funding/Cost shared (federal, state, NGO, non-cost shared)	Inspection fee. But may need additional database development funding with increasing data requirements.
	Distinct state standards/specifications	Section D2.5.1.2
	Matching CBP BMP definition/efficiencies	Spreadsheet: NEIEN NPS BMP CBP Data Flow (Appendix8.26_01032014)
2	**Method/System of Verification/Assessment**	
	Description of methods/systems to be used	Tables D2.5.1.1 - Verification Design Protocol
	Documentation of procedures used to verify BMPs	Section D2.5.1.2
	Instruction manual for system users	Section D2.5.1.2
3	**Who Will Complete the Verification**	
	Qualification requirements	Section D2.5.1.2
	Training requirements	Section D2.5.1.2
	Certification requirements	Section D2.5.1.2
	CEU follow-up training requirements in the future	Section D2.5.1.2
4	**Documentation of Verification Finding**	
	Date of installation	Section D2.5.1.2
	Location (lat/long if applicable)	Section D2.5.1.2 - see maintenance checklist
	Level of reporting (watershed, HUC, county, sitespecific, etc.)	Section D2.5.1.2 - see maintenance checklist
	Units (number, acres, length, etc.) needed for NEIEN	Section D2.5.1.2
	Ownership (public, private)	Section D2.5.1.2 - see maintenance checklist
	Documentation:	
	Pictures	n/a
	Worksheets	Section D2.5.1.2 - see maintenance checklist
	Electronic Tool	n/a

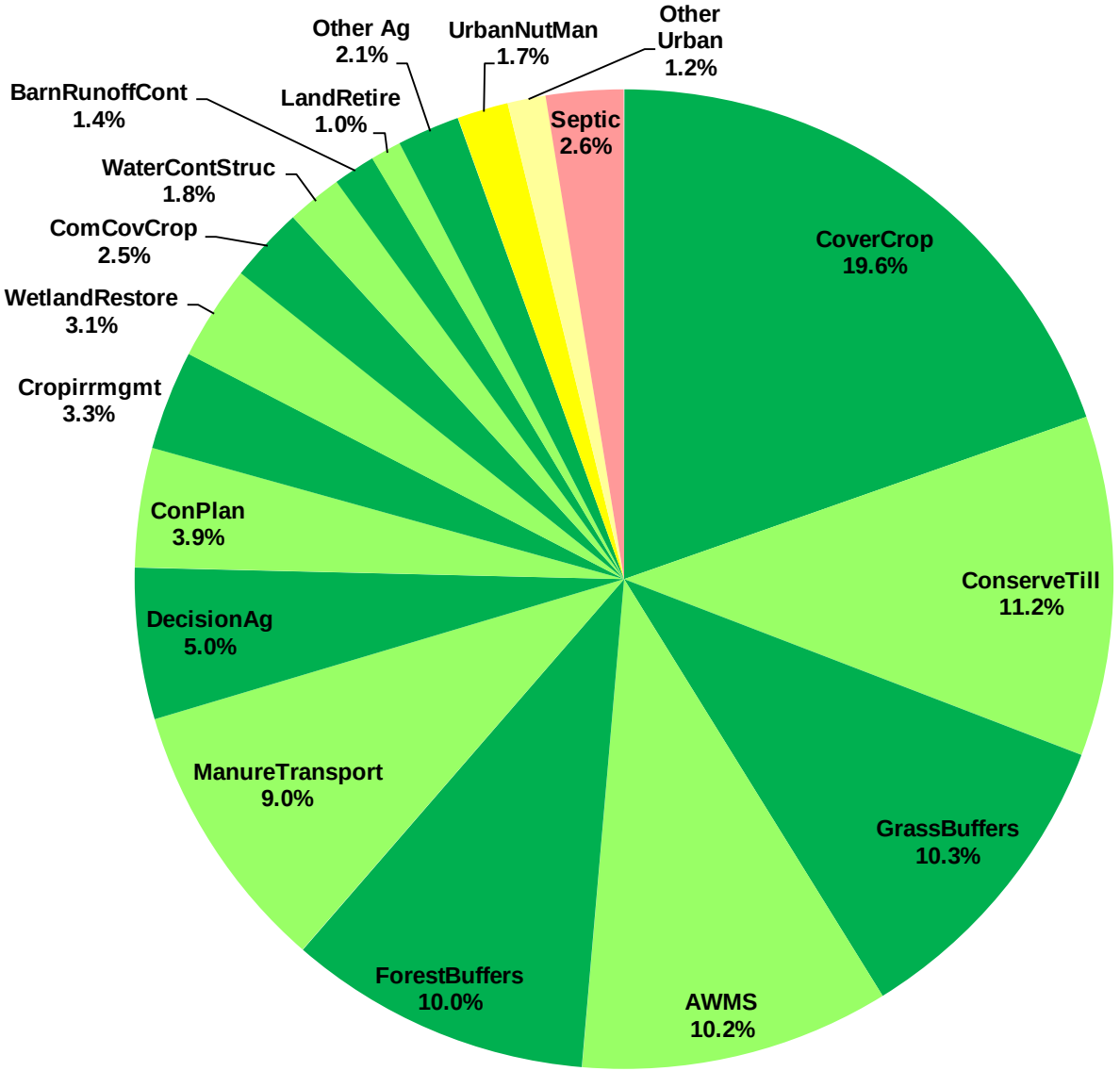
	Aerial Photos	n/a
	Maps	n/a
	Other	Section D2.5.1.2 - see maintenance checklist
	Report Generator	Section D2.5.1.2
5	**How Often Reviewed (Cycle of review)**	
	1-2 years	Tables D2.5.1.1 Verification Design Protocol
	5 years	Tables D2.5.1.1 Verification Design Protocol
	10 years	Tables D2.5.1.1 Verification Design Protocol
	Other	Tables D2.5.1.1 Verification Design Protocol
6	**Independent Verification of Finding**	
	Is this a requirement?	Section D2.5.1.2
	Internal Independent	Section D2.5.1.2
	External Independent	Section D2.5.1.2
	BMP Data Validation	
7	**Quality Assurance/Spot Checking**	
	Who-qualifications/training/certification	Section D2.5.1.3
	Method to select BMP for follow-up check	Section D2.5.1.3
	Method to select the number of BMPs to review	Section D2.5.1.3
	Other	Section D2.5.1.3
8	**Data Entry of BMP Implementation**	
	What is the system?	Section D2.5.1.3
	Who enters data (training/certification)?	Section D2.5.1.3
	Does the system connect to NEIEN?	Section D2.5.1.3
	System in place prevent double counting	Section D2.5.1.3
9	**External Provided Data Validation Meeting CBP Partnership Guidance**	
	Method to validate data	Section D2.5.1.3
	Who will validate data (training/certification)?	Section D2.5.1.3
10	**Historic Data Verification**	
	System to re-certify or remove	Section D2.5.1.3
	Who will verify historic data training/certification)?	Section D2.5.1.3

	Documentation of action	Section D2.5.1.3
	BMP Performance	
11	**Does state collect data to assess BMP Performance?**	
	System used to collect BMP performance data?	Section D2.5.1.3
	Who collects BMP performance data?	Section D2.5.1.3
	Who analyzes collected data and report to CBP?	Section D2.5.1.3

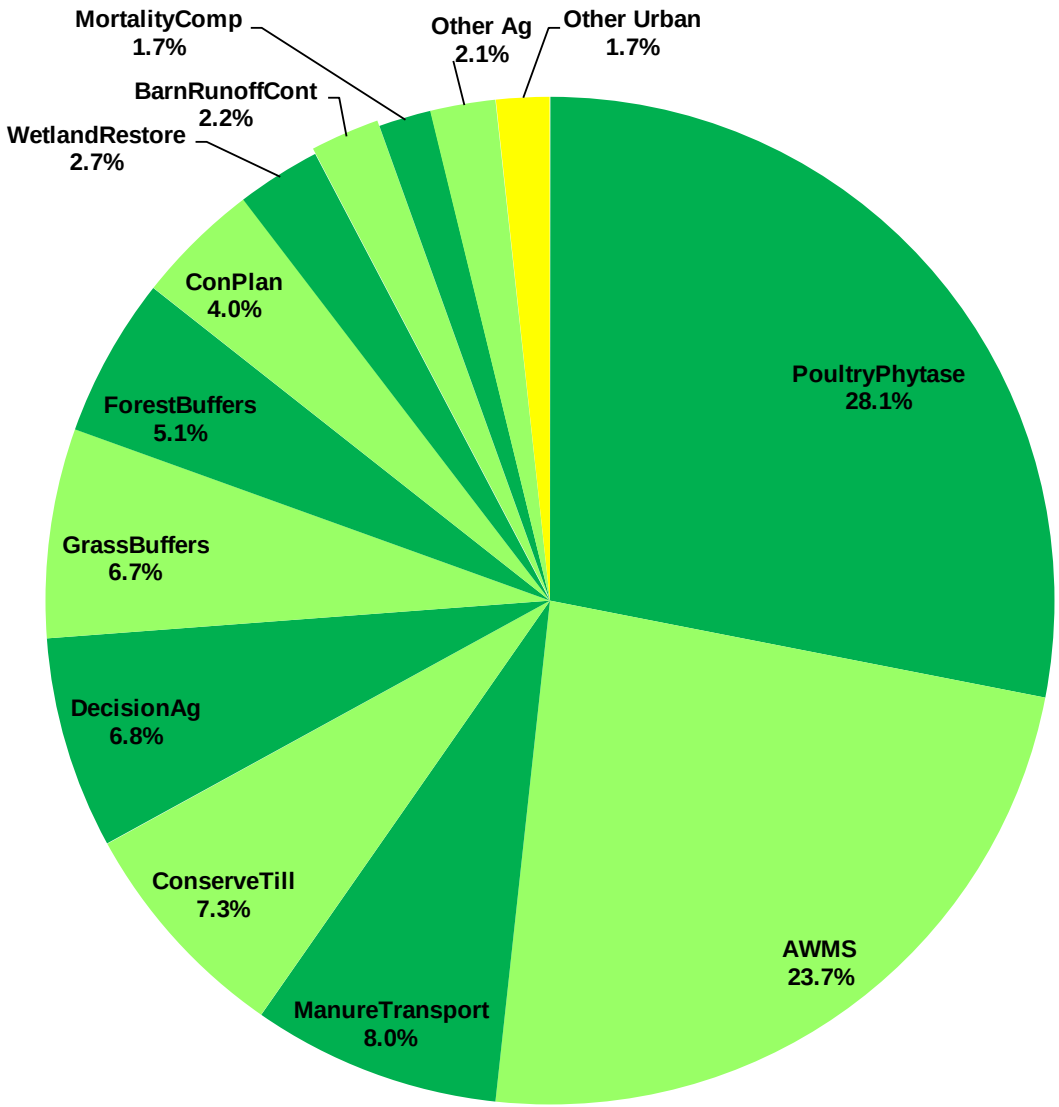
Source: Derived from Table 7 in CBP 2014.

Appendix G: BMP Targeting and Prioritization (Watermelon Charts)

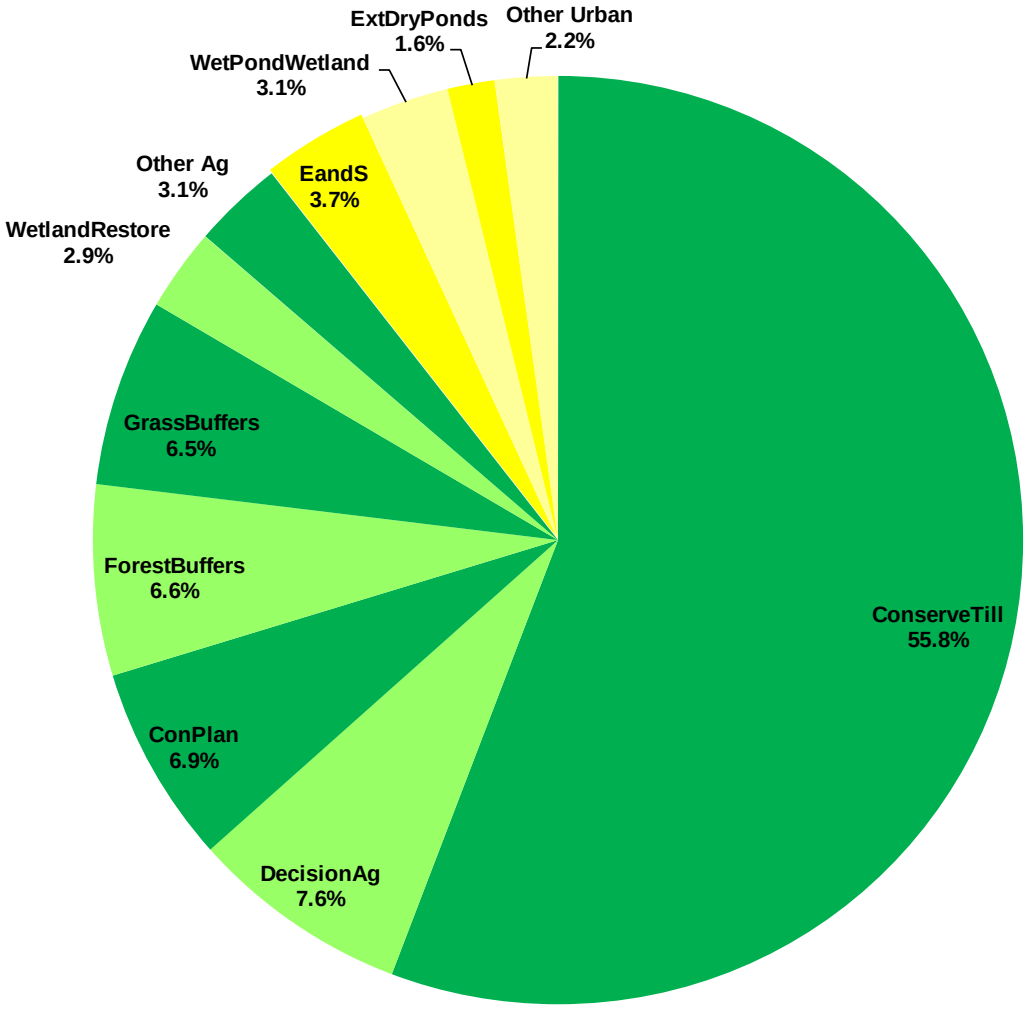
Relative contribution to WIP-planned Nitrogen load reduction among BMPs



Relative contribution to WIP-planned Phosphorus load reduction among BMPs


MortalityComp
1.7%
Other Ag
2.1%
Other Urban
1.7%
BarnRunoffCont
2.2%
WetlandRestore
2.7%
ConPlan
4.0%
PoultryPhytase
28.1%
ForestBuffers
5.1%
GrassBuffers
6.7%
DecisionAg
6.8%
ConserveTill
7.3%
AWMS
23.7%
ManureTransport
8.0%

Relative contribution to WIP-planned Total Solids load reduction among BMPs



Appendix H – NEIEN Methodology for Historical Data Clean Up
June 2015

Delaware Department of Natural Resources and Environmental Control (DNREC)
Nonpoint Source Program (NPS): Marcia Fox
Tetra Tech: Eugenia Hart

This document provides a summary of the methodology used to clean up the historic NEIEN data. To start, the data submitted from 2010 through 2014 were downloaded from the node. The downloaded data were compared to the input files for year 2010-2014 to confirm that the downloaded data matched the data that were originally submitted. The most recent error report from the 2014 Progress Run (from February 2015) was reviewed to identify any errors. The errors were addressed by updating the BMP name where applicable. Note that ALL previously submitted data were resubmitted (not just data that contained errors or were not previously reported) with new model version of Phase 6 in the header schema.

Credit duration for each BMP was also included as "Lifespan" (in years) for all of the historical data. The lifespan or credit duration of each BMP is based on the values provided in the *CreditDurations05222015.xlxs* spreadsheet developed by CBP. This spreadsheet includes credit durations for each BMP type approved by the Urban Stormwater Workgroup on March 17, 2015; the Ag Workgroup on May 21, 2015; and the Wastewater Workgroup on June 2, 2015. The code in the DE NPS BMP Database has been modified so that the lifespan/credit duration is added to the implementation date of a particular BMP to calculate the Lifespan End Date. Once the Lifespan End Date has been passed, that BMP will be tagged as "retired". Credit duration for several practices (mostly NRCS practices) that were not included in the *CreditDurations05222015.xlxs* spreadsheet were provided by Sally Kepfer at NRCS (Dover, DE).

In addition, any BMP that is known to be implemented ***in*** the Chesapeake Bay watershed should have the qualifier code IMNFW so that it is not spread across the county/state. This option is not currently in the data input template, but will be added later. The IMNFW qualifier code was added manually for all historical BMPs identified as "ST" (state) rather than "FED" (federal). The only federal BMPs in Delaware are NRCS and FSA practices. This code was also added to 2007 cover crops from Kent Conservation District provided for the entire county.

Specific methodologies for each of the practices reported are provided for each source sector:

Agricultural BMPs

Animal Waste Management Structures (AWMS)/Waste Storage facilities: provided for the entire county. Submitted as is and indicated N in the in BD watershed column. Note that "roofs and covers" is a type of AWMS. Data provided by DDA for 2014. Previously provided by NRCS.

Conservation Tillage – Percentage provided by county for Conservation Tillage and High Residue Minimum Soil Disturbance. Can be entered as a percentage. Data provided by DNREC WAMS in 2014.

Cover Crops – Where cover crop names were not accepted in NEIEN, the acres were divided evenly between each crop type and submitted individually. If the cover crop names were still not accepted in NEIEN, they were changed to general "cover crop" to receive the minimum credit.

Sussex County – Cover crops for Chesapeake Bay watershed were provided by SCD. Harvested cover crops were identified as "commodity cover crops". Also, if a specific BMP wasn't listed (for example: "Cover Crop Early Aerial Wheat"), but "Cover Crop Early Other Wheat" was listed, "Aerial Wheat" was included as "Other Wheat". Planting dates were provided – used these dates and CBP's BMP guidelines to determine whether the crops were early/late/standard. These acres were NOT subtracted from the NRCS cover crop acres for Sussex County as the conservation districts submit as CTA and are separate from the NRCS values. Historic Cover Crop data for the Chesapeake Bay watershed portions of Sussex County (2005 through 2010) were also provided by SCD. These cover crops were included as general "cover crops" as no specific planting details were provided.

Kent County –cover crop data were provided by Kent County Conservation District (KCD) for the entire county. Watersheds not in the Chesapeake were removed. Harvested cover crops were identified as "commodity cover crops". A few records had 2 dates, as though the cover crops were planted over 2 days. For these entries, the later date was used, assuming this was the date the planting was completed. "Late" and "Early" dates were used as indicated by KCD. These acres were NOT subtracted from the NRCS cover crop acres for Kent County as the conservation districts submit as CTA and are separate from the NRCS values.

New Castle County – Cover crop data were provided by the New Castle County Conservation District (NCCD) by HUC 12. Data entry followed same methodology as Sussex and Kent counties. These acres were NOT subtracted from the NRCS cover crop acres for New Castle County as the conservation districts submit as CTA and are separate from the NRCS values.

NRCS and FSA – Note that NRCS and FSA had cover crop data that were included (see NRCS above). These are separate acres and were provided for the entire state/county (not just the CB watershed) so they need to be spread evenly. Any NRCS cover crop acres were subtracted from the FSA cover crop acres and any remaining acres were included as "Commodity Cover Crop Late Other Wheat" for minimum credit.

DDA Manure Relocation – Manure Relocation was provided by DDA as tons of poultry manure. The data included the sending watershed (by name; GIS was used to find the county), receiving watershed (by name; GIS used to identify location), receiving town (by name), receiving state, claim tons, claim date, application #, and whether the relocation was "farm to alternative use" (NMAU). Note that the majority of the Nanticoke watershed is in Sussex County and a small portion is in Kent County. An assumption was made that all manure was coming from Sussex County. Marshyhope watershed is in 2 counties, but it is unknown which county the manure is coming from, so the claim tons were split evenly between the 2 counties. Only manure exported FROM the Chesapeake Bay watershed were included. COUNTY_TO in the Excel sheet was left blank if the manure leaves the Chesapeake Bay watershed or is identified as "farm to

alternative use". The HUCs included were the receiving HUC. Only the most descriptive HUC needs to be included (i.e., include the best level of detail available). HUCs were included where available. Anything outside of Delaware, but inside the Chesapeake watershed doesn't have HUCs because exact location/watershed is unknown.

- Note that Delaware does not transport any manure besides poultry. The poultry in Delaware are all broilers except for one layer facility, therefore, the Animal Group was labeled as "Poultry".
- 'County To' and 'County From' were included for ALL manure transported within the watershed. Even if it went to another state, the FIPS code was identified for that out-of-state location. Unique BMPs IDs for each manure entry (poultry, county to, county from) are the same.
- As of 1/9/2015, DNREC provided all manure transported from Perdue AgriRecylce outside of the watershed. Any transport within a 10-mile radius of the facility isn't included in the cost-share data so these data had never been included before 2014.
- Additional historical data were provided by DDA for 2002, 2005, 2007, and 2009. The data included County From, County To, Year, and tons.

DDA Nutrient Management Planning – DDA provided total acres in each watershed (by name). Watershed names were matched with the appropriate HUC. All NMPs are done as a 3-year plan (per Bob Coleman at DDA), but those acres are only put in the database for the first year, so the NMP acres for the two previous years are added to the current year (e.g., 2012 and 2013 were added to the 2014 acres) to get the actual acres with NMP for the current year)Nutrient Management acres are provided by DDA's Nutrient Management Program and are calculated using the total number of acres from the DDA annual reports database with a 5% adjustment.

DNREC Restoration Database (grass buffers, water control structures, land retirement) – DNREC –DWS-NPS maintains a restoration database that captures restoration practices like grass buffers, tree plantings, stream restoration, wetland restoration and water control structures. These practices are compiled from various projects throughout DNREC. In 2014, DNREC worked closely with scientists, planners and biologists with Fish and Wildlife, Parks, and Watershed to review practices within the database and upload missing practices. The restoration database links DNREC BMPs to NRCS practice codes. The database is not set to match the BMPs reporting to EPA-CBPO. Therefore, DNREC-DWS-NPS must make judgment calls when assigning acres (or other units) to specific EPA-CBPO BMPs.

Large Animal Disposal – provided by county from the conservation districts, but this practice – Large Animal Mortality – is not accepted in NEIEN. Note that this is only a special program when funding is available.

NRCS/FSA Data - are provided at the state level and county level to be evenly distributed. These data were entered as-is into the Excel agriculture template. These data came from Olivia Deveraux and included data back to 2007. The Sussex, Kent, and New Castle County Conservation District cover crop acres were NOT subtracted from the NRCS as in past years. The NRCS cover crop acres for years 2010 through 2013 were revisited to include the correct NRCS cover crop acres. The acres are different and not cost-shared. Note that not all FSA and NRCS practices provide a water quality benefit or are accepted by the Chesapeake Bay Program for the Annual Progress Report; however, all are accepted in NEIEN (according to Olivia Devereux). Note that if there is no HUC, FIPS, or lat/long info to identify the location of these BMPs, "DE" was manually added in the xml file as the geographic code until the template is updated (expected late 2015).

Poultry Phytase: Historical Poultry Phytase data were provided by county from DDA for years 1997, 2002, 2005, 2007, and 2005.

Water Control Structures: In 2013, DNREC and SCD updated GIS coverage for water control structures in the Chesapeake Bay watershed (DNREC QAPP 2015, Appendix C). These structures were implemented and funded by the SCD. This project focused on data verification for reporting purposes.

Forestry BMPs

DDA Forestry Harvesting: In 2013, DNREC and DFS updated GIS coverage for timber harvest practices in the Chesapeake Bay watershed (DNREC QAPP 2015, Appendix D). The acres were provided in attribute table. The timber harvest coverage was intersected with the USGS HUC12 coverage to determine the HUC12 for each harvested area. If dates were not provided they were assumed to be 1/1/2014 (or other appropriate year).

DNREC Restoration Database (tree plantings on ag land use) – DNREC –DWS-NPS maintains a restoration database that captures restoration practices like grass buffers, tree plantings, stream restoration, wetland restoration and water control structures. These practices are compiled from various projects throughout DNREC. In 2014, DNREC worked closely with scientists, planners and biologists with Fish and Wildlife, Parks, and Watershed to review practices within the database and upload missing practices. The restoration database links DNREC BMPs to NRCS practice codes. The database is not set to match the BMPs reporting to EPA-CBPO. Therefore, DNREC-DWS-NPS must make judgment calls when assigning acres (or other units) to specific EPA-CBPO BMPs.

NRCS/FSA Data - are provided at the state level and county level to be evenly distributed. These data were entered as-is into the Excel agriculture template. These data came from Olivia Deveraux and included data back to 2007. Note that not all FSA and NRCS practices provide a water quality benefit or are accepted by the Chesapeake Bay Program for the Annual Progress Report; however, all are accepted in NEIEN (according to Olivia Devereux). Note that if there is no HUC, FIPS, or lat/long info to identify the location of these BMPs, "DE" was manually added in the xml file as the geographic code until the template is updated (expected late 2015). All NRCS "Ag Tree Planting" was also changed to "Riparian forest buffer" – according to FSA all tree plantings through CREP are planted along waterbodies and should be considered riparian.

Riparian Forest Buffer – CREP acres provided by HUC by the DNREC CREP Program Partnership with FSA. The acres were also provided in the FSA data from Olivia, so they were subtracted out of FSA practices CP22, CP4D, CP3A and submitted as "Riparian Forest Buffer".

Urban Tree Planting (Tree Planting) – These data are provided by DDA and are submitted as number of trees.

Restoration BMPs (Wetland and Stream)

NRCS/FSA Data - are provided at the state level and county level to be evenly distributed. These data were entered as-is into the Excel agriculture template. These data came from Olivia Deveraux and included data back to 2007. The Sussex, Kent, and New Castle County Conservation District cover crop acres were NOT subtracted from the NRCS as in past years. Note that not all FSA and NRCS practices provide a water quality benefit or are accepted by the Chesapeake Bay Program for the Annual Progress Report; however, all are accepted in NEIEN. Note that if there is no HUC, FIPS, or lat/long info to identify the location of these BMPs, "DE" was manually added in the xml file as the geographic code until the template is updated (expected late 2015). The NRCS "shallow wildlife area" practice was changed to "wetland restoration" for all records.

DNREC Restoration Database (wetland and stream) – DNREC –DWS-NPS maintains a restoration database that captures restoration practices like grass buffers, tree plantings, stream restoration, wetland restoration and water control structures. These practices are compiled from various projects throughout DNREC. In 2014, DNREC worked closely with scientists, planners and biologists with Fish and Wildlife, Parks, and Watershed to review practices within the database and upload missing practices. The restoration database links DNREC BMPs to NRCS practice codes. The database is not set to match the BMPs reporting to EPA-CBPO. Therefore, DNREC-DWS-NPS must make judgment calls when assigning acres (or other units) to specific EPA-CBPO BMPs.

Stormwater BMPs

Sediment and Stormwater – Received data by lat/long from the DNREC Sediment and Stormwater Program. Data come from MudTracker and the urban NOI database.

Street Sweeping – New Castle, Kent, and Sussex County street sweeping data were provided for calendar by DelDOT. Entered all as 1/1/2014. Converted Total waste (in tons) to lbs for inclusion in the template. Note that 2014 data were provided also, but the year is not complete so those data will be included in 2015 progress.

Wastewater BMPs

Onsite Sewer Connections – In 2013, DNREC and DNREC Groundwater Discharges group updated GIS coverage for onsite sewer connections in the Chesapeake Bay watershed (DNREC QAPP 2015, Appendix E). This project focused on data verification for reporting purposes.

Wastewater Treatment Plant Data – DNREC DWR(John DeFriece) provided historical clean-up of wastewater treatment plant data. EPA provided a data dump of all DMR data for all DE. NPDES discharges that go to the Chesapeake Bay, from both ICIS and PCS back to 1989 when DE first started putting data into PCS. Also, early on had sent permittees their old data, asking them to fill in any species data they have, in addition to the DMR requirements. Combined those into tables of data and missing data for the CBP parameters.

Step 1

- Filled in equations to calculate missing species data (e.g., TKN = TN – NO23), where possible.
- Used Excel to create "Data Tables" that calculate averages from actual data for each site for:
    - Each facility, parameter, and year.
    - Each facility and parameter, averaged over all results over the years (some of the smaller facilities had some data, but not enough to do yearly averages).
- For still missing data, used the Data Tables mentioned above to fill in, prioritized as follows:
    - 1st Data from same year,
    - 2nd Data from same facility, and
    - 3rd Old Ch. Bay Program default values. Adjusted those defaults for the Non-contact cooling water discharges with water supply from groundwater*
- Graphs were created to verify results. Values were adjusted based on Best Professional Judgment
- Did not overwrite data before Jan. 1989.

Step 2

1. Double-checked the DMR date with the last non-zero flow, replaced any flow data after that with zeroes, and cleared data from the other columns (similar to the way shown results in the PhaseV data).
2. Filled in 1984 through 1988 with a 12 month average of the nearest facility results (usually 1989 or 1990). I did not use the PhaseV data for ’84-’88, but did use what I could find of real data for each site.

References

DNREC (Department of Natural Resources and Environmental Control). 2015. *State of Delaware, Nonpoint Source Best Management Practice Implementation Data Quality Assurance Project Plan.*

Appendix I – Condensed Version of Urban & Agriculture Spreadsheet Used for Upload into NPS BMP Database

Condensed Version of Urban & Agriculture Spreadsheet used for upload into NPS BMP Database																		
BMP UNIQUE ID	SPECIFIC PRACTICE NAME	BMP NAME	MEASURE VALUE	BMP CATEGORY	FED STATE CODE	BMP STATUS	IMPLEMENTATION DATE	INSPECTION DATE	INSPECTION STATUS	SITE NAME	SITE ADDRESS	SITE CITY	SITE ZIPCODE	LATITUDE	LONGITUDE	COUNTY	FIPS CODE	HUC 12	WITHIN CHESAPEAKE WATERSHED?

Appendix J - Procedures for Using the Revised & Simplified Cropland Roadside Transect Survey for Obtaining Annual Tillage/Crop Residue/Cover Crop Data

Preface and Justification

In talking with the Chesapeake Bay Program following Delaware's 2013 Progress Run Submissions, it was recommended that the State look into the tracking and reporting of newly approved best management practices that have not been reported and may have been utilizing historic data sets. Conservation tillage practices are one of these practices. Delaware looked deeper into its WIP goals and identified Conservation Tillage practices as accounting for 11.2% of its relative nitrogen load reductions, classifying it as a priority practice. Since the current conservation tillage data utilized in progress runs comes from the Conservation Technology Information Center (CTIC) data set collected in 2004 and is applied to the decreasing cropland land use, the actual implementation of conservation tillage has been decreasing. In talking with the state's agricultural partners, the general consensus is that conservation tillage practice implementation should be increasing due to greater widespread knowledge of its benefits. Delaware agreed to move forward with the adoption of this statistically valid cropland residue transect survey originally conducted in western states through CTIC, and more recently in the state of Pennsylvania. This survey serves as the first update to the currently utilized conservation tillage data set for the state of Delaware since 2004.

In addition to tillage and crop residue practices, Delaware has decided to incorporate the observation of cover crop practices throughout the survey. The state currently receives cover crop acreages implemented through the County Soil and Water Conservation Districts, but knows actual implementation for this annual practice is greater than the acres received by the Conservation Districts. In order to take full advantage of the opportunity this survey presents, bringing together agricultural experts in a state-wide survey, Delaware has decided to incorporate cover crop observations. Being a priority practice in Delaware's WIP, accounting for 19.6% of Delaware's relative nitrogen load reductions, it is important that the state understands actual on the ground implementation as best as possible.

Throughout the development of the survey, we worked directly with the state's agricultural partners including our Conservation Districts in each county, Natural Resource Conservation Service, Farm Service Agency, Delaware Department of Agriculture, and University of Delaware's Cooperative Extension. We utilized the local knowledge from these partners to establish our driving routes through primarily agricultural crop land, as well as in the determining of appropriate timing. Most importantly, our collaborators provided experienced staff to be part in the actual survey teams. Our lead observer for the initial survey was Ben Coverdale of Delaware's Department of Agriculture Nutrient Management Program. Ben serves on the Chesapeake Bay Program's Conservation Tillage Expert Panel, as well as the Poultry Litter Subcommittee. He is also a grain farmer who produces corn, soybeans, wheat and barley in Kent County, Delaware. Dr. Richard Taylor served as the lead observer for the Quality Assurance and Quality Control (QA/QC) survey. Dr. Taylor is a soil science professor at the University of Delaware for almost 30 years, as well as an Extension Agronomist Specialist for the University's Extension Program. He has conducted a wide range of agricultural research focusing on cover crops and no-till practices. While in the vehicles, we were also able to utilize the personal relationships and local knowledge of our Conservation District staff who know the actual management techniques implemented on the fields we observed. All of the members in the vehicle also took part in a training held in conjunction with University of Maryland's Chesapeake Bay Representative Mark Dubin to practice residue estimation

techniques and calibrate the observer's eye for estimation. Ben Coverdale attended a crop residue transect training on May 15th, 2015 with Mark Dubin in Lancaster, Pennsylvania to consult with members of Pennsylvania's transect team. On-farm visual assessment training was conducted during this session and training was provided by Joel Meyers – a member of the Agriculture Workgroup with the Chesapeake Bay Program.

During the actual survey, our team took many precautions and extra steps to ensure accurate observations and record keeping. Since we had numerous trained participants and resources available, we were able to run our QA/QC team almost immediately after the initial observations were made. The team was able to verify a random sample of the initial observations, at most, two days after the initial observations were made. This ensured that the conditions originally observed were as close as possible to what was viewed in the QA/QC runs. In addition to the immediacy of our quality assurance and quality control review, our lead observer Dr. Taylor is also able to ground truth and interview the land manager of several of the fields with their permission. Dr. Taylor utilized the bead-and-line residue estimation method in several cases to verify that correct observations were recorded.

The development of the mobile application utilizing ESRI ArcCollector GIS software also allowed for a much more streamlined data entry process. With the app, the data enterer was able to record the observations more quickly and accurately by selecting from pre-determined drop down fields, as well as the opportunity for free text entry notes. The GPS aspect of the app means that we have created definitive stopping points for our future surveys. Teams can return to the exact same observation location year after year and track how the agricultural landscape has changed. We have proven this by making an additional survey run in July to gather more information than required by the Conservation Technology Information Center (CTIC). This additional run returned to the observation points where small grains or no crops were initially observed, and were indicated within the application. Observers could then record the second crop that had been planted after the small grains had been harvested. A third survey run is also conducted in late November-early December to collect information on fall cover crop plantings. The application also gave us the opportunity to more easily collect additional fields on top of what CTIC originally collected. This information included observations on the presence of cover crops, their planting method, and the type (traditional vs commodity).

Introduction

The cropland roadside transect survey method is designed to gather information on tillage and crop residue management systems, as well as cover crops. In 2014, CTIC welcomes data collected voluntarily by conservation partnerships around the country. Any county in which this survey method is used is encouraged to submit the data using CTIC's web site, **www.crmsurvey.org**. Experience has been that counties with a grid road system, those with fields readily visible from the road, where crops are planted in a relatively short period of time, and where conservation tillage is being adopted are the most likely candidates for conducting a transect.

Crops, soils, and climate interaction dictate to some degree the adoption of high residue systems. Adoption of conservation tillage dramatically reduces nonpoint pollution, enhances soil quality, and enhances carbon accumulation in the soil. Some Midwest states have found the data so valuable that a

transect survey has been completed on an annual basis by each county for a number of years. These counties can track changes in tillage practices due to changing weather conditions, as well as a means of documenting effective educational programs, equipment rental, and other affiliated activities.

The purpose of the survey is threefold: (1) to provide information that can be used by individual soil and water conservation districts and others in establishing priorities for educational or other programs, (2) to evaluate progress achieved in reaching county, statewide, and watershed wide goals, and (3) to provide accurate data on the adoption of conservation tillage systems by crop for the CTIC National Crop Residue Management Survey, and possibly to the Chesapeake Bay Program for Chesapeake Bay Model calibration. This makes the transect survey an ideal tool for assessment as well as measuring progress for locally led conservation. The transect survey will enable counties to have a higher level of confidence in their data for use in county programs and in the report submitted to CTIC. State and national data will have a correspondingly higher confidence level.

Statistical reliability of the cropland roadside survey method

When conducted properly, this cropland transect survey procedure provides a high degree of confidence in the data summaries. Users can have 90% or more confidence in the accuracy of the results. This level of reliability translates into data summaries that can help guide the local or state decision-making process. Several states have used transect data to allocate cost-share funds, develop new resource management goals, and to provide information to the general public about the positive impact of progress on land use trends. In general, few data sources have such a high level of reliability combined with quick data collection!

Selecting the crops

The crop list for the 2013 CRM survey includes 17 crops. Visit **www.crmsurvey.org** for more information.

Crops should be selected for each county from the following list:

corn	edible beans and peas	sunflowers
soybeans (full season)	barley	rye
soybeans (double-cropped)	canola	potatoes
forage crop (seeding year only)	permanent pasture	oats
vegetables and other crops	fallow	sorghum
winter wheat	grain (other)	hay
specialty crops (orchard, sod, etc.)		

A worksheet is available from the CTIC Web site www.crmsurvey.org to record transect data.

Procedure:

Step 1 - Establishing and Marking the Route

The first step in conducting the tillage and crop residue management survey was to establish a driving route. For future surveys, counties shall use the same routes as long as no conflicts come about. Utilizing the same route allows for evaluation of cropping system changes over time. A county highway map with

cropland was used to draw a route that passes through areas that are heavily used for crop production. Largely urbanized areas, forested land, rangeland, and heavily traveled federal and state highways were avoided when possible. The direction of the route was not important, however, the route was required to be at least 110 miles long in each county. The routes did not double-back along the same road more than once. Prior to the survey, each route received a trial drive-through to ensure the routes would have minimal issues.

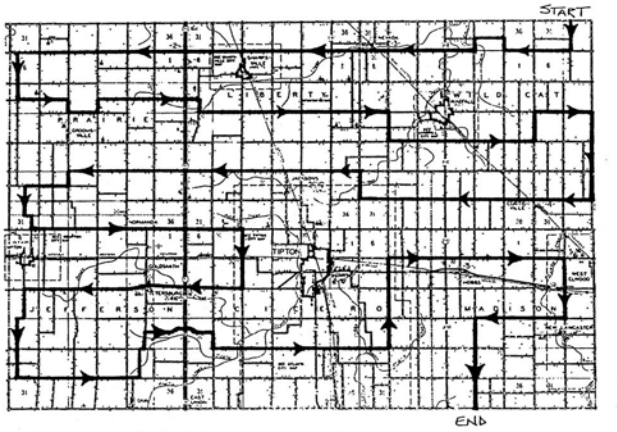


Figure 1. Sample county road transect route for Tipton County, Indiana. Note how the route bypasses towns (such as Tipton, Indiana located in the center of the county). This survey is applicable regardless of the layout of the county, i.e. counties need not be square to provide accurate results with this method.

Step 2 - Establishing the Survey Date and Team

Once the route was established and marked, a date was scheduled for conducting the survey. The survey should be conducted after the majority of the main crops have been planted but before the crop canopy closes or the first row cultivation takes place. In order to obtain all of the necessary cropping information to get the most accurate representation of yearly cropping practices, multiple transect runs had to be completed. The survey team makes three survey runs per for a singular cropping season. The first run is conducted in late November into early December to collect cover crop planting data. The second run is in the early spring, depending on weather patterns and the general planting timeline among the agricultural community. This is conducted after a majority of the spring-seeded crops have been planted, but before canopy closure to ensure windshield observations can be made. A third survey run in late summer is made to obtain the second crop in a double-cropping planting method. Conducting the surveys at these times allows for easy “windshield observations” without stopping at each field. Since the dates for conducting the county survey depend upon local planting progress, flexibility in scheduling is necessary.

Next, a survey team is established of at least 2 individuals. In this case, 4-5 individuals are utilized, each with a specific role; driver, navigator who marks data collection points on the map, and data recorder, and occasionally someone needs to verify field observations (measuring residue, previous crop, etc.). Survey team members involved the following organizations: NRCS district or soil conservationist, county Extension agriculture agent, University of Delaware agriculture extension agent, and DNREC employees. At least one individual on each team is very familiar with tillage systems and estimating residue levels. Ben Coverdale from Delaware Department of Agriculture is the primary observer in the initial survey.

Ben served on the Agricultural Workgroup's Conservation Tillage Panel and has been trained to identify residue cover percentages. These observers remained constant across all 3 counties within the state to ensure consistent data observations. Dr. Richard Taylor is an Extension Specialist for the University of Delaware's Cooperative Extension as well as a professor for Plant and Soil Sciences and served as our primary observer in the QA/QC runs. By getting a variety of people involved, the ability to assemble a full team for each day of surveying was greatly increased.

In addition to the original survey team, a Quality Assurance and Quality Control team was established to retrace the original routes after the initial survey was conducted to ensure quality data. The QA/QC team consisted of members that did not participate in initial survey, but from the same organizations. Using the same GPS coordinates as marked in the initial survey run-through; the team checked and confirmed or rejected the initial observations on at least 10% of the fields. Members on the QA/QC team had access to the original observations and were able to compare them with their own judgments.

A training was held for all of the members of the observation teams prior to the actual survey. Mark Dubin and other agricultural specialists informed the teams of various measurement techniques used to estimate on-field residue. The attendees then practiced these methods on sample fields at University of Delaware's Agricultural Research Center in Georgetown DE. This location allowed for observations on fields utilizing various management techniques for different residue levels, crop types, and planting methods.

Step 3 - Collecting the Survey Data

The highway map aids navigation across the county, especially if there are detours or road changes since the last transect.

For counties with 300,000 cropland acres or less, data was collected at one-half mile intervals in Kent and Sussex Counties and 0.2 mile intervals in New Castle County, as indicated by the vehicle odometer. To obtain a statistically reliable data set, **approximately 460 cropland sites** are to be observed along the route.

For data collection purposes, a mobile application was developed by DTI through use of ESRI's ArcCollector application. The app allowed for a more streamlined collection process utilizing a tablet device rather than previous methods of utilizing paper data sheets. The driving route is preloaded onto the application for each county. Using GPS location, the team can track their driving progress throughout the day and follow the predetermined path. As the team comes to their interval observations, they are able to drop a point at that location. Once a point is dropped, a list of selectable fields appears for the data recorder to enter exactly what the observer sees for each side of the road. The fields include residue cover, cover crop observations, and landuse categories, as well as a free text entry field for observation notes. This app allows for greater ease of entry, reduces entry errors, and helps with subsequent surveys. Example screen captures from the application can be found below in figures 1-3.

Beginning at the start of the route, the team traveled the predetermined interval distance and stopped. Fields were observed on both sides, and recorded the appropriate information in the mobile application. Since data is being collected from 2 fields, this constitutes as 2 data collection points. The application

automatically saves the GPS location of that data observation. This procedure was repeated until the route is completed and the appropriate number of observations had been collected.

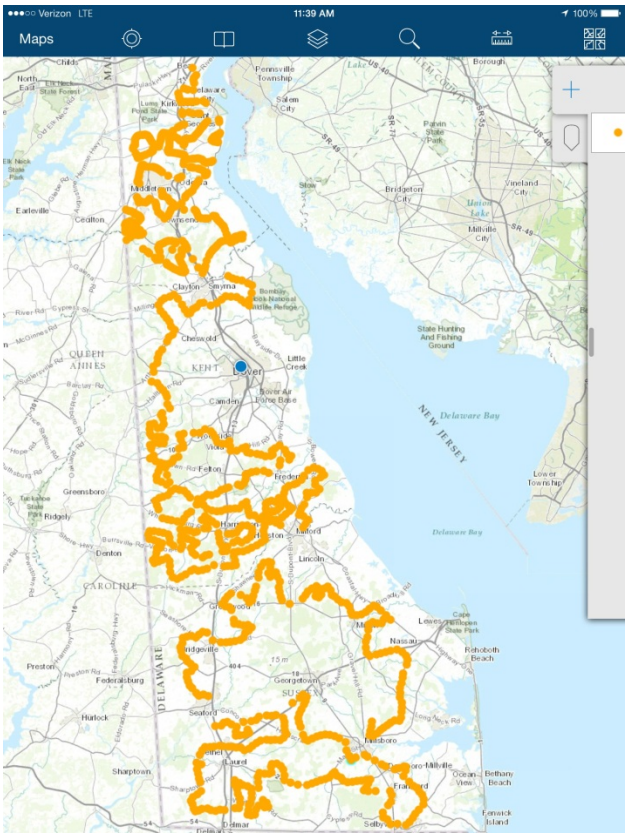


Figure 1. Data collection points for the entire state of Delaware during the survey. Each orange dot represents a stop during the survey, in which data was collected.

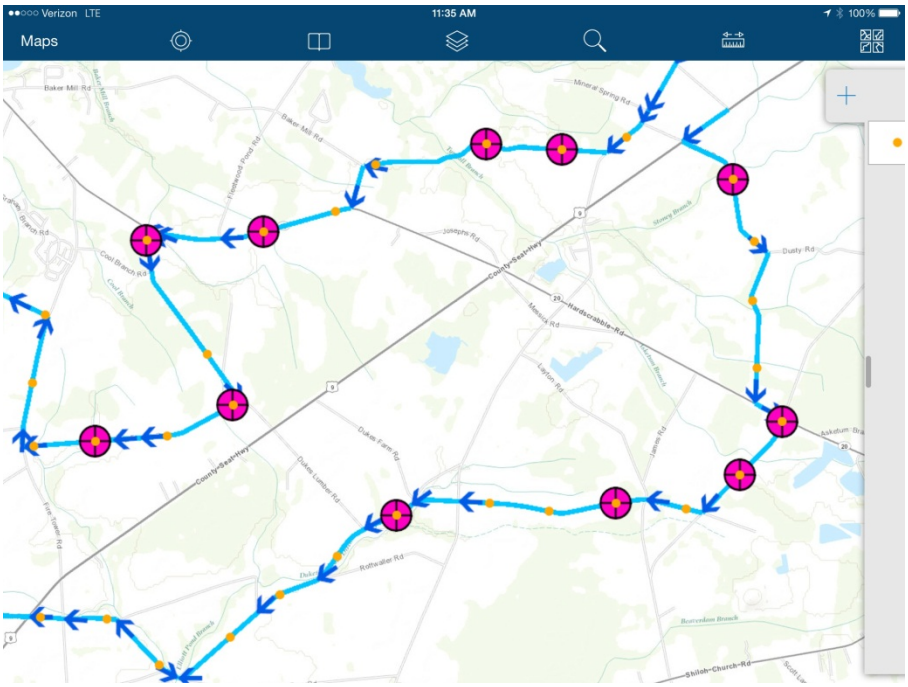


Figure 2. Participants in the survey followed the blue path in the direction of the arrows, which was the pre-determined route for the survey. Each orange dot represents a data collection point. Other symbology (ex. Larger pink dot) was used later in the survey for identifying QA/QC stops or for follow up observations.

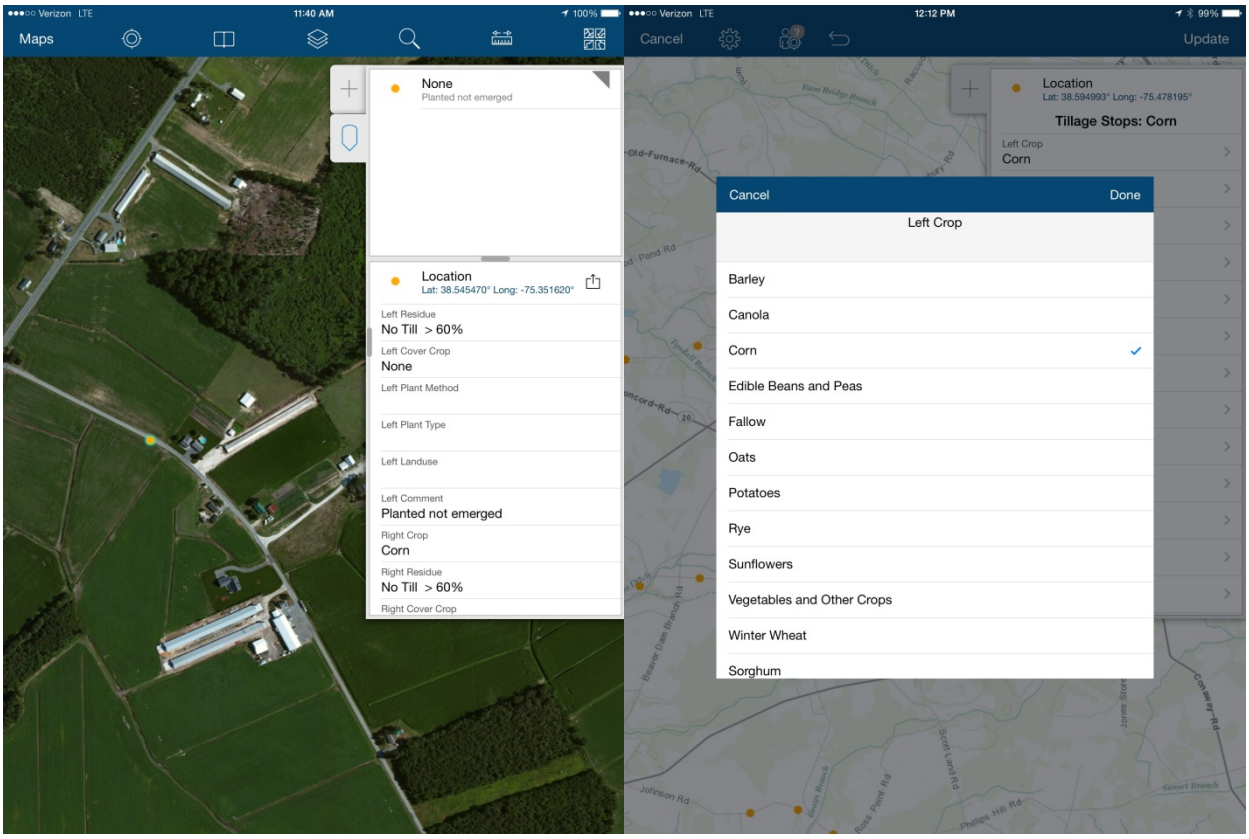


Figure 3. Once a stop was made for data collection, the user was able to enter the observations using drop-down options from predetermined fields. The data point is saved and can be edited if needed.

Important:

(A) If a data point is a cropland field but is not planted to a crop (hayland, CRP, etc) in 2012, then it was noted as unknown for tillage type.

(B) If a cropland field (pasture, farmstead, subdivision, etc.) is not encountered at the stopping point on one side of the road, data was recorded for only the side with cropland. The non-cropland point becomes not applicable (NA).

(C) Only record data for fields where the tillage type/residue level is obvious. For example, if one is conducting a transect in the spring, it is futile to walk into a winter wheat field to try and determine tillage/residue level. The field was simply marked as unknown for tillage/residue level.

(D) If no cropland field is encountered on either side of the road, the team continued driving until cropland was observed on at least one side of the road.

As the transect survey continued, the survey team stopped and checked field conditions on a regular basis to insure correct estimates are being made for different crop, tillage, and residue conditions. Once the team has calibrated their visual estimates to match actual field conditions, were made less frequently. The team re-calibrated their visual estimates when entering a region of the county with different soil surface conditions due to changes in moisture, organic matter levels, stoniness, or crops grown.

Crop residue cover levels will be the most important data category to confirm with field measurements. Therefore, the line-transect method as described in the National Agronomy Manual for confirming percent residue cover was utilized. Visual estimates were confirmed with field measurements in borderline cases. A list of field residue categories can be found in the appendix A and match those described in the latest Conservation Tillage Panel Report.

As the initial observation team completed a county, the Quality Assurance and Quality Control (QA/QC) team followed through along the same route to verify a random selection of initial observations (10% of initial stops). The short turn-over time between the initial and QA/QC observations increased the likelihood of identical conditions and allowed for more accurate confirmations from the QA/QC team. To make these confirmations, the QA/QC team periodically would conduct a line and bead test on the actual field to get an accurate measurement of residue cover.

At the end of the route, the number of cropland sites where data was recorded was counted. Fields were not counted twice if the transect crossed over its previous route. The totals for route mileage, vehicle stops, and actual cropland observations are found in the table below.

	Route (miles)	Vehicle Stops	Cropland Observations
New Castle County	133	315	470
Kent County	206	341	504
Sussex County	202	331	497

Step 4 - Crop Acreage and Percentage Calculation

The number of observations were summed for each residue/tillage category and then summed for each crop. Dividing the sum in each category by the total for the crop will provide the percentage for each tillage system. For example, if there were 36 observations for no-till corn, 22 for mulch-till corn, 28 for reduced-till corn, and 14 for conventional corn, the sum would be 100. So this county would have 36% no-till corn, 22% mulch-till corn, 28% reduced-till corn, and 14% conventional-till.

For producing an acreage of CTIC-based survey cover crops, acreages are reported utilizing the methodology that was approved by the Agricultural Workgroup at the September 2015 meeting. The cover crop observation percentages that are made during the survey are categorized by species, planting time, and planting method based on the NEIEN appendix for approved cover crop BMPs. The observation percentages for each of the cover crop categories were then applied the 2012 NASS county-wide harvested cropland acreages, yielding estimated acreages for traditional cover crops based on the survey. The acreages for each cover crop category reported by the county conservation districts are then subtracted from the matching cover crop category calculated from the CTIC-based survey. The acres left are submitted through NEIEN at the county-wide level, where model simulation calculates acreages within the watershed. NRCS acres of cover crops are not reported in order to prevent double counting of cover crops.

The calculations will be submitted to CTIC as part of their national survey. The data collected will be submitted to the Chesapeake Bay Program to receive nutrient reduction credits towards meeting Delaware's Watershed Implementation Plan Goals. The data will be submitted in the form of implementation percentages under each residue category. In addition, the survey data will also be submitted to CTIC as part of their National Crop Residue Management (CRM) Survey. The latest Crop Residue Management Survey results previously reported for every county in the U.S. are posted on the CTIC Web site http://www.ctic.purdue.edu/CRM/.

APPENDIX A

Tillage Definitions

Tillage Systems Definitions as featured in the *National Crop Residue Management Survey:*

The following set of definitions was established by CTIC and is recognized as a standard. They are used nationwide by many government agencies and private industry.

Conservation Tillage systems include high residue minimum soil disturbance, no-till, ridge-till and mulch-till.

Any tillage and planting system that **covers 30 percent or more** of the soil surface with crop residue, after planting, to reduce soil erosion by water. Regional studies have showed that the highest level of soil conservation and water quality benefits are achieved when crop residue cover is greater than 60 percent. This methodology serves as a revision to the current CTIC methodology to specifically include the >60% residue cover category into the field transect survey.

High Residue, Minimum Soil Disturbance – The Continuous High-Residue Minimum Soil-Disturbance (HR) BMP is a crop planting and residue management practice in which soil disturbance by plows and implements intended to invert residue is eliminated. Any disturbance must leave a minimum of 60% crop residue cover on the soil surface as measured after planting. HR involves all crops in a multi-crop, multi-year rotation and the crop residue cover requirement (including living or dead material) is to be met immediately after planting of each crop. The purpose of implementing the HR BMP is to improve soil organic matter content and soil quality, and to reduce runoff and sediment and nutrient losses coupled with a continuous high-residue management system. Multi-crop, multi-year rotations on cropland are eligible. The system must be maintained for a minimum of one full crop rotation.

High Residue, Minimum Soil Disturbance

- Minimum of 60% crop residue cover after planting
- Must be maintained for a minimum of one full crop rotation

No-till/strip-till - The soil is left undisturbed from harvest to planting except for strips up to 1/3 of the row width (strips may involve only residue disturbance or may include soil disturbance). Planting or drilling is accomplished using disc openers, coulter(s), row cleaners, in-row chisels or rototillers. Weed control is accomplished primarily with crop protection products. Cultivation may be used for emergency weed control. Other common terms used to describe No-till include direct seeding, slot planting, zero-till, row-till, and slot-till.

No-till/strip-till

- Less than 1/3 of row disturbed
- Greater than 30% residue after planting
- Crop protection products used for weed control

Ridge-till - The soil is left undisturbed from harvest to planting except for strips up to 1/3 of the row width. Planting is completed on the ridge and usually involves the removal of the top of the ridge. Planting is completed with sweeps, disk openers, coulters, or row cleaners. Residue is left on the surface between ridges. Weed control is accomplished with crop protection products (frequently banded) and/or cultivation. Ridges are rebuilt during row cultivation.

Ridge-till

- Less than 1/3 of row disturbed
- Greater than 30% residue after planting
- Top 1-2" of ridge removed at planting
- Crop protection products are usually banded
- Row cultivation is used for weed control and to rebuild ridges

Mulch-till – Full-width tillage that involves one or more tillage trips, disturbs the entire soil surface and is done prior to and/or during planting. Tillage tools such as chisels, field cultivators, disks, sweeps or blades are used. Weed control is accomplished with crop protection products and/or cultivation.

Mulch-till

- Entire field is tilled
- Greater than 30% residue after planting
- Usually one to 3 tillage trips
- Chisel plow, disk, field cultivator, and combination tools are used

Other Tillage Types:

Reduced-till (15-30% residue) Full-width tillage that involves one or more tillage trips, disturbs the entire soil surface and is performed prior to and/or during planting. There is 15-30 percent residue cover after planting or 500 to 1,000 pounds per acre of small grain residue equivalent throughout the critical wind erosion period. Weed control is accomplished with crop protection products and/or row cultivation.

Reduced-till

- Entire field is tilled
- 15 to 30% residue after planting
- Usually one to 3 tillage trips (maybe more)
- Chisel plow, disk, field cultivator, and combination tools are used

Conventional-till or intensive-till Full-width tillage that involves one or more tillage trips and disturbs the entire soil surface and is performed prior to and/or during planting. There is less than 15 percent residue cover after planting, or less than 500 pounds per acre of small grain residue equivalent throughout the critical wind erosion period. Generally involves plowing or intensive (numerous) tillage trips. Weed control is accomplished with crop protection products and/or row cultivation.

Conventional-till

- Entire field is tilled
- Less than 15% residue after planting
- Usually two to as many as four or more tillage trips are used involving the moldboard plow, chisel plow, disk, field cultivator, or combination tools**.**

APPENDIX B

Background on Surveys

Transects have been used by a number of states to quantify the amount of various tillage systems being used by crop. Although the exact method of data collection and procedure varies, all sought to improve the accuracy of the amount of conservation tillage by county.

Cropland surveys designed to estimate the amount of conservation tillage being used on the land are a relatively new concept. The Conservation Technology Information Center (CTIC) initiated the annual National Crop Residue Management Survey in 1982. The data gathered for this national survey usually involved a meeting of minds and data. NRCS field office personnel (usually district conservationists) in each county were annually urged to utilize area agricultural statistical data and meet with others who may have information to arrive at “best estimates” for the national survey. NRCS district conservationists are often assisted by soil and water conservation district personnel, county extension agents, agribusiness, local farm organizations, and other interested parties to complete a survey form that denotes these best estimates, which are generally based on personal knowledge.

Another survey conducted on a national basis is the 5-year NRCS National Resources Inventory (NRI). These data are collected on some 22 parameters, including physical characteristics of the land and the effects of agronomic practices on soil erosion. The NRI is a “point” survey method, where points correspond to random locations within a field. The first NRI in 1977 contained limited data on conservation tillage systems, as did subsequent surveys in 1982, 1987, 1992, and 1997.

Use of the NRI to estimate accurate acreage of conservation tillage or to document annual cropland trends in a state or county is greatly limited. The NRI has proven valuable in development of national resource policies.

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Appendix J - Standard Operating Procedures for Delaware Nutrient Management Plan Verification for Land and/or Animal Operations

Overview

The DE Nutrient Management Program (Program) was designed to protect Delaware waters from agricultural and commercial organic and inorganic pollutants while maintaining farm profitability. Part of the Program's goal is to verify these practices are being followed by the regulated community thereby measuring compliance and providing technical assistance for farmers out of compliance. Estimates of verified compliance is a tool for measuring Program success, fiscal responsibility and taking credit for pollution reduction activities for water quality restoration efforts around the state and region.

Definitions:

Best Management Practice (BMP): Methods or techniques found to be the most effective and practical means in achieving water quality while making the optimum use of farms' resources.

Commercial Nutrient Handler: Individuals who apply nutrients to 10 or more acres of land as part of a commercial business.

Compliance: operation is in good standing according to nutrient management law based upon verification evaluation.

Disabled: Certification holder has a lapsed certification due to lack of continuing education credits.

Enabled: Certification holder is in good standing and up to date on continuing education credits.

Program staff scientist: Person performing verification evaluations on behalf of the Program and the Delaware Department of Agriculture.

Farm Gate: the management unit of one farm, linked by operator and consisting of multiple fields managed as one. Fields may have different soil tests, but agronomic outcomes should be consistent.

Field-Scale: a management unit with the same crop, application rate and representative soil sample under the direction of an operator.

Management Unit: an area of crop production that is continuous in its extent and recognized individually in a nutrient management plan with specific application rates and timing from other farm areas.

Nutrient Generator: Individuals who need to be certified at the Nutrient Generator level have operations that include 8 or more animal units and less than 10 acres of land receiving nutrients.

Nutrient Management Consultant: Individual who is certified to write nutrient management plans.

Non-Compliance: operation has areas of improvement to gain compliance and failure to improve could result in public hearing and/or civil penalty.

Operation: Any agricultural operation that has a need for nutrient management practices per the nutrient management law

Operator: Any person that is responsible for nutrient management activities associated with agricultural production.

Private Nutrient Handler: Individuals who apply nutrients to 10 or more acres that is owned, managed, or rented by the individual.

Records: receipts, logs, journals or electronic notes that indicate the amount, location and temporal specifics of farm activities.

State Technical Standards: The State Technical Standards can be found at https://dda.delaware.gov/nutrients/NM_TechStandards.shtml Specifications for component practices required or advised by Nutrient Management Plan or CAFO regulation can be found here and provide additional metrics by which component practices may be verified for compliance.

Verification Evaluation: Scheduled meeting with operator to evaluate operation nutrient management plans, activities and records to protect water quality.

Criteria

Operator Eligibility

The certified person should have attended the initial certification sessions with the University of Delaware and have a valid certification number. This person should also be "enabled" and current on continuing education credits. Continuing Education Credits can be issued based on time spent for the verification evaluation at discretion of the administrator.

Verification Evaluation Types

Operation verification evaluation type is determined by operation practices as listed below.

1) Animal Only (and CAFO GP1): any operation that has 8 animal units or more. An animal unit is equal to 1000 lbs. These operations have no land under production.
2) Land & Animal (and CAFO with land GP2 & 3): any operation that has 8 animal units or more AND applies nutrients to 10 acres or more.
3) Land Only: any operation that applies nutrients to 10 acres or more. These operations have no animal units.

Eligibility & Selection

Based on recent previous compliance rates between 75 and 85 percent the Program estimates 17.7% of farms require verification evaluations annually (See Appendix A, Table 1). The Program staff can select an operator and/or operation for audit via any of the following manners:

5) Random selection- operators may be picked at random from a database of contacts by Program staff scientist at any given time- not due to non-compliance or complaint- to reach target verification evaluation numbers
    a) Selection interval follows the recommendation in Appendix A below: *Sampling Recommendations for Delaware Nutrient Management Verification*
6) Consultant selection- if willing, consultants can help arrange verification evaluations for their clients to mitigate the travel and schedule burdens of random audits.
7) Targeted by Non-Compliance- an operator may be selected for a verification evaluation due to annual report inaccuracies or incompleteness or non-compliance from previous audit.
8) Targeted by Program staff- an operator may be selected for a verification evaluation due to complaint investigation initiated by a public citizen or program official. If the Program staff investigates a complaint and has suspicion of non-compliance, officer may ask Program staff scientist to conduct verification evaluation.
9) Participation in other state and federal programs – higher inspection rates for select groups of farmers participating in state land leasing, federal cost-share programs or other programs for

which nutrient management activities are involved may be preselected by a fellow agency for Nutrient Management Program verification evaluation based on available funding and program verification goals. These evaluations may be performed with Program partner staff in an advisory role and may result in regulatory enforcement beyond the scope of the Program itself.

Notification

Once the Program staff has selected an operator and/or operation for a verification evaluation they must schedule a time to meet with the certified operator via the following guidelines.

1) Initiate contact by phone to the farmer, schedule an appointment date & time.
2) Schedule appointment 1-2 weeks in advance of the verification evaluation date and the farmer should feel free to notify their plan writer to prepare materials or generally invite them to join.
3) Mail a letter to the farmer providing a list of the documents & records that will be needed to conduct the verification evaluation.
4) If the farmer cannot be reached by phone after 3 calls during a 2 week period, a certified Departmental letter will be sent containing a date and time for a verification evaluation. The letter should state that contact has been initiated by the DDA via telephone on the dates provided and that this letter serves as an official notification. The letter will require that a response confirming or rescheduling the evaluation sent back to the department must be received within 14 days of the letter date. Failure to respond in a timely manner may result in a public hearing before the Commission or a fine from the Program.
5) The Program strives to exercise flexibility in scheduling evaluations during agricultural operations, so in extenuating circumstances, a verification evaluation may be delayed to a more appropriate time at the discretion of the Program staff. Considerations such as planting and harvest seasons for grain and vegetable farmers or heat waves during which poultry operations are tenuously managed.
6) The farmer will need to have available the most current NMP and implementation records as well as the previous NMP and implementation records from a minimum of previous 3 crops or 24 months of history, whichever is less. Retrieving crop yield history of up to 7 years is advised to verify accuracy of yield goals in accordance with the State Technical Standards.

Areas of Verification Evaluation

2) Certification: Each operation is required to have a minimum of one (1) certified operator. The certified operator or a certified designee should be present for the verification evaluation. *An hour-long verification evaluation should receive one credit. No more than one credit should be issued per verification evaluation within each renewal cycle.*
   a) Animal only (and CAFO no-land – GP1): Operator(s) should be certified as Nutrient Generator or higher.
   b) Land plans (and CAFO with land – GP2 & 3): Operator(s) should be certified as Private Nutrient Handler or higher.

3) Nutrient Management Plan or Animal Waste Management Plan: The Nutrient Management Plan or Animal Waste Management Plan is to be written by a certified nutrient management consultant without conflict of interest in the operation. An Animal Waste Management Plan may be written by the certified (Nutrient Generator or higher) operator as outlined below. During the verification evaluation the Program staff scientist will check for completeness of each plan according to the plan requirements.

4) Records of Implementation: Each operator is required to keep certain records of implementation outlining their operation practices for five years. We advise a minimum of previous 3 crops or 24 months of history, whichever is less, be available upon inspection. Plans that are cost-shared or updated annually would need to present two consecutive plans. Two and three year plans cover the requested time period for routine inspection. The Program Staff scientist may inspect as little as 12 months of record keeping for the following areas.
   a) Actual Yield: Specific field or management unit yield information for the last 7 years or less if the yield goal is based on less historical information.
   b) Nutrient Type(s): Type of nutrients applied such as inorganic fertilizer, organic fertilizer (manure), or other (ex. DAF). i.e. fertilizer receipts or manure weigh tickets; note: if all inorganic fertilizer was purchased and applied by a custom application fertilizer company, then the invoice detailing the total blend weight would be sufficient.
   c) Analysis/Nutrient Content of fertilizers or manures: N-P-K analysis of fertilizers applied i.e. fertilizer labels, blend work orders, manure analyses.
   d) Application Rates & Quantity: Pounds, gallons, or tons applied per acre and total amount applied per total crop acres per application period. Applications such as pre-plant, side-dress or fertigation should be itemized by quantity and traceable to analysis as indicated above. i.e. application records sent by a co-op, log book of applications kept by operator or bulk order receipts with supplemental records of annualized rates.
      It is expected that all records are kept on a field scale. Two to three fields will be evaluated per operation. Program staff, at their discretion, may accept farm gate scale records in the few cases where the operation has homogenous management across multiple fields and records to match.
   e) Application Timing & Placement: Date(s) applied and indicated method such as banded or starter. Date of last calibration of spreading equipment should be verified as appropriate. i.e. log book of maintenance and application records kept by operator or plan notations in the margins
   f) Manure Management Information: Manure type, date of removal from production area or manure shed, receiver information, approximate tonnage removed (if applicable). i.e. manure export records kept by operator, receipts from manure export company, weigh tickets from certified truck scales.
5) Inspection of Component BMPs-

a) Phosphorus Site Index (PSI) (if applicable): spot check records of actual nutrient application on fields where a PSI has been calculated to make sure the actual application did not result in over fertilization of phosphorus (P). If no PSI has been performed on fields with a FIV >150, then the P application can be no more than a 3 year crop removal rate. (Staff would need a printout detailing the University of Delaware's crop removal rates by bushel and crop) See **https://cdn.extension.udel.edu/wp-content/uploads/2016/03/23084930/Part-A-phosphorus-loss-potential-due-to-site-and-transport-characteristics.pdf** and **https://dda.delaware.gov/nutrients/downloads/PSI_DE_All_Counties_110910.pdf**

b) Carry over nitrogen credits: Legumes and cover crops provide plant available nitrogen in the next season with sufficient yield of biomass. Residual Nitrogen values can be estimated using the Mid-Atlantic Nutrient Management Handbook (**https://s3.amazonaws.com/udextension/ag/files/2013/06/The-Mid-Atlantic-Nutrient-Management-Handbook-2006.pdf**). Additionally, available nitrogen from legume cover crops, non-legume cover crop, or any other green manure source, can be assessed by determining plant available nitrogen (Staff would need to see available nitrogen test results and the provider of the results).

c) Pre-side-dress Nitrate Tests (PSNT): Provide all relevant test results on all fields that received manure applications to check that side-dress N application rates were within the allowable range recommended by the a certified consultant or lab. (Example: UD calculation table & knowledge of how to perform the calculations to determine the side-dress N recommendation – *See Attached)*
http://extension.udel.edu/factsheets/nitrogen-removal-by-delaware-crops/
http://extension.udel.edu/factsheets/phosphorus-removal-by-delaware-crops/

6) Management Changes & Plan Modifications during Implementation – Any revisions to the NMP must be justified, documented, and included in the records. Any significant alterations in operations or upon a 25% or greater increase in operation caused by unforeseen circumstances (ex. weather) that occur prior to a NMP's expiration date will require an addendum to the NMP from the certified nutrient consultant.

7) Supplemental record inspection: In the event that 1-2 years of records does not exhibit compliance with the plan specifications, a Program staff scientist, in their sole discretion can evaluate antecedent conditions and records to better evaluate overall farmer performance.

8) Additional BMPs may be inspected for crediting practices that exist as separately tracked items. Some of these may be required for CAFO compliance and others may be collected in an effort to better capture BMP extent across the state for non-cost shared practices.

a) Animal Operation BMPs:
   i) Composter
   ii) Mortality Freezers
   iii) Manure Shed
   iv) Heavy use area pads (HUAPs) or concrete end pads
   v) Stockpiling
   vi) Storm Water Retention Pond

vii) Pasture Rotation
viii) Pasture Stream Fencing
ix) Grassed Waterway
x) Windbreaks
xi) Regular Manure Sample

b) Land Operation BMPs:
i) Temporary Field Staging
ii) Application Setbacks
(1) Can be verified with inquiry and application rate and quantity information
iii) Application Rates less than Recommendations
iv) Cover Crops
v) Grid Soil Sampling
vi) Annual or semi-annual Soil Test
vii) PSNT; following a recommendation from a certified consultant or approved lab.
viii) CSNT; following a recommendation from a certified consultant or approved lab.
ix) Precision Application
x) Yield Mapping
xi) Strip Trials
xii) Split N or P Applications
xiii) Variable Rate N or P Applications
xiv) Manure Incorporation
xv) Subsurface Injections

Results

Levels of Compliance

During a verification evaluation two different parties are subject to evaluation- the operator and the certified Nutrient Management Consultant (Consultant). The consultant is held accountable for elements of the plan that are missing or incomplete. The operator is held accountable for the certification, implementation (e.g. records) and farm management aspects of the audit. Compliance and non-compliance will be aggregated on a semi-annual basis for reporting purposes under various agreements, but protecting anonymity where legally required.

5) Compliance: an operation is in compliance if all aspects of the verification evaluation pass with no reason to follow up. Certification status is enabled and up to date, the operation plan is complete and valid, records of implementation are kept and complete, and farm management is up to specification.
6) Substantive Compliance: an operation is in substantive compliance if the findings of the verification evaluation have a good explanation and are within nutrient management recommendations. (i.e. the operator applied less N or P than the plan recommended and this rate maintained productivity.)
7) Procedural Non-Compliance: an operation could be in procedural non-compliance if the findings of the verification evaluation have a good explanation and within nutrient management recommendations. (i.e. According to plan a field should have been planted in

corn, instead soybeans were planted due to weather the nutrients however were applied at soybean rate.)

8) Non-Compliance: an operation will be in non-compliance if there is an environmental issue that needs to be addressed. (i.e. not following nutrient management plan recommendations, records of implementation not being kept, waste being handled improperly.)

Follow-Up Guidelines

Follow up practices will be communicated to the operator and/or the consultant at the conclusion of a verification evaluation. If compliant, no verification evaluation should be repeated for up to 5 years, unless otherwise determined by selection process. Follow-ups can be made as soon as two weeks or as long as 1 year determined by the cause of follow up. These guidelines are outlined below.

5) Compliant: normal selection criteria employed
6) Substantive Compliance: normal selection criteria employed, next random selection will seek to cull further deviations.
7) Procedural Non-compliant: discretion of program staff
8) Non- Compliant: follow up verification evaluation as soon as 2 weeks and as late as 1 year depending on cause, examples provided:
    a) Waste storage facility being improperly used or not tidy- 2 week follow up
    b) Insufficient records- 1 year follow-up implementation verification
    c) No plan or out of date plan- 3 month follow-up to validate current plan and subsequent 1 year implementation verification

Appendix A: Sampling Recommendations for Delaware Nutrient Management Verification-DRAFT

February 5, 2018

Tetra Tech, Inc., Fairfax, VA

EPA Contract EP-C-12-055, Task Order 003, Task 04, Technical Direction 53

Background

Sampling recommendations were derived using information contained in records for 893 unique reporting IDs found for 2016 in data provided by the Delaware Department of Agriculture (DDA). This data set is described in detail in *Delaware Nutrient Management Data* (Tetra Tech, January 5, 2018). These 893 records constitute the population from which samples are assumed to be taken. These recommendations are made in accordance with Activity 3 of Technical Direction 53 (*Statistical Support to the State of Delaware for Determination of Statistically Significant Sub-sampling of Farms Implementing Nutrient Management Practices*), which calls for "recommendations for how to design a statistically valid, sub-sampling-based approach to verification of nutrient management practices and compliance with State regulations."

Method

The sampling plan is based on assigning each of the 893 records to one of three strata and designing a stratified random sampling plan. The three strata are (see *Delaware Nutrient Management Data* for details on the development of these categories):

- Priority 1: Highest priority, potential CAFOs
- Priority 2: Next highest priority (includes non-pastured animals)
- Priority 3: Lowest priority (no non-pastured animals)

Of the 893 records in the data set, 423 records were assigned to Priority 1, 286 were assigned to Priority 2, and 184 were assigned to Priority 3.

As used in this analysis, the overall (i.e., statewide) proportion of operations meeting requirements, $\hat{p}$, can be estimated with Equation 1.

$$\hat{p} = \sum_{i=1}^{L} w_i \hat{p}_i \qquad \text{Eq 1}$$

where $w_i = {}^{N_i}/_{N}$, $\hat{p}_i$ is proportion of operations meeting requirements in strata i, N_i is the number of operations in strata i, and N is the total number of operations across all strata. The standard deviation of the strata $s(\hat{p}_i)$ and overall proportion $s(\hat{p})$ are given Equations 2 and 3, respectively.

$$s(\hat{p}_i) = \sqrt{\frac{\hat{p}_i(1-\hat{p}_i)}{n_i}}\left(1 - \frac{n_i}{N_i}\right) \qquad \text{Eq 2}$$

$$s(\hat{p}) = \left(\frac{1}{N^2}\sum_{i=1}^{L} N_i^2 \left(\frac{N_i - n_i}{N_i}\right)\left(\frac{\hat{p}_i(1-\hat{p}_i)}{n_i}\right)\right)^{1/2} \qquad \text{Eq 3}$$

L is the number of strata and n_i is the number of samples collected for strata i. The 90th and 95th percent confidence interval (CI) half widths (or error margins) are calculated with Equation 4.

$$CI = Z_{1-\alpha/2}s \quad \text{Eq 4}$$

where s is either $s(\hat{p}_i)$ or $s(\hat{p})$ and $Z_{1-\alpha/2}$ is 1.645 and 1.96 for the 90th and 95th percent CI, respectively.

The above equations were applied to evaluate alternative stratified random sampling plans assuming a binomial distribution. The binomial distribution assumes that each evaluated facility can be uniquely classified as meeting or not meeting requirements.

The following characteristics were considered.

- Restrict sampling in Priority 1 (potential CAFOs) to 20 percent.
- The minimum proportion of facilities in compliance:
    - All strata exceed 0.70 compliance
    - All strata exceed 0.80 compliance
- Error margins (CI half width)
    - Not to exceed 0.05
    - Not to exceed 0.10
- Confidence Level
    - 95 percent
    - 90 percent

The binomial distribution is used in cases where there are two choices: yes or no, pass or fail, present or not present. While an assessment of whether an operation is in compliance with nutrient management requirements may involve a checklist or observation of multiple factors, application of the binomial distribution assumes that the final result of an audit will be expressed simply as either "in compliance" or "not in compliance."

The 20 percent sampling for Priority 1 is designed for consistency with Chesapeake Bay Program verification requirement for CAFOs (concentrated animal feeding operations) (*Strengthening Verification of Best Management Practices Implemented in the Chesapeake Bay Watershed: A Basinwide Framework*, Chesapeake Bay Program 2014). These requirements state that *random, follow-up inspections are recommended to be conducted on 20% of [permit-issued] BMPs*. All records designated as Priority 1 represent "potential" CAFOs.

The compliance assumption of 0.80 (i.e., at least 80 percent of operations are in compliance with nutrient management plan implementation requirements) is based on actual data from Delaware. The value of 0.70 is used to provide a conservative estimate as a reference; this lower compliance rate will result in a greater sampling requirement. When using the binomial distribution in an application such as this, a value of 50 percent (i.e., 0.50) results in the largest sample size. As the value approaches 0 or 100 percent, sample size is reduced.

Error margins, or confidence interval half-widths, determine the upper and lower bounds of the estimate. For example, an error margin of 0.05 (or 5 percent) means that if the measured compliance were 0.82, then the actual compliance would fall between 0.77 and 0.87 at the specified confidence level. In the applications presented here, the compliance rate estimates used for sample size calculations are 0.70 or 0.80.

The confidence level indicates the certainty associated with the calculated error margins for the estimate. For example, a confidence level of 90 percent (0.90) means that the true value of

compliance has a 90 percent chance of falling within the range determined by the measured compliance ± the calculated error margin (e.g., 0.05). Continuing with the above example, there would be a 90 percent chance that the compliance rate falls between 77 and 87 percent, with a 10 percent chance that the true compliance rate falls outside of that range. In other words, there is a 90 percent chance that the estimated range is correct.

Results

Multiple scenarios were run using the characteristics described above. Findings from calculations led to a narrowing of scenarios to those represented in Table 1.

Central to the calculations is an assumption regarding compliance rate. This assumption is represented in Column 1 for Priority 1 (Prty. 1 Comp. Est.) and Column 2 for the other two categories (Prty. 2-3 Comp. Est.). For example, the assumption for all categories is 80 percent compliance (0.8) in Row 1. It is assumed for these calculations that the statewide compliance rate is the same as the compliance rate for each category.

The calculated sample sizes are shown in Column 3 for Priority 1 (Prty. 1 Sample Size), Column 4 for Priority 2 (Prty. 2 Sample Size), Column 5 for Priority 3 (Prty. 3 Sample Size), and Column 6 for statewide (Total Samples). For example, the statewide sample size is 158 in Row 1.

Columns 7-10 show the confidence interval half width values (CI Half Width, or error margins) for the 90% confidence level. These CI Half Width values are to be applied to the compliance rate assumption values. For example, the 90% CI Half Width value for statewide compliance (Statewide) in Row 1 is 0.049, so the actual compliance rate based on 158 statewide samples should be expressed as 0.80 ±0.049, or 75 to 85 percent at the 90% confidence level.

Assumptions represented in Table 1 include the following:

- A 90 percent confidence level is assumed for all cases.
- The statewide error margin is fixed at no greater than 0.05 (rounded) in all cases: Column 7.
- The error margin for each priority level is fixed at no greater than 0.10 (rounded) in all cases: Columns 8-10.
- The sampling percentage for Priority 1 is fixed at 20 percent (n=85): Rows 1 and 2
- The compliance rate is assumed to be 0.80 for all priority levels and statewide: Rows 1 and 3.
- The compliance rate is assumed to be 0.70 for all priority levels and statewide: Rows 2 and 4.
- The total sample sizes in Rows 3 and 4 are set to equal those in Rows 1 and 2, respectively, while sampling of Priority 1 records (Column 3) is set well below the 20 percent requirement of 85. This was done to test the impact of the Priority 1 sample size on meeting overall requirements of a statewide error margin of no greater than 0.05 (Column 7) and priority level error margins of no greater than 0.10 (Columns 8-10).

The table shading identifies assumptions, input, and resulting calculations. The yellow shading indicates the two levels of assumed compliance. The grey shaded values in Column 3 represent the sampling assumption for CAFOs (Priority 1). The green and peach shaded cells represent the “not-to-exceed” margins of error of 0.050 (actually 0.049-0.050) for statewide and 0.10 (actually 0.064-0.099) for each priority level, respectively.

Table 3. Comparison of alternative sampling options

							90% CI Half Width (error margins)			
Row	Prty. 1 Comp. Est.	Prty. 2-3 Comp. Est.	Prty. 1 Sample Size	Prty. 2 Sample Size	Prty. 3 Sample Size	Total Samples	State-wide	Prty. 1	Prty. 2	Prty. 3
1	0.8	0.8	85	38	35	158	0.049	0.064	0.099	0.100
2	0.7	0.7	85	54	44	183	0.050	0.073	0.092	0.099
3	0.8	0.8	58	50	50	158	0.050	0.080	0.085	0.079
4	0.7	0.7	77	62	44	183	0.050	0.078	0.085	0.099
Column	1	2	3	4	5	6	7	8	9	10

Discussion

Sample size requirements generally increase as error margin is reduced, confidence level increases, and compliance rate decreases from 80 to 70 percent.

All error margin constraints (0.05 for statewide and 0.10 for each priority level) were met with statewide sample sizes of 158 and 183 for compliance rates of 80 and 70 percent, respectively, at the 90 percent confidence level under the assumption that 20 percent (n=85) of Priority 1 operations are sampled. Assumptions of lower sampling rates for Priority 1 resulted in greater sampling rates for Priority 2 and Priority 3 to achieve the same statewide sample sizes, but did not alter attainment of error margin goals. See Figure 1 for a graphical summary of data in Table 1.

Recommendation

Based on the findings presented here, it is recommended that DDA sample 20 percent of CAFOs (thereby meeting EPA verification requirements), set the statewide error margin goal to not exceed 0.05, set the error margin goal for each priority level at 0.10, and apply a confidence level of 90% to sample size calculations. An initial assumption of 80 percent compliance is appropriate based on existing DDA compliance data, but the assumption should be reconsidered annually and altered to reflect the most recent compliance rates. To ensure that calculated sample size requirements are met, DDA should develop a randomly-selected list of operations that exceeds by 5 or 10 percent the calculated needs. This will facilitate meeting sampling goals in the event that operations on the list cannot be inspected (e.g., operation is no longer in business).

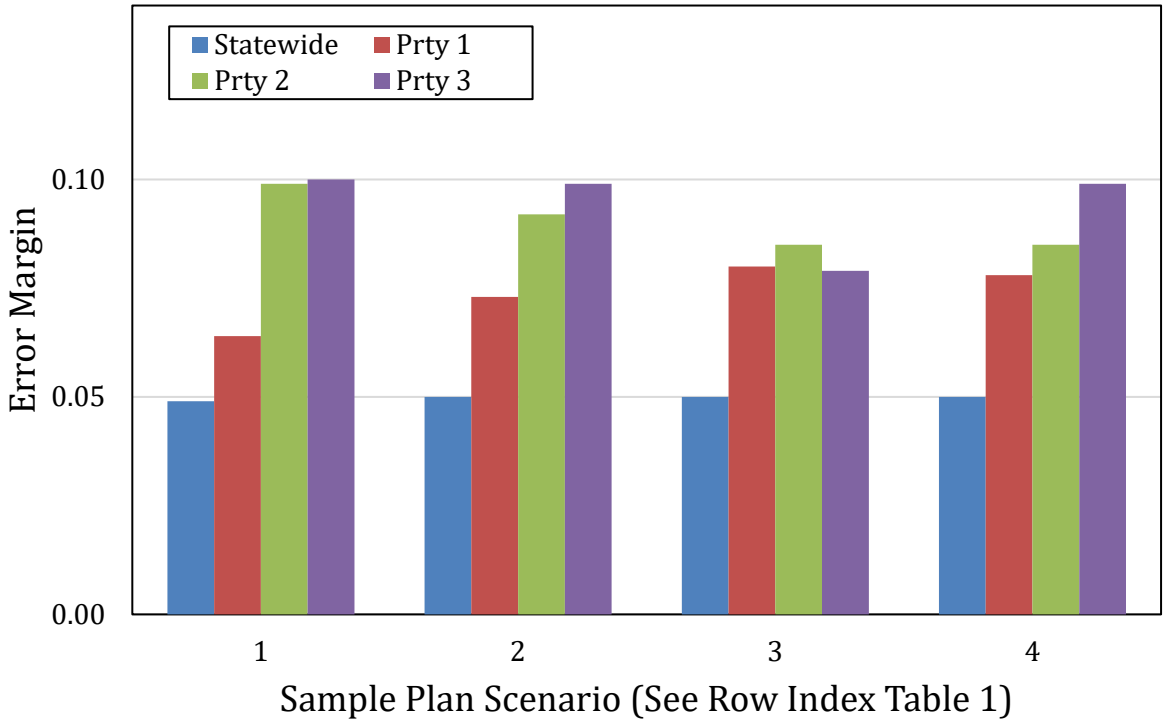

Figure 1. Summary of error margin calculations by sampling scenario