

# **An Analysis of the 2020 Pennsylvania Farm Conservation Practices Inventory for Purposes of Reporting Practices to the Chesapeake Bay Program**

**Matt Royer**

**Director**

**Agriculture and Environment Center**

**Institute for Sustainable Agricultural, Food, and Environmental Science**

**Aaron Cook**

**Research Assistant**

**Agriculture and Environment Center**

**Institute for Sustainable Agricultural, Food, and Environmental Science**

**Chris Houser**

**Assistant Director, Agronomy and Natural Resources Programs**

**Penn State Extension**

**Jim Shortle**

**Distinguished Professor of Agricultural and Environmental Economics**

**Department of Agricultural Economics, Sociology, and Education**

**Anil Kumar Chaudhary**

**Assistant Professor of Agricultural and Extension Education**

**Department of Agricultural Economics, Sociology, and Education**

**Prepared for the Commonwealth of Pennsylvania,**

**Department of Agriculture**

**February 1, 2021**

**Final Report**

# **An Analysis of the 2020 Pennsylvania Farm Conservation Practices Inventory for Purposes of Reporting Practices to the Chesapeake Bay Program**

## **Executive Summary**

A survey of Pennsylvania farmers in Lancaster, York, Adams and Franklin Counties was conducted in 2020 to provide them an opportunity to self-report conservation practices implemented on their farms. The survey especially sought data on “voluntary,” non-cost shared practices. This survey followed successful methodologies of a survey of all Pennsylvania farmers across the Chesapeake Bay watershed undertaken in 2016. The instrument and procedures were developed in collaboration by survey research experts in Penn State’s Survey Research Center, and subject matter experts from state agencies and agriculture. The survey development and implementation process was led and managed by the Agriculture and Environment Center (AEC), Penn State University, College of Agricultural Sciences.

The survey was mailed to approximately 15,000 farmers in February 2020, with returns accepted until the end of May 2020. A total of 1,794 were completed and returned.

To assess the reliability of the self-reporting, approximately 10 percent of returns were selected randomly for on-farm verifications conducted by trained and experienced Penn State Extension staff. Extension educators were able to complete farm visits on 7 percent of farms in the four county area. Analyses of the data reject systematic under or over reporting in the sample data for the majority of relevant conservation practices, and means and 95% confidence intervals indicate reliability in the reported data. We further applied various methodologies to ensure that conservation practices reported by respondents were not already reported to the Chesapeake Bay Program through other methodologies employed by the Commonwealth.

Based on our analysis, farmers in Lancaster, York, Adams and Franklin Counties, Pennsylvania have implemented the following non-cost shared and/or previously unreported practices: 63,254 acres of core nitrogen nutrient management; 40,143 acres of core phosphorus nutrient management; 84,418 acres of supplemental nitrogen nutrient management for rate; 39,834 acres of supplemental nitrogen nutrient management for placement; 63,507 acres of supplemental nitrogen nutrient management for timing; 54,537 acres of supplemental phosphorus nutrient management for rate; 29,394 acres of supplemental nitrogen phosphorus management for placement; 34,231 acres of supplemental phosphorus nutrient management for timing; 22,040 acres of manure incorporation/injection; 277 animal waste storage units; 118 barnyard runoff control systems; 4,898 acres of prescribed grazing; 52,480 acres with soil conservation and water quality plans; 3,502 acres of commodity cover crops; and 7,330 acres of riparian buffers (inclusive of all buffer types).

## **Introduction**

The implementation of water quality protection practices in Pennsylvania agriculture is a high priority solution for addressing issues related to water quality, soil and water health, and agricultural productivity in the Commonwealth. Conservation practice adoption is well-documented for practices that are implemented with federal or state financial assistance. More difficult continues to be accounting for practices that farmers adopt on their own, without public financial support.

In 2016, the Penn State Agriculture and Environment Center (AEC), with funding from the Pennsylvania Department of Environmental Protection (DEP) and collaboration of many agency and agricultural industry partners, conducted a survey of farmers in the Chesapeake Bay watershed inviting farmers to self-report conservation practices recognized toward Chesapeake Bay water quality goals. The survey's methodology and results were presented to and accepted by the Chesapeake Bay Program's Agricultural Technical Workgroup and many previously-unaccounted for practices were successfully reported to DEP and the U.S. Environmental Protection Agency (EPA), giving farmers credit for implementing these practices.

In 2020, this survey was repeated, with a geographic focus of Lancaster, York, Adams, and Franklin Counties, the four counties identified as pilot counties in Pennsylvania's Phase 3 Chesapeake Bay Watershed Implementation Plan (Phase 3 WIP). The survey was again undertaken by the Penn State AEC with funding from the Pennsylvania Department of Agriculture (PDA), and with collaboration from DEP, Pennsylvania Farm Bureau, Penn Ag Industries, Professional Dairy Managers of Pennsylvania, Pennsylvania State Conservation Commission, Pennsylvania Association of Conservation Districts, and Penn State Extension. The survey was designed specifically to provide data on self-funded high priority practices as identified in Pennsylvania's Phase 3 WIP.

Methodologies for survey development and administration, farm visit verification, and data reliability analysis followed previously accepted protocols established in the 2016 survey.

## **Survey Methodology**

As in 2016, the survey instrument was developed by a set of topic experts with technical assistance from the Penn State Survey Research Center (SRC). The survey asks questions to determine the use of a set of priority conservation practices, the funding sources for the practices, and farm operation characteristics. To control the length and complexity of the survey, the set of practices addressed in the survey was limited to the following practices that provide high levels of nutrient and sediment reductions, are practices accepted by the Chesapeake Bay Program for credit toward meeting nutrient and sediment load allocations, and are likely to have high levels of voluntary adoption:

- Core nutrient management (nitrogen and phosphorus)
- Supplemental nutrient management (nitrogen and phosphorus)
- Manure incorporation and injection
- Animal waste storage systems

Barnyard runoff controls  
Prescribed grazing  
Soil conservation and water quality plans  
No till and minimum till  
Cover crops  
Riparian buffers

Questions determine whether the practices are present on a farm, and if so, determine the level of implementation using units compatible with the Chesapeake Bay model, the funding source, and whether they meet definitions acceptable to the Chesapeake Bay Program. A copy of the survey instrument is provided in Appendix A. A summary of how responses to specific questions corresponded to conservation practices definitions is provided in Appendix B.

The survey was mailed by the SRC to approximately 15,000 potential respondents located in Lancaster, York, Adams and Franklin Counties in late February 2020. The sample frame was developed from county parcel data analysis and targeted agricultural landowners with 10 acres or greater. The mailing included a letter from Pennsylvania Secretary of Agriculture Russell Redding, Dean Richard Roush of the Penn State College of Agricultural Sciences, and Richard Ebert, President of Pennsylvania Farm Bureau, inviting farmers to respond, explaining the reasons for and the importance of the survey, describing the uses of the data, and describing data management procedures that assured the confidentiality of farmers' responses. Instructions in both the letter and the survey instructed recipients to have the individual most familiar with farm operations fill out the survey.

Respondents were provided both web and mail options for returning the survey. Postcard reminders and a second copy of the survey were mailed to non-respondents during the survey period. The original deadline for the survey was April 30, 2020. However, since returns were depressed (potentially due to priority challenges related to the COVID-19 global pandemic and its impact on agriculture during this time), two extensions were granted (May 15, 2020 and May 30, 2020, respectfully). The survey closed May 30, 2020.

To help boost response rates, partnering farm and agency organizations promoted the survey through periodic press releases, in publications such as Lancaster Farming, and within their memberships. Unlike in 2016, promotion at in-person meetings and events was not an option because of universal cancellation of such events due to COVID-19 precautions.

The SRC accepted all returns via business reply envelopes and website and processed all returns. Returns were checked for duplicates, machine scanned and coded by the SRC. In its administration of the survey, the SRC assigned a unique ID number to each respondent. Respondents who returned a survey in 2016 were also mailed a survey in 2020 and the same unique ID number was used to facilitate data analysis and inventorying practices. The SRC retained as confidential all data which links the ID numbers to names and addresses of respondents. A total of 1,794 individual survey returns were received and processed, with county breakdowns as follows: Lancaster County 989; York County 270; Adams County 253; Franklin County 282. The returns were analyzed to determine

conservation practices implemented by respondents. Results are reported cumulatively in aggregate by county, the Commonwealth's preferred method for reporting agricultural conservation best management practice (BMP) implementation data to the Chesapeake Bay Program.

## **Farm Visit Verification Methodology**

Reported conservation practices may differ from actual practices for various reasons. In order to assess the reliability of the results, a subsample of 10% of the respondents was randomly selected for farm visits by Penn State Extension educators. Given DEP's preference for reporting results by county, the subsample was drawn by taking a random sample of 10% of the responses in each of the sampled counties. The on-farm visits were conducted by approximately a dozen Penn State Extension educators with expertise in relevant disciplines such as agronomy, livestock operations, nutrient management, horticulture and cropping systems, and extensive experience working with farmers.

Participating educators were trained by staff from DEP, PDA, PA State Conservation Commission, Chesapeake Bay Program and Penn State Extension. A full day training was held on June 10, 2020 via Zoom and was recorded for later viewing and reference by trainees. The training provided information on biosecurity protocols, overviews of the survey and the farm visit form to be used during farm visits, and information on how to use DEP checklists for determining the existence of manure management plans and agricultural E&S plans and Chesapeake Bay Program Resource Improvement (RI) practice standards for applicable structural practices.

A form was developed by the survey development team for use by Extension educators to record their findings. The questions mirrored those asked on the survey about the presence and extent of practices, but additional information was sought in the visits to determine whether the practices were installed and functioning sufficient to meet Bay Program standards. Specifically, the educators were trained on the visual indicators for meeting RI practice standards for applicable structural best management practices. If these indicators were not met, the practice was not counted. Extension educators were also trained on the essential substantive elements of manure management plans and agricultural E&S Plans. If the farmer was not able to produce a plan and the plan did not contain these essential elements, it was not counted. A copy of the farm visit report form is provided in Appendix C.

Farm visits in Lancaster and York Counties were conducted in August and September 2020. Educators were assigned farmers from the subsample. The educators were responsible for setting up the visits with participating farmers. The instructions for the survey indicated the possibility that respondents might be chosen for a farm visit. Educators contacted the farmers chosen for visits by letter and by phone to schedule visits. In some cases, door knocking was necessary to reach farmers who did not respond by letter or phone. Consistent with the confidentiality of the survey responses and to eliminate potentials for bias, educators were not provided participating farmers' survey responses.

Farm visits in Adams and Franklin Counties also took place in August and September 2020. However, challenges arose in reaching a sufficient number of farmers in these counties for an adequate subsample. More farmers were nonresponsive, unreachable, or unwilling to participate in these two counties as compared to Lancaster and York. Efforts continued through October 2020, with continued challenges. To increase the potential for successful visits, a second letter from Secretary Redding, Dean Roush, and President Ebert of Pennsylvania Farm Bureau was sent to Adams and Franklin County farmers, encouraging them to participate in the visits if contacted by Penn State Extension. This yielded additional visits, and Extension educators worked through December 2020 to complete farmer visits in these two counties.

The completed farm visit reports were submitted by the agents to the AEC data analysis team for coding. Unique ID numbers on the farm visit reports allowed researchers to link each farm visit report with the corresponding farm survey responses, and systematically compare the answers as described more fully in the next section.

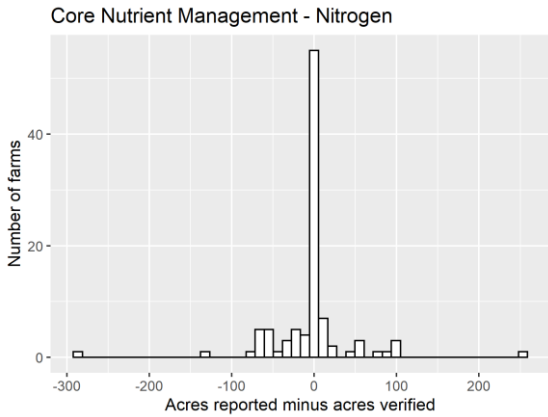
## **Reliability Data Analysis**

Tetra Tech's assessment report of the 2016 survey data recommends data reliability analysis be conducted on a county-by-county basis if possible to determine any county-specific variability of accuracy. However, for many of the practices captured in the 2020 survey in each county (particularly in York, Adams and Franklin Counties, where the number of survey returns were much smaller than in Lancaster), the sample size was too small to make any statistically significant conclusions. Accordingly, we grouped data from all four counties together for purposes of the reliability analysis.

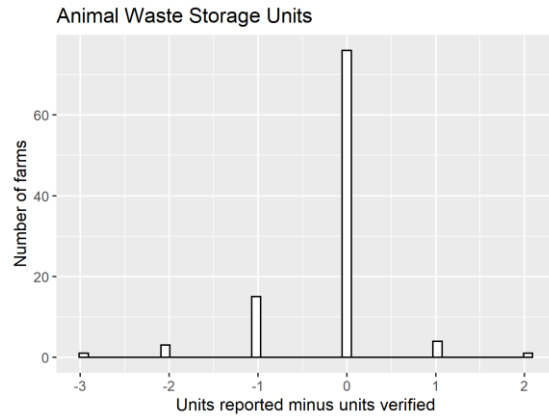
The reliability analysis involves comparison of the conservation practices reported by survey respondents selected for the subsample with the implemented practices recorded in the farm visits. For the analysis, the difference between the "reported" values from the farm survey and the "verified" value from the farm visits is computed for each practice. Combining data from all four counties for the reasons described above provided us with 1,794 surveys with "reported" values, and 124 farm visit reports with "verified" values, a subsample of 7%.

Systematic underreporting or overreporting of BMP types can be determined statistically by testing whether the mean of the differences across farms for the BMP type is not significantly different than zero. In addition to the analysis of means, histograms are presented for each practice to give a visual representation of the distribution of the "difference" variables. By way of example, Figures 1 and 2 are histograms for acres under core nutrient management for nitrogen and animal waste storage units. All other histograms and our analysis of mean differences is summarized for each practice in Appendix D ("BMP Survey Verification Summary").

**Figure 1. Histogram of differences between reported and verified acres under core nitrogen management.**



**Figure 2. Histogram of differences between reported and verified numbers of animal waste storage units.**



For each conservation practice analyzed, several sources of data from the survey and the farm visits were used to determine “reported” and “verified” values. These sources, and specifically how they relate to particular survey questions in the original survey and the farm visit report, are described for each practice in Appendix D.

## Results

Statistical analysis of the survey data compared to farm visit data in the aggregate reveals a statistically significant reliability in the data for all conservation practices inventoried in the survey. These include the following conservation practices for which the Commonwealth seeks to use these survey results to report previously undocumented practices to the Chesapeake Bay Program:

- Core nutrient management (nitrogen and phosphorus)
- Supplemental nutrient management (nitrogen and phosphorus)
- Manure incorporation and injection
- Animal waste storage systems
- Barnyard runoff controls
- Prescribed grazing
- Soil conservation and water quality plans (aka agricultural E&S plans or conservation plans)
- Commodity cover crops
- Riparian buffers

For all of these practices, cumulative results are reported in the aggregate with associated means and 95% confidence intervals.

For all practices, data was analyzed to ensure practices met relevant standards and definitions under the Chesapeake Bay Program and to ensure certain practices were not double counted. Analysis to avoid double counting involved several methods to “net out” any conservation practices that are reported through other methodologies implemented in the Commonwealth. These include datasets from government cost share programs, regulatory and farm inspection programs, and non-annual structural practices previously reported in the 2016 survey.

To avoid double counting of practices already reported through government cost-share programs, the survey asked whether each practice reported was installed with government funding. Only those practices for which the farmer indicated that no government cost share funding was utilized were reported. The only exceptions to this are core nutrient management and agricultural E&S plans, for which there is currently no funding program reporting mechanism even if cost share is provided for plan development.

With respect to regulatory and inspection programs, since core nutrient management on farms regulated by Act 38 is reported through that program, any reported Act 38 nutrient management plans were netted out of the reported dataset. In addition, any conservation practices or plans already documented and reported through DEP’s Chesapeake Bay Agricultural Inspection Program (via PracticeKeeper) were netted out.

Finally, structural practices that were already reported in the 2016 survey were netted out of the 2020 survey results to avoid double counting. This was accomplished by analyzing the unit and date installed of each applicable practice and netting out reported practices that were accounted for in 2016. Unique ID numbers used in 2016 were again used for the same respondents in 2020, allowing for this comparison of unique respondents. Where specific practices were again reported in 2020, these practices were documented as re-verified in 2020, and are reported separately in Table 2 below. Applicable non-annual structural practices for this analysis included manure storages, barnyard runoff control systems, soil conservation and water quality plans, and riparian buffers.

Table 1 is a summary of all cumulative results of relevant practices eligible for reporting to the Chesapeake Bay Program from Lancaster, York, Adams and Franklin Counties. In Table 1, we also include results from the survey for tillage management and cover crop conservation practices which are reported countywide by the Commonwealth using other approved documentation and reporting methodologies. Table 2 shows all non-annual structural practices previously reported in the 2016 for the four surveyed counties that were re-verified in 2020.



**Table 1. Cumulative results by conservation practice from reported farm surveys in Lancaster, York, Adams and Franklin Counties.**

Practice	Amount Implemented			
Core nutrient management	Nitrogen: 63,254 ac		Phosphorus: 40,143 ac	
Supplemental N nutrient management	Rate: 84,418 ac	Placement: 39,834 ac	Timing: 63,507 ac	
Supplemental P nutrient management	Rate: 54,537 ac	Placement: 29,394 ac	Timing: 34,231 ac	
Manure incorporation	High disturbance w/in 24 hours: 1,520 ac	High disturbance w/in 1-3 days: 4,629 ac	Low disturbance w/in 24 hours: 5,066 ac	Low disturbance w/in 1-3 days: 9,391 ac
Manure injection	1,434 ac			
Animal waste management storages	168 dairy units	48 beef units	16 swine units	45 poultry units
Barnyard runoff controls	118 systems			
Prescribed grazing	4,898 ac			
Soil conservation and water quality plans	41,508 ac row crops	7,254 ac hay	3,718 ac pasture	
No-till/ minimum tillage	88,594 ac high residue, minimum soil disturbance tillage	35,979 ac conservation tillage	22,830 low residue tillage	
Cover crops	23,322 ac traditional cover crops	27,915 ac traditional cover crops with fall nutrients	3,502 ac commodity cover crops	
Riparian buffers (cropland)	1,066 ac wide forest buffers	1,163 ac narrow forest buffers	1,360 ac wide grass buffers	1,957 ac narrow grass buffers
Riparian buffers with stream exclusion fencing (pasture)	214 ac wide forest buffers	576 ac narrow forest buffers	408 ac wide grass buffers	586 ac narrow grass buffers

**Table 2. Re-verified non-annual structural conservation practices from reported 2020 farm surveys in Lancaster, York, Adams and Franklin Counties that were previously documented in 2016.**

Practice	Amount Implemented			
Animal waste management storages	245 dairy units	13 beef units	40 swine units	19 poultry units
Barnyard runoff controls	147 systems			
Soil conservation and water quality plans	6,416 ac row crops	524 ac hay		234 ac pasture
Riparian buffers	113.6 ac wide (>35 ft) forest buffers	11.5 ac narrow (10-35 ft) forest buffers	4.5 ac wide (>35 ft) grass buffers	19.3 ac narrow (10–35 ft) grass buffers

## Discussion

For all results of practices reported cumulatively in Table 1, we used the farm visits to estimate the most likely cumulative totals and develop 95% confidence intervals for these estimates. After calculating the means and standard deviations for the farm-level differences between the results reported in the original survey and the results verified during the farm visits, we applied these average per-farm differences to the aggregate reported totals to come up with “estimated” totals along with upper and lower bounds constructed by the 95% confidence intervals.

For all practices, our reported numbers fall inside or below these bounds, indicating that we do not find evidence that farmers overreported their practices in the original survey. For phosphorus-based supplemental nutrient management, animal waste storage systems, barnyard runoff controls, prescribed grazing, and soil conservation and water quality plans, the lower bound of the 95% confidence interval sits above the reported totals, providing strong evidence that farmers *underreported* these practices.

While we do not find strong evidence of overreporting in any of our reported practices this method allows us to adjust the totals for each practice according to the average discrepancies uncovered during the farm visits. Estimated totals for each practice are computed as follows:

$$\text{estimated totals} = \text{reported totals} - (\text{mean deviation per farm}) \times n$$

where n is the total number of farms returning surveys (1,794). Lower and upper 95% confidence bounds on this number can also be calculated in similar fashion using the two ends of the 95% confidence intervals developed for each practice. See Appendix E for a sample calculation to demonstrate how these numbers were achieved.

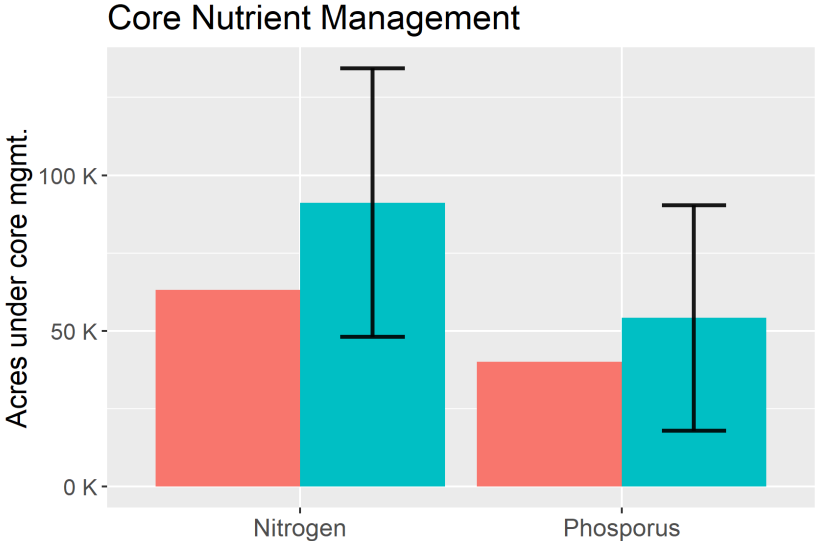
Table 3 displays the cumulative results for each conservation practice (“Reported Totals”), the adjusted cumulative numbers (“Estimated Totals,” i.e. our best estimates of the true totals based on the results of the farm visits), and the lower and upper bounds of these adjusted numbers based on the 95% confidence intervals produced from the statistical analysis of the numbers reported by the farmers in the survey relative to the numbers verified during the farm visits.

**Table 3. Reported totals and estimated (adjusted) totals by conservation practice, bounded by 95% confidence lower and upper bounds as applied to the cumulative totals in Lancaster, York, Adams and Franklin Counties.**

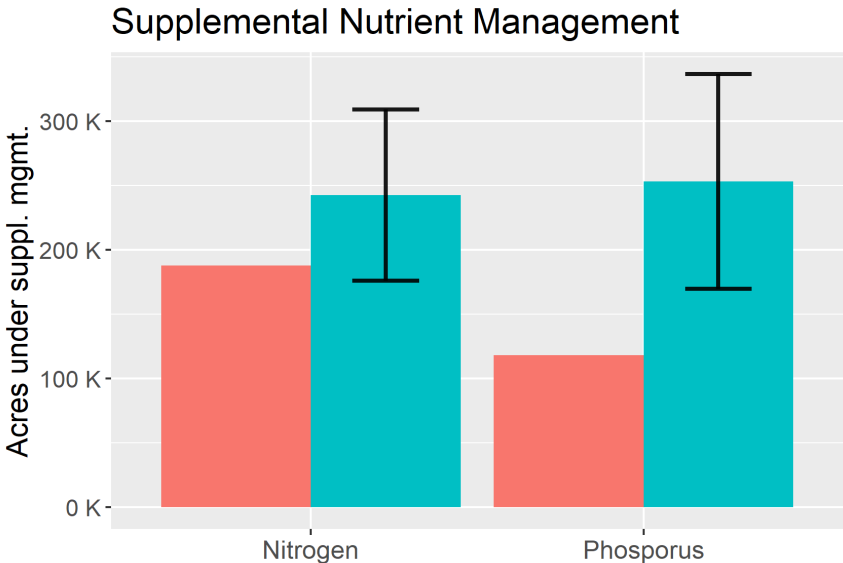
<b>Practice</b>	<b>Reported Totals</b>	<b>Lower 95% Bound</b>	<b>Estimated Totals</b>	<b>Upper 95% Bound</b>
Core N nutrient management	63,254 ac	48,040 ac	91,240 ac	134,296 ac
Core P nutrient management	40,143 ac	17,935 ac	54,172 ac	90,408 ac
Supplemental N nutrient management	187,759 ac	176,287 ac	242,782 ac	309,277 ac
Supplemental P nutrient management	118,162 ac	169,792 ac	253,256 ac	336,720 ac
Manure incorporation/ injection	22,040 ac	10,242 ac	19,001 ac	27,759 ac
Animal waste management storages	168 dairy 48 beef 16 swine 45 poultry	255 dairy 73 beef 24 swine 68 poultry	382 dairy 109 beef 36 swine 103 poultry	513 dairy 147 beef 49 swine 137 poultry
Barnyard runoff controls	118 systems	144 systems	289 systems	434 systems
Prescribed grazing	4,898 ac	5,406 ac	7,486 ac	9,566 ac
Soil conservation and water quality plans	41,508 ac row crops 7,254 ac hay 3,718 ac pasture	47,526 ac row crops 8,306 ac hay 4,257 ac pasture	79,907 ac row crops 13,965 ac hay 7,157 ac pasture	112,287 ac row crops 19,623 ac hay 10,058 ac pasture
No till/minimum tillage	147,403 ac	128,791 ac	166,225 ac	203,658 ac
Cover crops	54,739 ac	37,958 ac	60,167 ac	82,376 ac
Riparian buffers (cropland)	5,546 ac	3,197 ac	5,543 ac	7,881 ac
Riparian buffers with stream exclusion fencing (pasture)	1,784 ac	1,029 ac	1,783 ac	2,535 ac

Figures 3 through 12 display the reported cumulative results for each conservation practice compared to the estimated cumulative results with upper and lower bounds based on the 95% confidence intervals. For each graph, red bars display the reported totals from the original survey, while the blue bars represent our estimated totals with error bars showing the range of the confidence interval.

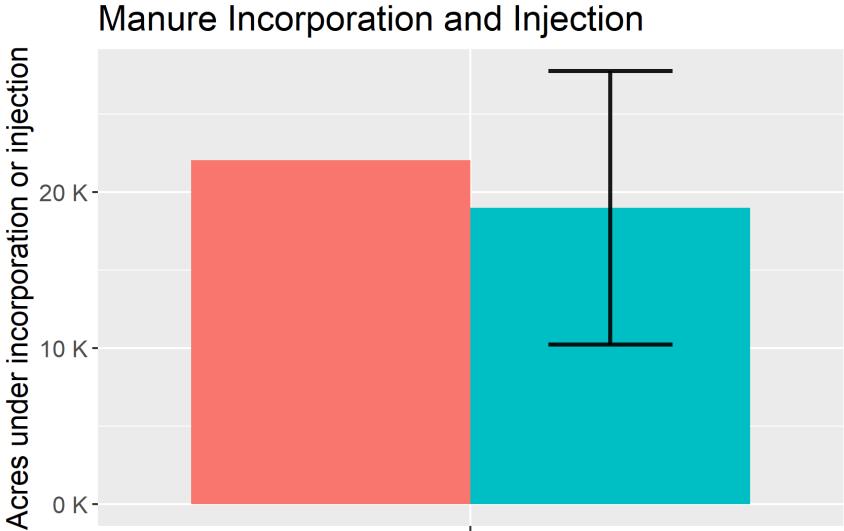
**Figure 3. Core nutrient management for nitrogen and phosphorus: reported acres (red) vs. estimated acres (blue) with 95% confidence intervals**



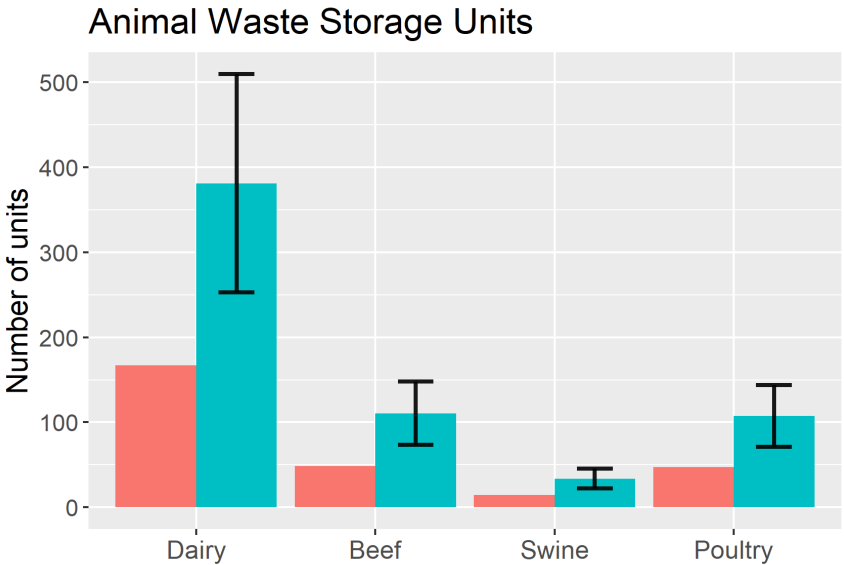
**Figure 4. Supplemental nutrient management for nitrogen and phosphorus: reported acres (red) vs. estimated acres (blue) with 95% confidence intervals**



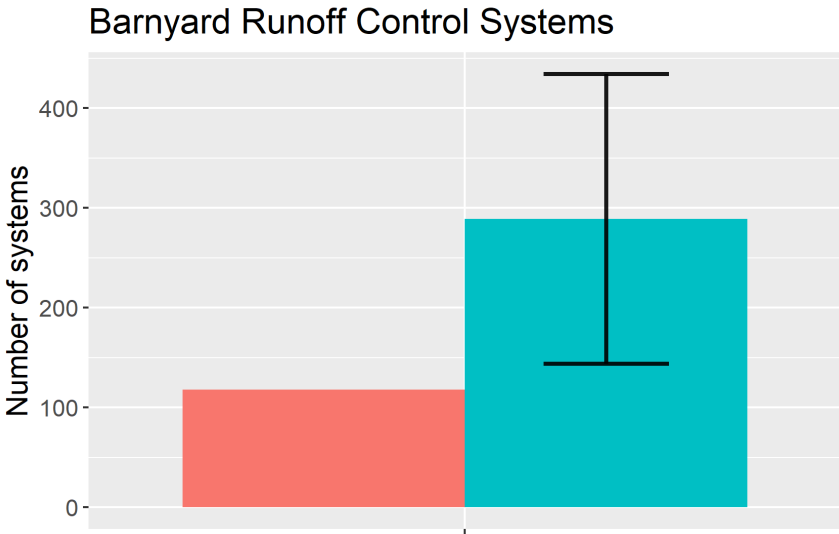
**Figure 5. Manure incorporation and injection: reported acres (red) vs. estimated acres (blue) with a 95% confidence interval**



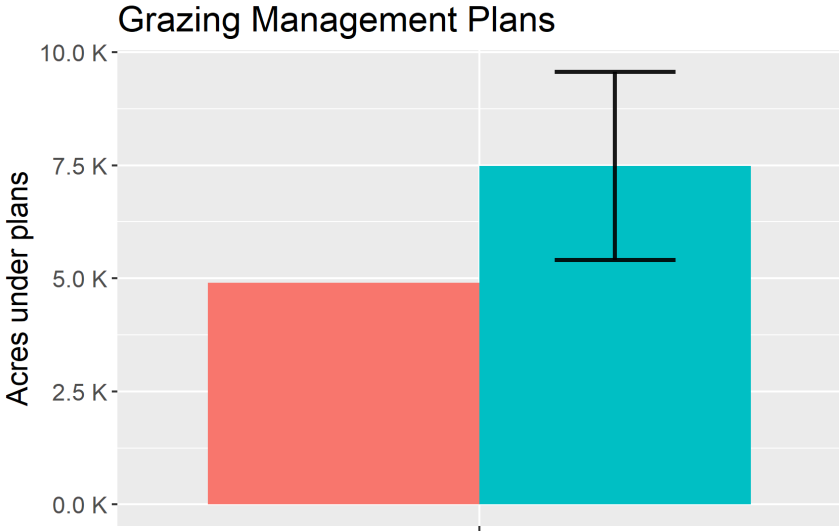
**Figure 6. Animal waste storage units: reported units (red) vs. estimated units (blue) with 95% confidence intervals**



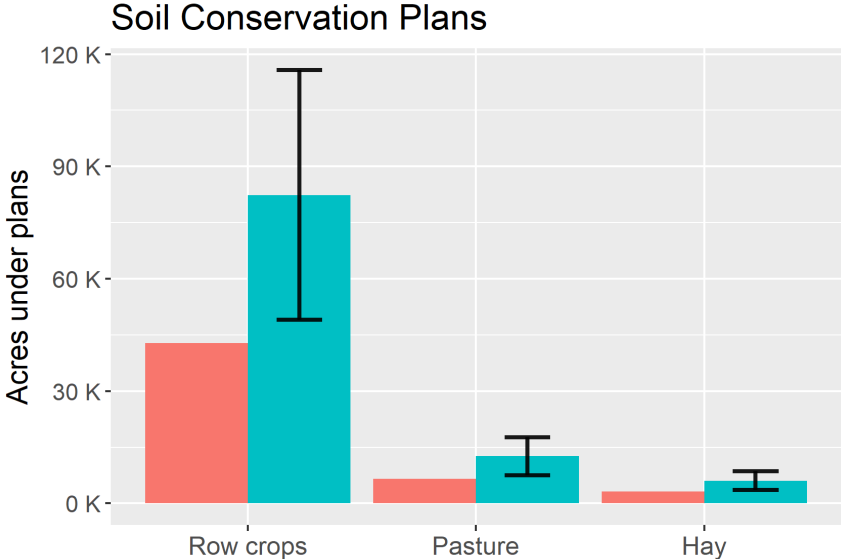
**Figure 7. Barnyard runoff control systems: reported number of systems (red) vs. estimated number of systems (blue) with a 95% confidence interval**



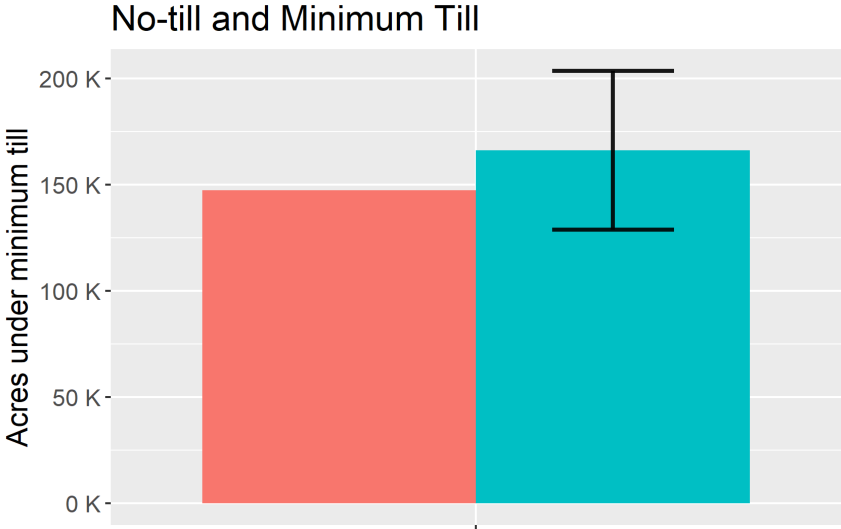
**Figure 8. Prescribed grazing: reported acres (red) vs. estimated acres (blue) with a 95% confidence interval**



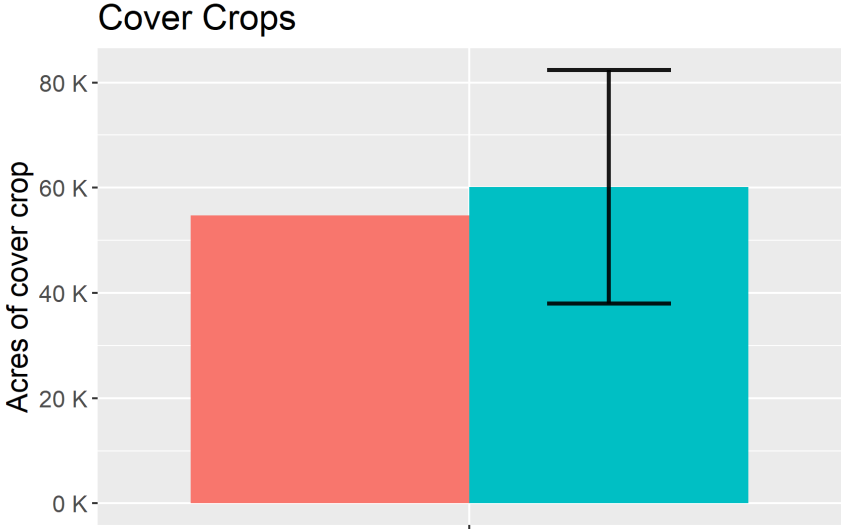
**Figure 9. Soil conservation and water quality plans: reported acres (red) vs. estimated acres (blue) with 95% confidence intervals**



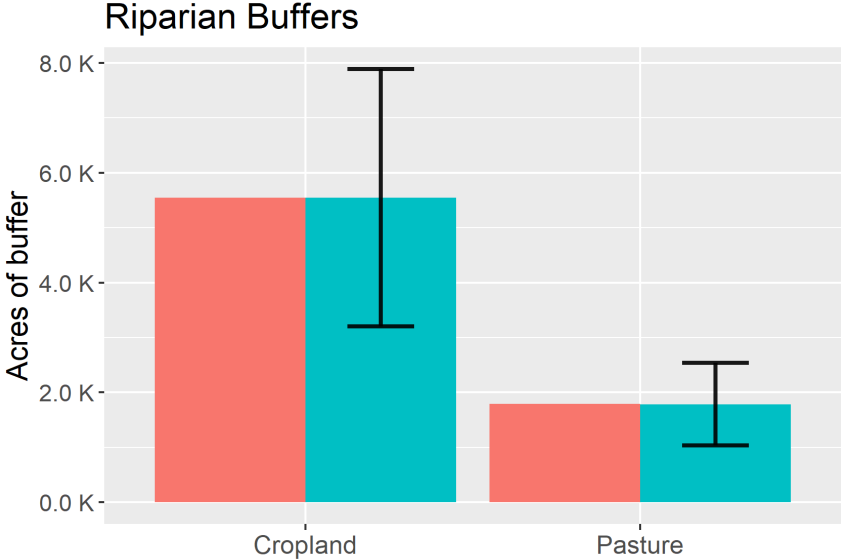
**Figure 10. No-till and minimum till: reported acres (red) vs. estimated acres (blue) with a 95% confidence interval**



**Figure 11. Cover crops: reported acres (red) vs. estimated acres (blue) with a 95% confidence interval**



**Fig 12. Riparian buffers adjacent to cropland and pasture: reported acres (red) vs. estimated acres (blue) with 95% confidence intervals**



To account for systematic overreporting and underreporting, an appropriate adjustment factor may be calculated and applied to reported totals. This can best be accomplished by applying the analysis just described, using the mean per farm deviation between reported and verified numbers as our adjustment factor and calculating the adjustment as described above (represented as the “estimated totals” in Table 3 and the blue bars in Figures 3-12). However, as can be seen in Figures 3-12, for all



practice types the reported numbers fall within the 95% confidence interval, indicating a lack of any systematic overreporting or underreporting. Accordingly, following the same analysis used for the 2016 survey, we do not recommend applying any adjustments to the reported totals for any of the practice types.

## **Conclusion**

This survey has followed the approved methodologies established for the 2016 survey, added additional methodologies to eliminate double counting from the 2016 survey and a variety of other conservation practice documentation efforts, and has shown to be a statistically reliable method for gathering data on implemented conservation practices through farmer self-reporting. It has proven extremely valuable in reporting voluntary, non-cost shared practices that lack other methodologies for adequately capturing and reporting for credit in the Chesapeake Bay model.

The cumulative numbers set forth in Table 1 reveal a large amount of conservation being implemented by Lancaster, York, Adams and Franklin County farmers outside of government cost share programs. Thus capturing this data is critical for accurately assessing progress toward Bay goals.

## Appendix A: Farm Survey

### Pennsylvania Farm Conservation Practices Inventory

#### Instructions

Thank you for agreeing to participate in this inventory of conservation practices on Pennsylvania farms. Please have the individual with the best knowledge of the conservation practices used in your operation complete the inventory. If you are a farm landowner who does not farm, you should give this survey to the farm operator. Farm operators may fill out one survey for all of their acreage. A consultant may also work with a client farmer to fill this out.

You may recall receiving a survey like this in the winter of 2016. If you filled out that survey, we thank you and ask you to fill out this year's survey in order to provide an update on your conservation practices. This provides you with the opportunity to report whether practices previously reported are still in place, report annual practices for 2019, and report any new practices that you have installed since you filled out the last survey.

The inventory will be used to determine the amount of conservation practice adoption on Pennsylvania farms. Cumulative results from this survey will be provided to Pennsylvania's Chesapeake Bay Office to document the practices that Pennsylvania farmers are using to conserve soil and water, and protect water quality. Ten percent of the participants in this inventory will be randomly selected for farm visits by Penn State Extension to assess the accuracy of the overall inventory.

Please be assured that your responses will be kept completely confidential and your response will never be associated with your name or locational information. The results reported from this survey to the Chesapeake Bay Office will be provided in summary form and will not include any names or locations of inventory participants. Inventory results will be permanently anonymized to prevent the identification of participants.

Please answer each question to the best of your knowledge. Where the question asks you to fill in a circle, please fill the circle in completely. Where the question asks you to write an answer, please print legibly.

The first part of this inventory asks basic questions about your farming operations in Pennsylvania. The second part of the inventory asks whether you are using certain conservation practices in your farming operations in Pennsylvania, and then asks some additional questions about each practice. Some of the practices listed may not be applicable to your operation. If you do not use a practice, answer "No" and continue on to the next question.

Please mail your completed inventory to the Penn State Survey Research Center by April 1, 2020 using the prepaid first-class envelope provided as part of the survey packet.

**First, we would like to learn about your farming operations in Pennsylvania.**

1. Please provide your name and the physical address of your farming operation.

Name: \_\_\_\_\_

Home Farm Street Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP: \_\_\_\_\_

Municipality (township, boro, etc.): \_\_\_\_\_ County: \_\_\_\_\_

2. How many acres is your farming operation? For purposes of answering this question and filling out the remainder of the survey, your farming operation includes all land in Pennsylvania which you manage for agricultural activities, including owned ground and rented ground.

Number of acres

3. For calendar year 2019, please indicate what crops you grew in Pennsylvania, how many acres of each grown on owned or rented ground, and whether any of the acres grown were a double crop.

Crop	Acres on Owned Ground	Acres on Rented Ground	Acres Grown as a Double Crop
Corn Grain	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Corn Silage	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Soybeans	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Wheat	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Rye	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Barley	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Alfalfa	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Grass Hay	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Other:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

4. Do you raise animals as part of your farming operation in Pennsylvania?

No → Please proceed to Question 5.

Yes → 4a. For calendar year 2019, please indicate the total animal head of each type animal.

Animal	Number	Animal	Number	Animal	Number	Animal	Number
Broiler	<input type="text"/>	Nursery Pigs	<input type="text"/>	Veal Calves	<input type="text"/>	Beef Cattle	<input type="text"/>
Layers	<input type="text"/>	Finisher Pigs	<input type="text"/>	Dairy Heifers (12 mo. & younger)	<input type="text"/>	Horses	<input type="text"/>
Turkeys	<input type="text"/>	Sows	<input type="text"/>	Dairy Heifers (12 mo. & older)	<input type="text"/>	Other	<input type="text"/>
Ducks	<input type="text"/>	Boars	<input type="text"/>	Cows (milking and dry)	<input type="text"/>	Other	<input type="text"/>

In the remaining questions, we will ask about your conservation practices on your farming operations in Pennsylvania.

5. Do you apply nutrients to your land?

No

Yes → 5a. Please indicate what type of nutrients you apply to your land (check all that apply):

- Manure
- Commercial (inorganic/synthetic) fertilizer
- Biosolids (sewage sludge)
- Food processing residual (FPR)
- Mushroom compost/substrate
- Other (other compost, leaf litter, feather meal, kelp, etc.) Please describe:

6. If you applied manure in 2019, did you inject or incorporate the manure?

No

Yes → 6a. Please indicate the total acres for each manure injection or incorporation method with each timing of manure incorporation.

Manure Injection/Incorporation Method	Timing of Incorporations	
	Within 24 hours after application	Within 1-3 days after application
Low-disturbance incorporation (using, for example, vertical tillage or rolling tine aerators)	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
High-disturbance incorporation (using any other tillage system, which may include chisel plow, moldboard plow, aggressive disking, etc)	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Immediate injection (using, for example, shallow disk or narrow shank injectors)	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	

7. Do you have a nutrient management or manure management plan for your farming operations?

No → Please proceed to Question 8 (NEXT PAGE)

Yes → Please answer questions 7a to 7g:

7a. What type of plan do you have?

- Act 38 Nutrient Management Plan
- Manure Management Plan
- NRCS 590 Plan or Comprehensive Nutrient Management Plan (CNMP)
- Nutrient Balance Sheets for imported manure
- Nutrient Balance Sheets with no manure
- Other, Please describe:

7b. When was your plan written or last updated?

Month        Year

7c. Number of cropland acres covered in your plan:

Acres

7d. Were any county, state or federal government funds used develop your plan?

- No
- Yes

7e. Is your plan a nitrogen-based plan, or both a nitrogen and phosphorus-based plan?

- A nitrogen based plan
- A nitrogen and phosphorus-based plan

7f. Do you follow your plan when you apply nutrients to your land?

- No
- Yes

7g. Do you keep nutrient application records in accordance with your plan?

- No
- Yes



8. The next three questions will ask you specifics about your nitrogen applications. In calendar year 2019, did you follow any of the practices described below that affect the rate of your nitrogen applications? If yes, please indicate the number of acres on which you used the practice.

Practice Description	Did you use this practice?	Acres
A. Total nitrogen application rates were lower than those recommended in the Penn State Agronomy Guide and basic nutrient balance recommendations for nitrogen (found in your Manure Management Plan, Nutrient Balance Sheets, etc.)	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
B. Nitrogen was applied by crop by multiple lower rate split applications made throughout the growing year, for example corn side-dress, small grain split applications, etc.	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
C. Nitrogen was applied at variable rates at the sub-field level based on variable crop response data from historical records or Pre-side dress Nitrate Test (PSNT), chlorophyll meter, NDVI sensor, plant sampling, nitrogen modeling, etc.	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

9. In calendar year 2019, did you follow any of the practices described below that affect the placement of your nitrogen applications? If yes, please indicate the number of acres on which you used the practice.

Practice Description	Did you use this practice?	Acres
A. Injection or incorporation of inorganic nitrogen fertilizer only within 24 hours of application	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
B. Setbacks: If fertilizer or manure is applied to fields near a water feature, maintaining a setback of 100 feet from any water feature, maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes. NOTE: When reporting acreage, only count those field management units where setbacks were implemented but count the entire crop acreage of those fields (including crops grown within the setbacks and outside of the setbacks).	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

10. In calendar year 2019, did you follow any of the practices described below that affect the timing of your nitrogen applications? If yes, please indicate the number of acres on which you used the practice.

Practice Description	Did you use this practice?	Acres
A. Nitrogen was applied by crop by multiple lower rate split applications made throughout the growing year, i.e. corn side-dress, small grain split applications, etc.	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
B. Nitrogen was applied through multiple applications based on recommendations from Pre-side dress Nitrate Test (PSNT), chlorophyll meter, NDVI sensor, plant sampling, nitrogen modeling, etc.	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

11. The next three questions will ask you specifics about your phosphorus applications. In calendar year **2019**, did you follow any of the practices described below that affect the rate of your phosphorus applications? If yes, please indicate the number of acres on which you used the practice.

Practice Description	Did you use this practice?	Acres
A. Total phosphorus application rates were lower than those recommended in the Penn State Agronomy Guide and basic nutrient balance recommendations for phosphorus (found in your Nutrient Balance Sheets, etc.)	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
B. Applications of manure were based on annual crop removal of phosphorus rather than nitrogen	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
C. Phosphorus was applied at variable rates at the sub-field level based on variable crop response data from historical records or tools like optical crop sensors	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

12. In calendar year **2019**, did you follow any of the practices described below that affect the placement of your phosphorus applications? If yes, please indicate the number of acres on which you used the practice.

Practice Description	Did you use this practice?	Acres
A. Injection or incorporation of inorganic phosphorus fertilizer only within 24 hours of application	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
B. Setbacks: If fertilizer or manure is applied to fields near a water feature, maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes. NOTE: When reporting acreage, only count those field management units where setbacks were implemented but count the entire crop acreage of those fields (including crops grown within the setbacks and outside of the setbacks).	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

13. In calendar year **2019**, did you follow any of the practices described below that affect the timing of your phosphorus applications? If yes, please indicate the number of acres on which you used the practice.

Practice Description	Did you use this practice?	Acres
A. Phosphorus was applied in seasons of lower risk for phosphorus loss	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
B. The P Index assessment was followed to change manure application to a time of year when there is a lower risk for phosphorus loss	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
C. Split applications of phosphorus fertilizer were made throughout the growing year	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

14. Do you have any animal waste storage systems (manure storages) for your farming operations?

- No → Please proceed to question 15
- Yes → Please answer question 14a

**14a. For each manure storage you have, indicate the type of manure it stores (both animal type and whether it is dry (stackable) or liquid), the date it was constructed, the months of storage it provides, whether any county, state or federal government funds were used to construct it, whether it was based on a certified engineer design, and whether runoff from the storage is being controlled.**

**Manure Type**

Dairy    Dry (stackable)    Beef    Liquid

Swine

Poultry

Date Constructed (mm/yyyy)   /

Months of storage provided

Were county, state or federal funds used to construct your storage?  No  Yes

Certified engineer design?  No  Yes

Is runoff controlled from your storage system?  No  Yes

**Manure Type**

Dairy    Dry (stackable)    Beef    Liquid

Swine

Poultry

Date Constructed (mm/yyyy)   /

Months of storage provided

Were county, state or federal funds used to construct your storage?  No  Yes

Certified engineer design?  No  Yes

Is runoff controlled from your storage system?  No  Yes

**Manure Type**

Dairy    Dry (stackable)    Beef    Liquid

Swine

Poultry

Date Constructed (mm/yyyy)   /

Months of storage provided

Were county, state or federal funds used to construct your storage?  No  Yes

Certified engineer design?  No  Yes

Is runoff controlled from your storage system?  No  Yes

**Manure Type**

Dairy    Dry (stackable)    Beef    Liquid

Swine

Poultry

Date Constructed (mm/yyyy)   /

Months of storage provided

Were county, state or federal funds used to construct your storage?  No  Yes

Certified engineer design?  No  Yes

Is runoff controlled from your storage system?  No  Yes

**Manure Type**

Dairy    Dry (stackable)    Beef    Liquid

Swine

Poultry

Date Constructed (mm/yyyy)   /

Months of storage provided

Were county, state or federal funds used to construct your storage?  No  Yes

Certified engineer design?  No  Yes

Is runoff controlled from your storage system?  No  Yes

15. Do you have any barnyards where animals are kept?

- No → Please proceed to Question 16.
- Yes → 15a. Do you have any barnyard runoff controls on these barnyards? (This includes practices that divert clean water from entering the barnyard, provide stabilized surfaces in the barnyard, and control runoff from barnyard areas.)
  - No → Please proceed to Question 16.
  - Yes → 15b. Indicate what kind of runoff control practices you have, the date they were constructed, and whether any county, state or federal government funds used to construct them.

Runoff Control Practice	Did you have this practice?	Were county, state or federal funds used to construct the practice?
A. Diversion to direct clean water runoff away from barnyard (such as roof gutters, downspouts, and outlets to send runoff away from barnyard)	<input type="radio"/> No    Date Constructed (mm/yyyy) <input type="radio"/> Yes → <input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes
B. Stabilized barnyard surface with concrete, stone aggregate or other suitable materials	<input type="radio"/> No    Date Constructed (mm/yyyy) <input type="radio"/> Yes → <input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes
C. System to catch barnyard runoff and discharge it to storage or stabilized vegetated filter area	<input type="radio"/> No    Date Constructed (mm/yyyy) <input type="radio"/> Yes → <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes

16. Do you have any pastures where you graze animals?

- No → Please proceed to Question 17.
- Yes → 16a. Do you have and follow a grazing management plan?
  - No → Please proceed to Question 17.
  - Yes → 16b. When was your plan written or last updated? mm/yyyy

 / 

16c. Were any county, state or federal government funds used develop your plan?

- No
- Yes

16d. Are you implementing your grazing management plan?

- No
- Yes → 16e. On how many acres of pasture are you implementing your grazing management plan?

 Acres



17. Do you have any Agricultural Erosion & Sedimentation Control Plans (Ag E&S Plans) or NRCS Conservation Plans for your farming operations?

No → Please proceed to Question 18

Yes → 17a. For each plan you have, indicate the type of plan, when it was written or last updated, whether any county, state or federal government funds were used to develop your plan, whether you are on schedule for implementing your plan, and the acres of cropland covered by your plan:

**Plan #1**

Plan Type:  Ag E&S Plan  NRCE Conservation Plan

Date Written or Updated (mm/yyyy)  /

Acres covered by plan: Row Crops:  Hay:  Pasture:

Were county, state or federal funds used to develop your plan?  No  Yes

Are you on schedule for implementing plan?  No  Yes

**Plan #2**

Plan Type:  Ag E&S Plan  NRCE Conservation Plan

Date Written or Updated (mm/yyyy)  /

Acres covered by plan: Row Crops:  Hay:  Pasture:

Were county, state or federal funds used to develop your plan?  No  Yes

Are you on schedule for implementing plan?  No  Yes

**Plan #3**

Plan Type:  Ag E&S Plan  NRCE Conservation Plan

Date Written or Updated (mm/yyyy)  /

Acres covered by plan: Row Crops:  Hay:  Pasture:

Were county, state or federal funds used to develop your plan?  No  Yes

Are you on schedule for implementing plan?  No  Yes

**Plan #4**

Plan Type:  Ag E&S Plan  NRCE Conservation Plan

Date Written or Updated (mm/yyyy)  /

Acres covered by plan: Row Crops:  Hay:  Pasture:

Were county, state or federal funds used to develop your plan?  No  Yes

Are you on schedule for implementing plan?  No  Yes

**Plan #5**

Plan Type:  Ag E&S Plan  NRCE Conservation Plan

Date Written or Updated (mm/yyyy)  /

Acres covered by plan: Row Crops:  Hay:  Pasture:

Were county, state or federal funds used to develop your plan?  No  Yes

Are you on schedule for implementing plan?  No  Yes

18. Did you practice no till or minimum till in calendar year 2019?

No → Please proceed to Question 19

Yes → 18a. Indicate how many acres meet the following amounts of residue left in the field at the time of planting:

60% or Greater       30% to 59%       15% to 29%

19. Did you plant cover crops or winter crops in calendar year 2019?

No → Please proceed to Question 20

Yes → 19a. Fill out the charts below to indicate what species you planted, the date you planted them, how many acres of each, method of planting, whether they received a fall manure nutrient application and/or received or will receive a spring nutrient (manure or fertilizer) application before March 1, and whether you plan to harvest any acres in the spring for forage or grain:

Please pick a cover crop that you planted in 2019

- Rye
- Wheat
- Barley
- Oats (Winter Hardy)
- Oats (Winter Killed)
- Annual Ryegrass
- Annual Legumes
- Barassica (Winter Hardy)
- Triticale
- Forage Radish
- Mixture of Forage Radish plus Grass
- Annual Legume plus grass at 25-49%
- Annual Legume plus grass at 50% or More
- Other

Method of Planting (check all that apply)

- Drilled with seed drill
- Broadcast with incorporation
- Broadcast without incorporation
- Aerial seeding with aircraft
- Other (specify):

Date Planted (mm/yyyy)

/

Acres Planted

Fall Manure Nutrient Application?

No  Yes

Spring Nutrient Application before 3/1?

No  Yes

Harvesting in the Spring?

No

Yes →

Acres Harvested

If applicable, please pick another cover crop that you planted in 2019

- Rye
- Wheat
- Barley
- Oats (Winter Hardy)
- Oats (Winter Killed)
- Annual Ryegrass
- Annual Legumes
- Barassica (Winter Hardy)
- Triticale
- Forage Radish
- Mixture of Forage Radish plus Grass
- Annual Legume plus grass at 25-49%
- Annual Legume plus grass at 50% or More
- Other

Method of Planting (check all that apply)

- Drilled with seed drill
- Broadcast with incorporation
- Broadcast without incorporation
- Aerial seeding with aircraft
- Other (specify):

Date Planted (mm/yyyy)

/

Acres Planted

Fall Manure Nutrient Application?

No  Yes

Spring Nutrient Application before 3/1?

No  Yes

Harvesting in the Spring?

No

Yes →

Acres Harvested

If applicable, please pick another cover crop that you planted in 2019

- |  |   |   |
|--|---|---|
| <input type="radio"/> Rye                  | <input type="radio"/> Annual Ryegrass         | <input type="radio"/> Mixture of Forage Radish plus Grass     |
| <input type="radio"/> Wheat                | <input type="radio"/> Annual Legumes          | <input type="radio"/> Annual Legume plus grass at 25-49%      |
| <input type="radio"/> Barley               | <input type="radio"/> Brassica (Winter Hardy) | <input type="radio"/> Annual Legume plus grass at 50% or More |
| <input type="radio"/> Oats (Winter Hardy)  | <input type="radio"/> Triticale               | <input type="radio"/> Other <input type="text"/>              |
| <input type="radio"/> Oats (Winter Killed) | <input type="radio"/> Forage Radish           |   |

<b>Method of Planting (check all that apply)</b> <input type="radio"/> Drilled with seed drill <input type="radio"/> Broadcast with incorporation <input type="radio"/> Broadcast without incorporation <input type="radio"/> Aerial seeding with aircraft <input type="radio"/> Other (specify): <input type="text"/>	<b>Date Planted (mm/yyyy)</b> <input type="text"/> / <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<b>Acres Planted</b> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
	Fall Manure Nutrient Application? <input type="radio"/> No <input type="radio"/> Yes		
	Spring Nutrient Application before 3/1? <input type="radio"/> No <input type="radio"/> Yes		
	Harvesting in the Spring? <input type="radio"/> No <input type="radio"/> Yes → <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	Acres Harvested	

If applicable, please pick another cover crop that you planted in 2019

- |  |   |   |
|--|---|---|
| <input type="radio"/> Rye                  | <input type="radio"/> Annual Ryegrass         | <input type="radio"/> Mixture of Forage Radish plus Grass     |
| <input type="radio"/> Wheat                | <input type="radio"/> Annual Legumes          | <input type="radio"/> Annual Legume plus grass at 25-49%      |
| <input type="radio"/> Barley               | <input type="radio"/> Brassica (Winter Hardy) | <input type="radio"/> Annual Legume plus grass at 50% or More |
| <input type="radio"/> Oats (Winter Hardy)  | <input type="radio"/> Triticale               | <input type="radio"/> Other <input type="text"/>              |
| <input type="radio"/> Oats (Winter Killed) | <input type="radio"/> Forage Radish           |   |

<b>Method of Planting (check all that apply)</b> <input type="radio"/> Drilled with seed drill <input type="radio"/> Broadcast with incorporation <input type="radio"/> Broadcast without incorporation <input type="radio"/> Aerial seeding with aircraft <input type="radio"/> Other (specify): <input type="text"/>	<b>Date Planted (mm/yyyy)</b> <input type="text"/> / <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<b>Acres Planted</b> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
	Fall Manure Nutrient Application? <input type="radio"/> No <input type="radio"/> Yes		
	Spring Nutrient Application before 3/1? <input type="radio"/> No <input type="radio"/> Yes		
	Harvesting in the Spring? <input type="radio"/> No <input type="radio"/> Yes → <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	Acres Harvested	

If applicable, please pick another cover crop that you planted in 2019

- |  |   |   |
|--|---|---|
| <input type="radio"/> Rye                  | <input type="radio"/> Annual Ryegrass         | <input type="radio"/> Mixture of Forage Radish plus Grass     |
| <input type="radio"/> Wheat                | <input type="radio"/> Annual Legumes          | <input type="radio"/> Annual Legume plus grass at 25-49%      |
| <input type="radio"/> Barley               | <input type="radio"/> Brassica (Winter Hardy) | <input type="radio"/> Annual Legume plus grass at 50% or More |
| <input type="radio"/> Oats (Winter Hardy)  | <input type="radio"/> Triticale               | <input type="radio"/> Other <input type="text"/>              |
| <input type="radio"/> Oats (Winter Killed) | <input type="radio"/> Forage Radish           |   |

<b>Method of Planting (check all that apply)</b> <input type="radio"/> Drilled with seed drill <input type="radio"/> Broadcast with incorporation <input type="radio"/> Broadcast without incorporation <input type="radio"/> Aerial seeding with aircraft <input type="radio"/> Other (specify): <input type="text"/>	<b>Date Planted (mm/yyyy)</b> <input type="text"/> / <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<b>Acres Planted</b> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
	Fall Manure Nutrient Application? <input type="radio"/> No <input type="radio"/> Yes		
	Spring Nutrient Application before 3/1? <input type="radio"/> No <input type="radio"/> Yes		
	Harvesting in the Spring? <input type="radio"/> No <input type="radio"/> Yes → <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	Acres Harvested	



20. Are there any streams or waterways on the lands that are part of your farming operation?

No → Please proceed to Question 21

Yes → 20a. Do you maintain permanent vegetation of an average width of at least 10 feet between the stream bank or waterway and any of your cropland?

No → Please proceed to Question 20b

Yes → For all such areas between streams and croplands on your farming operation, fill out the chart below to indicate the type of buffer (by vegetation type and average width), the date established, whether any county, state or federal government funds were used to establish the buffers, and the total acres of such areas.

Type of vegetation growing next to stream or waterway and average width from top of bank	Date established (mm/yyyy)	Were county, state or federal funds used to establish the practice?	Total Acres of Buffer
Grass with average width of at least 10 but less than 35 feet	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>
Grass with average width of 35 feet or greater	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>
Trees and/or shrubs with average width between 10 feet and 35 feet	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>
Trees and/or shrubs with average width of 35 feet or greater	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>

20b. Do you maintain permanent vegetation of an average width of at least 10 feet between the stream bank or waterway and any pastures that are part of your operation?

No → Please proceed to Question 21

Yes → For all such areas between streams and pastures on your farming operation, fill out the chart below to indicate the type of buffer (by vegetation type and average width), the date established, whether any county, state or federal government funds were used to establish the buffers, and the total acres of such areas.

Type of vegetation growing next to stream or waterway and average width from top of bank	If pastures are actively used for grazing, are animals excluded from buffer area (for example, with fencing)?	Date established (mm/yyyy)	Were county, state or federal funds used to establish the practice?	Total Acres of Buffer
Grass with average width of at least 10 but less than 35 feet	<input type="radio"/> No <input type="radio"/> Yes <input type="radio"/> Not used for grazing	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>
Grass with average width of 35 feet or greater	<input type="radio"/> No <input type="radio"/> Yes <input type="radio"/> Not used for grazing	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>
Trees and/or shrubs with average width between 10 feet and 35 feet	<input type="radio"/> No <input type="radio"/> Yes <input type="radio"/> Not used for grazing	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>
Trees and/or shrubs with average width of 35 feet or greater	<input type="radio"/> No <input type="radio"/> Yes <input type="radio"/> Not used for grazing	<input type="text"/> / <input type="text"/>	<input type="radio"/> No <input type="radio"/> Yes	<input type="text"/>

21. Please let us know what other conservation practices you have installed or are practicing on your farm without government funding.

- Dairy precision feeding      cows
- Planting trees on upland agricultural lands (not along streams)      acres
- Stream restoration      linear feet
- Wetland restoration      acres

Other conservation practices not listed above (include units):

SAMPLE ONLY

\*\*\*\*\* END OF SURVEY \*\*\*\*\*

Please place completed survey in postage paid envelope to return to Penn State Survey Research Center.  
Thanks!

## Appendix B: How Responses to Survey Questions Correspond to Chesapeake Bay Program Conservation Practices

Conservation Practice (Survey Question #)	Summary Responses to Survey Questions
Core nitrogen nutrient management (7)	<p>Answered yes to Q7.            Indicated a type of plan from the list provided in Q7            Answered yes to Q7f.            Answered yes to Q7g.</p>
Core phosphorus nutrient management (7)	<p>Answered yes to Q7.            Indicated a type of plan from the list provided in Q7.            Answered “A nitrogen and phosphorus-based plan” for Q7e.            Answered yes to Q7f.            Answered yes to Q7g.</p>
Supplemental nitrogen nutrient management: rate (8)	<p>Implementing core N nutrient management as determined in Q7.            Answered yes to one of the three practice descriptions (A, B or C) in Q8.            Avoid double counting of the three practice descriptions by counting only the largest of the acreages reported under any one of the three practices.</p>
Supplemental nitrogen nutrient management: placement (9)	<p>Implementing core N nutrient management as determined in Q7.            Answered yes to one of the three practice descriptions (A, B or C) in Q9.            Avoid double counting of the three practice descriptions by counting only the largest of the acreages reported under any one of the three practices.</p>
Supplemental nitrogen nutrient management: timing (10)	<p>Implementing core N nutrient management as determined in Q7.            Answered yes to one of the three practice descriptions (A, B or C) in Q10.            Avoid double counting of the three practice descriptions by counting only the largest of the acreages reported under any one of the three practices.</p>
Supplemental phosphorus nutrient management: rate (11)	<p>Implementing core N nutrient management as determined in Q7.            Answered yes to one of the three practice descriptions (A, B or C) in Q11.            Avoid double counting of the three practice descriptions by counting only the largest of the acreages reported under any one of the three practices.</p>
Supplemental phosphorus nutrient management: placement (12)	<p>Implementing core N nutrient management as determined in Q7.            Answered yes to one of the three practice descriptions (A, B or C) in Q12.            Avoid double counting of the three practice descriptions by counting only the largest of the acreages reported under any one of the three practices.</p>
Supplemental phosphorus nutrient management: timing (13)	<p>Implementing core N nutrient management as determined in Q7.            Answered yes to one of the three practice descriptions (A, B or C) in Q13.            Avoid double counting of the three practice descriptions by counting only the largest of the acreages reported under any one of the three practices.</p>

Conservation Practice (Survey Question #)	Summary Responses to Survey Questions
Manure incorporation (high disturbance within 24 hours) (6)	Answered yes to Q6. Reported acres of high-disturbance incorporation within 24 hours after application.
Manure incorporation (high disturbance within 1-3 days) (6)	Answered yes to Q6. Reported acres of high-disturbance incorporation within 1-3 days after application.
Manure incorporation (low disturbance within 24 hours) (6)	Answered yes to Q6. Reported acres of low-disturbance incorporation within 24 hours after application.
Manure incorporation (low disturbance within 1-3 days) (6)	Answered yes to Q6. Reported acres of low-disturbance incorporation within 1-3 days after application.
Animal waste storage systems (14)	Answered yes to Q14. Answered yes to "Is runoff controlled from your storage system?" For liquid storages only, answered yes to "Certified engineer design?"
Barnyard runoff controls (15)	Answered yes to Q15. Answered yes to Q15a. Answered yes to practices A and C in the list of runoff control practices.
Prescribed grazing (16)	Answered yes to Q16. Answered yes to Q16a. Answered yes to Q16d.
Soil conservation and water quality plans (17)	Answered yes to Q17. Answered yes to the question "Are you on schedule for implementing plan?"
High residue, minimum soil disturbance tillage (18)	Answered yes to Q18. Reported acres under "60% or Greater" in response to Q18a.
Conservation tillage (18)	Answered yes to Q18. Reported acres under "30% to 59%" in response to Q18a.
Low residue tillage (18)	Answered yes to Q18. Reported acres under "15% to 29%" in response to Q18a.
Traditional cover crops (19)	Answered yes to Q19. For the cover crop species planted, answered no to the question "Fall Manure Nutrient Application?" For the cover crop species planted, answered no to the question "Harvesting in the Spring?" or reported a difference between the acreage of cover crop planted and cover crop harvested.

Conservation Practice (Survey Question #)	Summary Responses to Survey Questions
Traditional cover crops with fall nutrients (19)	<p>Answered yes to Q19. For the cover crop species planted, answered yes to the question "Fall Manure Nutrient Application?"</p> <p>For the cover crop species planted, answered no to the question "Harvesting in the Spring?" or reported a difference between the acreage of cover crop planted and cover crop harvested.</p>
Commodity cover crops (19)	<p>Answered yes to Q19. For the cover crop species planted, answered no to the question "Fall Manure Nutrient Application?"</p> <p>For the cover crop species planted, answered yes to the question "Harvesting in the Spring?" and reported total acres harvested.</p>
Forest buffers on converted cropland (20)	<p>Answered yes to Q20. Answered yes to Q20a. Reported acres of buffer under "Trees and/or shrubs with average width of 35 feet or greater"</p>
Narrow forest buffers on converted cropland (20)	<p>Answered yes to Q20. Answered yes to Q20a. Reported acres of buffer under "Trees and/or shrubs with average width between 10 feet and 35 feet"</p>
Grass buffers on converted cropland (20)	<p>Answered yes to Q20. Answered yes to Q20a. Reported acres of buffer under "Grass with average width of 35 feet or greater"</p>
Narrow grass buffers on converted cropland (20)	<p>Answered yes to Q20. Answered yes to Q20a. Reported acres of buffer under "Grass with average width of at least 10 feet but less than 35 feet"</p>
Forest buffers on converted pastures (with stream exclusion fencing) (20)	<p>Answered yes to Q20. Answered yes to Q20b. Answered "Yes" or "Not used for grazing" to the question "If pastures are actively used for grazing, are animals excluded form buffer area (for example, with fencing)?"</p> <p>Reported acres of buffer under "Trees and/or shrubs with average width of 35 feet or greater"</p>
Narrow forest buffers on converted pastures (with stream exclusion fencing) (20)	<p>Answered yes to Q20. Answered yes to Q20b. Answered "Yes" or "Not used for grazing" to the question "If pastures are actively used for grazing, are animals excluded form buffer area (for example, with fencing)?"</p> <p>Reported acres of buffer under "Trees and/or shrubs with average width between 10 feet and 35 feet"</p>



Conservation Practice (Survey Question #)	Summary Responses to Survey Questions
Grass buffers on converted pastures (with stream exclusion fencing) (20)	<p>Answered yes to Q20.            Answered yes to Q20b.            Answered "Yes" or "Not used for grazing" to the question "If pastures are actively used for grazing, are animals excluded form buffer area (for example, with fencing)?"            Reported acres of buffer under "Grass with average width of 35 feet or greater"</p>
Narrow grass buffers on converted pastures (with stream exclusion fencing) (20)	<p>Answered yes to Q20.            Answered yes to Q20b.            Answered "Yes" or "Not used for grazing" to the question "If pastures are actively used for grazing, are animals excluded form buffer area (for example, with fencing)?"            Reported acres of buffer under "Grass with average width of at least 10 but less than 35 feet"</p>

## Appendix C: Farm Visit Report

Name of Individual Completing Report: <input type="text"/>		
Start Time: <input type="text"/>	End Time: <input type="text"/>	Date: <input type="text"/>

<h1>Pennsylvania Farm Conservation Practices Inventory Penn State Extension Farm Visit Form</h1> <p>June 10, 2020 Version</p>
---

## Preliminary Information

Unique ID #: <input type="text"/>	County: <input type="text"/>
-----------------------------------	------------------------------

<b>When filling out the survey did the operator include only acres farmed in Pennsylvania?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No	<b>When filling out the survey did the operator include:</b> <input type="checkbox"/> Owned ground <input type="checkbox"/> Rented ground <b>(Check all that apply)</b>
<b>When filling out the survey did the operator include only acres farmed in the home county listed above?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>If no, list other counties and the total acres farmed in each:</b>	
County: <input type="text"/>	Acres: <input type="text"/>
County: <input type="text"/>	Acres: <input type="text"/>
County: <input type="text"/>	Acres: <input type="text"/>

If the operator included acres farmed in counties other than the home county when they filled out the survey, you should complete a separate form for each county.

## Nutrient Management

### Types of Nutrients Land Applied

Does the operator (including custom/commercial applicators on behalf of the operator) land apply nutrients?

No

Yes → What type of nutrients are applied? (Check all that apply):

Manure

Commercial (inorganic/synthetic) fertilizer

Biosolids (sewage sludge)

Food processing residual (FPR)

Mushroom compost/substrate

Other (other compost, leaf litter, feather meal, kelp, etc. Please describe:

### Manure Injection/Incorporation

If manure was applied in 2019, did the operator inject or incorporate the manure?

No

Yes → Please indicate the total acres for each manure injection or incorporation method with each timing of manure incorporation. *NOTE: If incorporation does not occur within 3 days, do not count the practice.*

Manure Injection/Incorporation Method	Timing of Incorporation	
	Within 24 hours after application	Within 1-3 days after application
Low-disturbance incorporation (using, for example, vertical tillage or rolling tine aerators)	<input style="width: 80px;" type="text"/> Acres	<input style="width: 80px;" type="text"/> Acres
High-disturbance incorporation (using any other tillage system, which may include chisel plow, moldboard plow, aggressive disking, etc.)	<input style="width: 80px;" type="text"/> Acres	<input style="width: 80px;" type="text"/> Acres
Immediate injection (using, for example, shallow disk or narrow shank injectors)	<input style="width: 100px;" type="text"/> Acres	

## Nutrient/Manure Management Plan

**Does the operator have a nutrient management or manure management plan?**

No

Yes → **What type of plan?**

Act 38 Nutrient Management Plan

Manure Management Plan\*

NRCS 590 Plan or Comprehensive Nutrient Management Plan (CNMP)

Nutrient Balance Sheets for imported manure

Nutrient Balance Sheets with no manure

Other, please describe:

*\*NOTE: Use the DEP Manure Management Plan (MMP) Administrative Completeness Review Guide (i.e., checklist) to determine whether the operator's MMP meets the definition of an MMP. If it does not meet the definition of an MMP, do not check the box.*

**When was the plan written or last updated?**  Month  Year

**Number of cropland acres covered in plan:**  Acres

**Were any county, state or federal government funds used to develop the plan?**

No

Yes

**Is the plan a nitrogen-based plan, or both a nitrogen and phosphorus-based plan?**

Nitrogen-based plan

Nitrogen and phosphorus-based plan

**Does the operator (including custom/commercial applicators on behalf of the operator) follow the plan when nutrients are land applied?**

No

Yes

**Does the operator keep nutrient application records in accordance with the plan?**

No

Yes

## Advanced Nitrogen Application (4Rs)

In 2019, did the operator follow any of the practices described below to affect rate, placement, or timing of nitrogen applications? If yes, indicate the number of acres on which the practice was used.

Practice Description	Was practice used?	Acres
<b>Rate-based Practices</b>		
Total nitrogen application rates were lower than those recommended in the Penn State Agronomy Guide and basic nutrient balance recommendations for nitrogen (found in your Manure Management Plan, Nutrient Balance Sheets, etc.)	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Nitrogen was applied by crop by multiple lower rate split applications made throughout the growing year, for example corn side-dress, small grain split applications, etc.	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Nitrogen was applied at variable rates at the sub-field level based on variable crop response data from historical records or Pre-side dress Nitrate Test (PSNT), chlorophyll meter, NDVI sensor, plant sampling, nitrogen modeling, etc.	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
<b>Placement-based Practices</b>		
Injection or incorporation of inorganic nitrogen fertilizer only within 24 hours of application	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Setbacks: If fertilizer or manure is applied to fields near a water feature, maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes.  <i>NOTE: When reporting acreage, only count those field management units where setbacks were implemented but count the entire crop acreage of those fields (including crops grown within the setbacks and outside of the setbacks).</i>	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
<b>Timing-based Practices</b>		
Nitrogen was applied by crop by multiple lower rate split applications made throughout the growing year, i.e. corn side-dress, small grain split applications, etc.	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Nitrogen was applied through multiple applications based on recommendations from Pre-side dress Nitrate Test (PSNT), chlorophyll meter, NDVI sensor, plant sampling, nitrogen modeling, etc.	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>

## Advanced Phosphorus Application (4Rs)

In 2019, did the operator follow any of the practices described below to affect rate, placement, or timing of phosphorus applications? If yes, indicate the number of acres on which the practice was used.

Practice Description	Was practice used?	Acres
<b>Rate-based Practices</b>		
Total phosphorus application rates were lower than those recommended in the Penn State Agronomy Guide and basic nutrient balance recommendations for phosphorus (found in your Nutrient Balance Sheets, etc.)	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Applications of manure were based on annual crop removal of phosphorus rather than nitrogen	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Phosphorus was applied at variable rates at the sub-field level based on variable crop response data from historical records or tools like optical crop sensors	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
<b>Placement-based Practices</b>		
Injection or incorporation of inorganic phosphorus fertilizer within 24 hours of application	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Setbacks: If fertilizer or manure is applied to fields near a water feature, maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes.  <i>NOTE: When reporting acreage, only count those field management units where setbacks were implemented but count the entire crop acreage of those fields (including crops grown within the setbacks and outside of the setbacks).</i>	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
<b>Timing-based Practices</b>		
Phosphorus was applied in seasons of lower risk for phosphorus loss.	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
The P Index assessment was followed to change manure application to a time of year when there is a lower risk for phosphorus loss	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>
Split applications of phosphorus fertilizer were made throughout the growing year	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="text"/>

# Manure Storages

**Does the operator have any manure storages?**  
 No  
 Yes → For each storage, fill in the information below.

Manure Type		Date Constructed	Mos. of Storage Provided & # of Animals	Funding, engineering, and runoff control
<input type="checkbox"/> Dairy <input type="checkbox"/> Beef <input type="checkbox"/> Swine <input type="checkbox"/> Poultry	<input type="checkbox"/> Dry* (stackable) <input type="checkbox"/> Liquid	<input type="text"/> Mo <input type="text"/> Yr	<input type="text"/> Mos. # Animals <input type="text"/>	Were county, state or federal funds used to construct the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No Is there a certified engineer design? <input type="checkbox"/> Yes <input type="checkbox"/> No Is runoff controlled from the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Dairy <input type="checkbox"/> Beef <input type="checkbox"/> Swine <input type="checkbox"/> Poultry	<input type="checkbox"/> Dry* (stackable) <input type="checkbox"/> Liquid	<input type="text"/> Mo <input type="text"/> Yr	<input type="text"/> Mos. # Animals <input type="text"/>	Were county, state or federal funds used to construct the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No Is there a certified engineer design? <input type="checkbox"/> Yes <input type="checkbox"/> No Is runoff controlled from the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Dairy <input type="checkbox"/> Beef <input type="checkbox"/> Swine <input type="checkbox"/> Poultry	<input type="checkbox"/> Dry* (stackable) <input type="checkbox"/> Liquid	<input type="text"/> Mo <input type="text"/> Yr	<input type="text"/> Mos. # Animals <input type="text"/>	Were county, state or federal funds used to construct the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No Is there a certified engineer design? <input type="checkbox"/> Yes <input type="checkbox"/> No Is runoff controlled from the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Dairy <input type="checkbox"/> Beef <input type="checkbox"/> Swine <input type="checkbox"/> Poultry	<input type="checkbox"/> Dry* (stackable) <input type="checkbox"/> Liquid	<input type="text"/> Mo <input type="text"/> Yr	<input type="text"/> Mos. # Animals <input type="text"/>	Were county, state or federal funds used to construct the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No Is there a certified engineer design? <input type="checkbox"/> Yes <input type="checkbox"/> No Is runoff controlled from the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Dairy <input type="checkbox"/> Beef <input type="checkbox"/> Swine <input type="checkbox"/> Poultry	<input type="checkbox"/> Dry* (stackable) <input type="checkbox"/> Liquid	<input type="text"/> Mo <input type="text"/> Yr	<input type="text"/> Mos. # Animals <input type="text"/>	Were county, state or federal funds used to construct the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No Is there a certified engineer design? <input type="checkbox"/> Yes <input type="checkbox"/> No Is runoff controlled from the storage? <input type="checkbox"/> Yes <input type="checkbox"/> No

*\*NOTE: For dry storages, conduct assessment, applying the following checklist. Do not count as a storage if not all applicable standards are met. (Chesapeake Bay Program Resource Improvement BMP checklist)*

- Facility is large enough to store all accumulated dry animal manure.
- Facility is located at least 100 feet from streams and wells.
- All runoff is controlled and non-polluting.
- Offsite runoff is excluded from storage or accounted for in storage.
- No safety concerns present.
- Slab on grade, or other stabilized impervious surface.
- Retaining wall if used is straight, not in imminent danger of failure.

# Barnyard Runoff Controls

**Does the operator have any barnyards where animals are kept?**  
 No  
 Yes → **Does the operator have any barnyard runoff controls on these barnyards?**  
 No  
 Yes → **Fill in the information below for those runoff control practices the operator has.**

Runoff Control Practice	Date Constructed	Were county, state or federal funds used to construct the storage?
Diversions to direct clean water runoff away from barnyard (such as roof gutters, downspouts, and outlets to send runoff away from barnyard)* <input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="text"/> Month <input type="text"/> Year	<input type="checkbox"/> Yes <input type="checkbox"/> No
Stabilized barnyard surface with concrete, stone aggregate or other suitable materials <input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="text"/> Month <input type="text"/> Year	<input type="checkbox"/> Yes <input type="checkbox"/> No
System to catch barnyard runoff and discharge it to storage or stabilized vegetated filter area <input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="text"/> Month <input type="text"/> Year	<input type="checkbox"/> Yes <input type="checkbox"/> No

*\*NOTE: For clean water diversions, conduct assessment, applying the following checklist. Do not count as a clean water diversion if all applicable standards are not met. (Chesapeake Bay Program Resource Improvement BMP checklist)*

- Surface outlet is stable; downspouts have elbow and dissipation device directed away from buildings, as appropriate.
- Any gutter-less system has stone-filled collection trench under entire roof drip line: width ≥ 24", depth ≥ 24".
- Drip line stone extends along sides of and over pipe.
- Gutter is K-style, half-round or box-type on vertical fascia board in good condition, free floating on supports, and ≥ 5" top width. Roof rafter ends are sound.
- Downspout avoids mixing clean runoff with manure or polluting runoff.
- The system is sound and functioning.
- Downspouts are securely fastened at top and bottom, with intermediate supports ≤ 10 feet, installed appropriately.
- Gutter and downspout are protected from livestock, or if not are otherwise made of steel pipe, Sch40, or similar.
- Clean surface runoff is directed away from barnyard area.



# Grazing Management

<p><b>Does the operator have any pastures where animals are grazed?</b></p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Yes → <b>Does the operator have an NRCS grazing management plan (Prescribed Grazing or 528 Plan)?</b></p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Yes</p>
<p><b>When was the plan written or last updated?</b> <input type="text"/> Month <input type="text"/> Year</p>
<p><b>Were any county, state or federal government funds used to develop the plan?</b></p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Yes</p>
<p><b>Is the operator implementing the grazing management plan?</b></p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Yes</p>
<p><b>Number of acres of pasture on which plan is being implemented:</b> <input type="text"/> Acres</p>
<p><b>If operator does not have a grazing management plan but is practicing rotational grazing, conduct assessment, using the following checklist (<i>Chesapeake Bay Program Resource Improvement BMP checklist</i>):</b></p> <p><input type="checkbox"/> <i>75% perennial grass cover is maintained in all grazing areas through the appropriate use of fencing as needed.</i></p> <p><input type="checkbox"/> <i>Livestock have limited (restricted) access to streams, seeps, ponds, and other surface waters.</i></p> <p><input type="checkbox"/> <i>Livestock have close access to clean water, which meets their average daily water requirements.</i></p> <p><input type="checkbox"/> <i>Grazing system (watering, feeding and heavy use areas) minimizes erosion and protects sensitive areas.</i></p> <p><input type="checkbox"/> <i>Manure management requirements for pastures are applied.</i></p> <p><input type="checkbox"/> <i>Operator has a grazing objective for all grazing units and manages the grass height.</i></p> <p><input type="checkbox"/> <i>Operator has a plan for movement of animals to maintain appropriate forage cover.</i></p> <p><b>Number of acres of pasture for which all applicable standards are met:</b> <input type="text"/> Acres</p>

# Erosion and Sedimentation Control/Conservation Plans

**Does the operator have any Agricultural Erosion & Sedimentation Control Plans (Ag E&S Plans) or NRCS Conservation Plans for the farming operations?**

- No  
 Yes → For each plan, fill in the information below.

Plan Type	Date Written or Updated	Acres Covered by Plan	Funding & Implementation
<input type="checkbox"/> Ag E&S Plan <input type="checkbox"/> NRCS Conservation Plan	<input type="text"/> Month  <input type="text"/> Year	Row Crops: <input type="text"/>  Hay: <input type="text"/>  Pasture: <input type="text"/>	<b>Were county, state or federal funds used to construct the storage?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Is the operator on schedule for implementing the plan?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Ag E&S Plan <input type="checkbox"/> NRCS Conservation Plan	<input type="text"/> Month  <input type="text"/> Year	Row Crops: <input type="text"/>  Hay: <input type="text"/>  Pasture: <input type="text"/>	<b>Were county, state or federal funds used to construct the storage?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Is the operator on schedule for implementing the plan?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Ag E&S Plan <input type="checkbox"/> NRCS Conservation Plan	<input type="text"/> Month  <input type="text"/> Year	Row Crops: <input type="text"/>  Hay: <input type="text"/>  Pasture: <input type="text"/>	<b>Were county, state or federal funds used to construct the storage?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Is the operator on schedule for implementing the plan?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Ag E&S Plan <input type="checkbox"/> NRCS Conservation Plan	<input type="text"/> Month  <input type="text"/> Year	Row Crops: <input type="text"/>  Hay: <input type="text"/>  Pasture: <input type="text"/>	<b>Were county, state or federal funds used to construct the storage?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Is the operator on schedule for implementing the plan?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Ag E&S Plan <input type="checkbox"/> NRCS Conservation Plan	<input type="text"/> Month  <input type="text"/> Year	Row Crops: <input type="text"/>  Hay: <input type="text"/>  Pasture: <input type="text"/>	<b>Were county, state or federal funds used to construct the storage?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Is the operator on schedule for implementing the plan?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No

# No Till/Minimum Till

<b>Does the operator practice no till or minimum till in 2019?</b> <input type="checkbox"/> No <input type="checkbox"/> Yes → Indicate how many acres met the following amounts of residue left in the field at the time of planting:		
<b>60% or Greater</b>	<b>30% to 59%</b>	<b>15% to 29%</b>
<input type="text"/> Acres	<input type="text"/> Acres	<input type="text"/> Acres

# Cover Crops

<b>Does the operator plant cover crops or winter crops in 2019?</b> <input type="checkbox"/> No <input type="checkbox"/> Yes → For each species planted, check the appropriate box and fill out the additional information regarding that species.		
<b>First Cover Crop Species</b>		
<b>Pick a cover crop the operator planted in 2019:</b> <input type="checkbox"/> Rye <input type="checkbox"/> Annual Ryegrass <input type="checkbox"/> Mixture of Forage Radish plus Grass <input type="checkbox"/> Wheat <input type="checkbox"/> Annual Legumes <input type="checkbox"/> Annual Legume plus Grass at 25-49% or more <input type="checkbox"/> Barley <input type="checkbox"/> Brassica (Winter Hardy) <input type="checkbox"/> Annual Legume plus Grass at 50% or more <input type="checkbox"/> Oats (Winter Hardy) <input type="checkbox"/> Triticale <input type="checkbox"/> Other <input style="width: 150px; height: 15px;" type="text"/> <input type="checkbox"/> Oats (Winter Killed) <input type="checkbox"/> Forage Radish		
<b>Method of Planting:</b> <input type="checkbox"/> Drilled with seed drill <input type="checkbox"/> Broadcast with incorporation <input type="checkbox"/> Broadcast without incorporation <input type="checkbox"/> Aerial seeding with aircraft <input type="checkbox"/> Other: <input style="width: 150px; height: 15px;" type="text"/>	<b>Date Planted:</b> <input style="width: 30px; height: 15px;" type="text"/> Mo <input style="width: 30px; height: 15px;" type="text"/> Yr  <b>Acres Planted:</b> <input style="width: 60px; height: 15px;" type="text"/> Acres	<b>Fall manure nutrient application?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Spring nutrient application before 3/1?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Harvested in the spring?</b> <input type="checkbox"/> No <input type="checkbox"/> Yes → Acres Harvested: <input style="width: 60px; height: 15px;" type="text"/> Acres
<b>Second Cover Crop Species</b>		
<b>Pick another cover crop the operator planted in 2019:</b> <input type="checkbox"/> Rye <input type="checkbox"/> Annual Ryegrass <input type="checkbox"/> Mixture of Forage Radish plus Grass <input type="checkbox"/> Wheat <input type="checkbox"/> Annual Legumes <input type="checkbox"/> Annual Legume plus Grass at 25-49% or more <input type="checkbox"/> Barley <input type="checkbox"/> Brassica (Winter Hardy) <input type="checkbox"/> Annual Legume plus Grass at 50% or more <input type="checkbox"/> Oats (Winter Hardy) <input type="checkbox"/> Triticale <input type="checkbox"/> Other <input style="width: 150px; height: 15px;" type="text"/> <input type="checkbox"/> Oats (Winter Killed) <input type="checkbox"/> Forage Radish		
<b>Method of Planting:</b> <input type="checkbox"/> Drilled with seed drill <input type="checkbox"/> Broadcast with incorporation <input type="checkbox"/> Broadcast without incorporation <input type="checkbox"/> Aerial seeding with aircraft <input type="checkbox"/> Other: <input style="width: 150px; height: 15px;" type="text"/>	<b>Date Planted:</b> <input style="width: 30px; height: 15px;" type="text"/> Mo <input style="width: 30px; height: 15px;" type="text"/> Yr  <b>Acres Planted:</b> <input style="width: 60px; height: 15px;" type="text"/> Acres	<b>Fall manure nutrient application?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Spring nutrient application before 3/1?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Harvested in the spring?</b> <input type="checkbox"/> No <input type="checkbox"/> Yes → Acres Harvested: <input style="width: 60px; height: 15px;" type="text"/> Acres

<b>Third Cover Crop Species</b>		
<b>Pick another cover crop the operator planted in 2019:</b>		
<input type="checkbox"/> Rye	<input type="checkbox"/> Annual Ryegrass	<input type="checkbox"/> Mixture of Forage Radish plus Grass
<input type="checkbox"/> Wheat	<input type="checkbox"/> Annual Legumes	<input type="checkbox"/> Annual Legume plus Grass at 25-49% or more
<input type="checkbox"/> Barley	<input type="checkbox"/> Brassica (Winter Hardy)	<input type="checkbox"/> Annual Legume plus Grass at 50% or more
<input type="checkbox"/> Oats (Winter Hardy)	<input type="checkbox"/> Triticale	<input type="checkbox"/> Other <input type="text"/>
<input type="checkbox"/> Oats (Winter Killed)	<input type="checkbox"/> Forage Radish	
<b>Method of Planting:</b>	<b>Date Planted:</b>	<b>Fall manure nutrient application?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Drilled with seed drill	<input type="text"/> Mo <input type="text"/> Yr	<b>Spring nutrient application before 3/1?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Broadcast with incorporation	<b>Acres Planted:</b>	<b>Harvested in the spring?</b>
<input type="checkbox"/> Broadcast without incorporation		<input type="checkbox"/> No
<input type="checkbox"/> Aerial seeding with aircraft	<input type="text"/> Acres	<input type="checkbox"/> Yes → <b>Acres Harvested:</b> <input type="text"/> Acres
<input type="checkbox"/> Other: <input type="text"/>		
<b>Fourth Cover Crop Species</b>		
<b>Pick another cover crop the operator planted in 2019:</b>		
<input type="checkbox"/> Rye	<input type="checkbox"/> Annual Ryegrass	<input type="checkbox"/> Mixture of Forage Radish plus Grass
<input type="checkbox"/> Wheat	<input type="checkbox"/> Annual Legumes	<input type="checkbox"/> Annual Legume plus Grass at 25-49% or more
<input type="checkbox"/> Barley	<input type="checkbox"/> Brassica (Winter Hardy)	<input type="checkbox"/> Annual Legume plus Grass at 50% or more
<input type="checkbox"/> Oats (Winter Hardy)	<input type="checkbox"/> Triticale	<input type="checkbox"/> Other <input type="text"/>
<input type="checkbox"/> Oats (Winter Killed)	<input type="checkbox"/> Forage Radish	
<b>Method of Planting:</b>	<b>Date Planted:</b>	<b>Fall manure nutrient application?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Drilled with seed drill	<input type="text"/> Mo <input type="text"/> Yr	<b>Spring nutrient application before 3/1?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Broadcast with incorporation	<b>Acres Planted:</b>	<b>Harvested in the spring?</b>
<input type="checkbox"/> Broadcast without incorporation		<input type="checkbox"/> No
<input type="checkbox"/> Aerial seeding with aircraft	<input type="text"/> Acres	<input type="checkbox"/> Yes → <b>Acres Harvested:</b> <input type="text"/> Acres
<input type="checkbox"/> Other: <input type="text"/>		
<b>Fifth Cover Crop Species</b>		
<b>Pick another cover crop the operator planted in 2019:</b>		
<input type="checkbox"/> Rye	<input type="checkbox"/> Annual Ryegrass	<input type="checkbox"/> Mixture of Forage Radish plus Grass
<input type="checkbox"/> Wheat	<input type="checkbox"/> Annual Legumes	<input type="checkbox"/> Annual Legume plus Grass at 25-49% or more
<input type="checkbox"/> Barley	<input type="checkbox"/> Brassica (Winter Hardy)	<input type="checkbox"/> Annual Legume plus Grass at 50% or more
<input type="checkbox"/> Oats (Winter Hardy)	<input type="checkbox"/> Triticale	<input type="checkbox"/> Other <input type="text"/>
<input type="checkbox"/> Oats (Winter Killed)	<input type="checkbox"/> Forage Radish	
<b>Method of Planting:</b>	<b>Date Planted:</b>	<b>Fall manure nutrient application?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Drilled with seed drill	<input type="text"/> Mo <input type="text"/> Yr	<b>Spring nutrient application before 3/1?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Broadcast with incorporation	<b>Acres Planted:</b>	<b>Harvested in the spring?</b>
<input type="checkbox"/> Broadcast without incorporation		<input type="checkbox"/> No
<input type="checkbox"/> Aerial seeding with aircraft	<input type="text"/> Acres	<input type="checkbox"/> Yes → <b>Acres Harvested:</b> <input type="text"/> Acres
<input type="checkbox"/> Other: <input type="text"/>		

## Riparian Buffers

Are there any streams or waterways on the lands that are part of the operation?

- No → Skip to the last page of the form (page 16)
- Yes → Proceed to the next box

## Riparian Buffers along Cropland

Does the operator maintain permanent vegetation of an average width of at least 10 feet between the stream bank or waterway and cropland?

No → Skip to the next box

Yes → If yes, complete the information below for all applicable buffer types

Buffer Type & Total Acres	Date Established	Funding
<p><i>Narrow Grass Buffer:</i> Grass with average width of at least 10 feet but less than 35 feet</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p><i>Wide Grass Buffer:</i> Grass with average width of 35 feet or greater</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p><i>Narrow Forest Buffer:</i> Trees and/or shrubs with average width of at least 10 feet but less than 35 feet</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p><i>Wide Forest Buffer:</i> Trees and/or shrubs with average width of 35 feet or greater</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>

*NOTE: For buffers, conduct assessment, applying the following checklist. Do not count as a buffer if not all applicable standards are met. (Chesapeake Bay Program Resource Improvement BMP checklist)*

- Horizontal buffer width is  $\geq 10$  feet for narrow buffers and  $\geq 35$  feet for wide buffers, measured perpendicular to top-of-bank of stream/watercourse (estimate by pacing).
- For grass buffers, plant species are native (preferred) or introduced and non-invasive, with stiff stems and high stem density; compatible in growth rate and tolerant of flooding/saturation and shade; and minimum 75% perennial grass cover is present.
- For grass buffers, excessive rill and concentrated flow are controlled in areas upgradient of buffer before entering, and overland flow through buffer is maintained as sheet flow.
- For grass buffers, no livestock are present nor have access.
- For forest buffers, dominant vegetation ( $> 50\%$  canopy cover) consisting of existing, naturally regenerated, or planted trees and/or shrubs.
- For forest buffers, overland/sheet flow is maximized through buffer (no concentrated flow), and structural measures are present were vegetation practice is insufficient to control erosion.

## Riparian Buffers along Pastures

Does the operator maintain permanent vegetation of an average width of at least 10 feet between the stream bank or waterway and pastures?

- No → Skip to the last page of the form (page 16)  
 Yes → If yes, complete the information below for all applicable buffer types

Buffer Type & Total Acres	Date Established	Funding & Grazing Management
<p><i>Narrow Grass Buffer:</i> Grass with average width of at least 10 feet but less than 35 feet</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If pastures are actively used for grazing, are animals excluded from buffer area?  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not used for grazing</p>
<p><i>Wide Grass Buffer:</i> Grass with average width of 35 feet or greater</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If pastures are actively used for grazing, are animals excluded from buffer area?  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not used for grazing</p>
<p><i>Narrow Forest Buffer:</i> Trees and/or shrubs with average width of at least 10 feet but less than 35 feet</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If pastures are actively used for grazing, are animals excluded from buffer area?  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not used for grazing</p>
<p><i>Wide Forest Buffer:</i> Trees and/or shrubs with average width of 35 feet or greater</p> <p>Total acres of buffer: <input type="text"/></p>	<p><input type="text"/> Mo <input type="text"/> Yr</p>	<p>Were county, state or federal funds used to establish the practice? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If pastures are actively used for grazing, are animals excluded from buffer area?  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not used for grazing</p>

*NOTE: For buffers, conduct assessment, applying the following checklist. Do not count as a buffer if not all applicable standards are met. (Chesapeake Bay Program Resource Improvement BMP checklist)*

- Horizontal buffer width is  $\geq 10$  feet for narrow buffers and  $\geq 35$  feet for wide buffers, measured perpendicular to top-of-bank of stream/watercourse (estimate by pacing). If fencing is needed to exclude livestock, fencing meets these minimum setbacks.
- If fence is needed to exclude livestock, exclusion method controls intended animals and is determined to be critical to confinement/exclusion from environmental area; livestock concentration and grazing are minimized in riparian buffer areas; and the areas around fence are stabilized.
- Vegetation in buffer between barrier and surface water are of density to reduce polluted runoff. For forest buffers, dominant vegetation ( $> 50\%$  canopy cover) is trees and/or shrubs; for grass buffers, minimum 75% perennial grass cover is present.



# Other Conservation Practices

Has the operator installed other conservation practices without government funding? If so, please list the practices and include appropriate units to quantify the size of the practice.

Dairy Precision Feeding  Cows

Planting trees on upland agricultural lands (not along streams)  Acres

Stream restoration  Linear feet

Wetland restoration  Acres

Other conservation practices not listed above (include units):

\*\*\*\*\*END OF FORM\*\*\*\*\*

Please return form to: DeAndrea Kuhns, 323 Ag Admin Building, University Park PA 16802, [drk231@psu.edu](mailto:drk231@psu.edu), (814) 863-5901. For specific questions about the form, contact Matt Royer, [mroyer@psu.edu](mailto:mroyer@psu.edu), (717) 460-3612.

## Appendix D: BMP Survey Verification Summary

To test the reliability of farmer responses, we compared the amounts provided by farmers in the survey responses (“reported totals”) to the amounts verified by the extension educators in the farm visits (“verified totals”). For each practice, we computed the difference between the reported and verified totals for each farm and examined whether this “difference” variable was statistically different from zero. All units are in acres except for manure storage units, which are measured in number of units and barnyard runoff control systems, which are measured in number of systems.

Table 6 shows the summary statistics of these “difference” variables for each practice. Since our key test statistic is the mean difference per farm, we present the standard error of the mean (std. dev./ $\sqrt{n}$ ) and use this information about the distribution of mean difference per farm to generate a 95% confidence interval around our point estimates. We assume our sample mean follows a t-distribution which is typically assumed to converge to a normal distribution when  $n$  exceeds 30. Since we have a sample size of 126, we therefore assume the mean is normally distributed and use z-values of 1.96 to construct our 95% confidence intervals.

**Table 6: Results of the statistical analysis comparing the survey results with the farm visit results (n = 126)**

Practice	Mean	Min	Max	Standard deviation	Standard error of the mean	Lower 95% confidence bound	Upper 95% confidence bound
Core nitrogen management	-15.60	-872	759	138	12.3	-39.6	8.48
Core phosphorus management	-7.82	-1,000	300	116	10.3	-28.0	12.4
Supplemental nitrogen management	-30.70	-1,700	700	212	18.9	-67.7	-6.39
Supplemental phosphorus management	-75.30	-1,800	470	266	23.7	-122	-28.8
Manure incorporation and injection	1.69	-70	200	28	2.49	-3.19	6.58
Manure storages	-0.20	-3	2	0.681	0.0607	-0.317	-0.0794

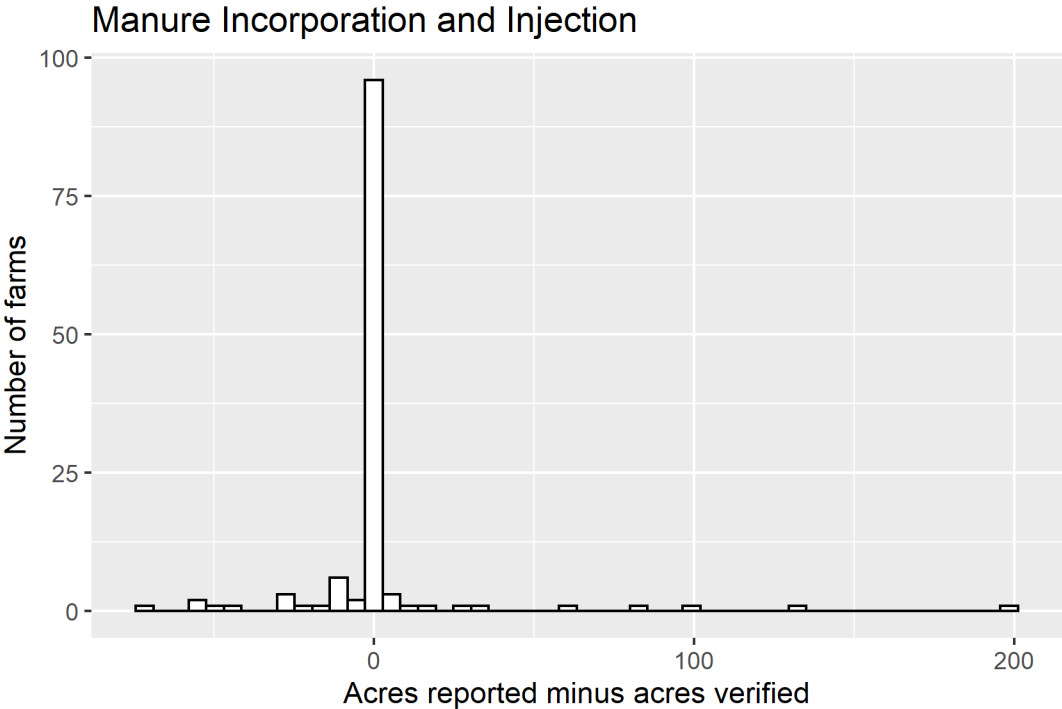
Barnyard runoff controls	-0.01	-1	1	0.464	0.0413	-0.176	-0.0143
Prescribed grazing	-1.44	-35	16	6.64	0.592	-2.60	-0.283
Soil conservation plans	-27.10	-952	340	131	11.6	-49.9	-4.24
No-till	-10.50	-972	365	119	10.6	-31.4	10.4
Cover crops	-3.03	-525	280	70.9	6.32	-15.4	9.35
Riparian buffers	0.002	-45	60	9.48	0.88	-1.72	1.73

In the totals from Tables 1-5 we differentiated between various subcategories of practices (e.g., we reported manure storages units separately for dairy, beef, swine, and poultry manure, and we reported soil conservation plans separately for plans covering row crops versus hay versus pasture). However, because the number of farms visited (126) was much smaller than the number of survey responses (1,794) we aggregated many of these subcategories for the statistical analysis. In this way, our statistical analysis tests for the whether the farm correctly reported *the presence and quantifiable units* of a practice, rather than testing for whether the farm correctly classified the practice based on specific elements of a particular practice's definition. This aggregation is summarized as follows:

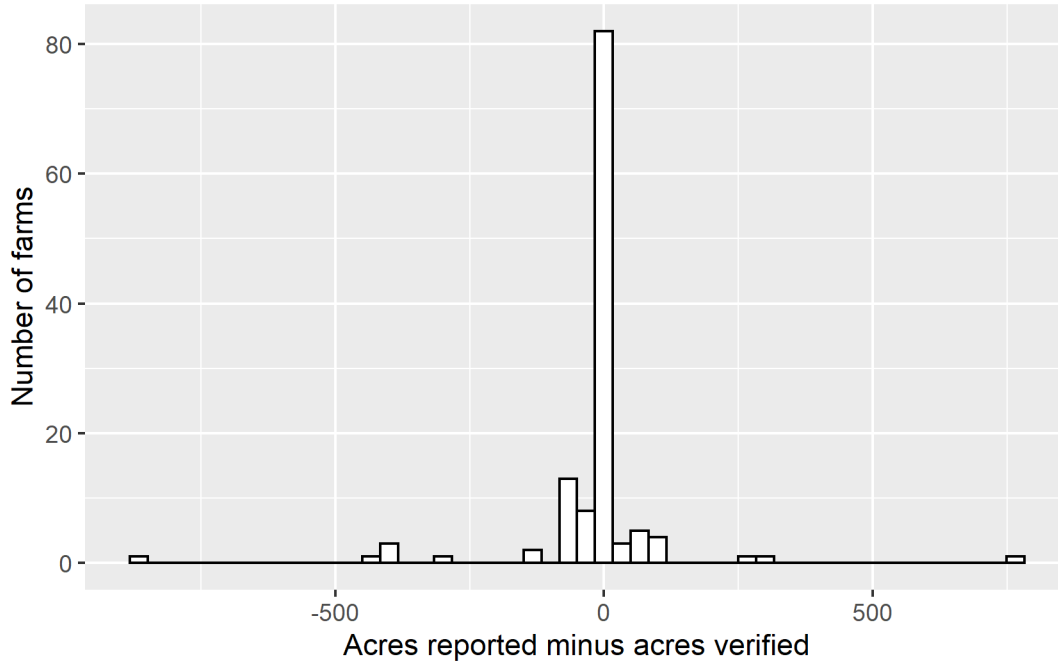
- We aggregated all three categories of supplemental nutrient management and used (acres under rate adjustment) + (acres under placement adjustment) + (acres under timing adjustment) as the basis for comparing reported acres with verified acres. (but we did distinguish between N and P)
- We aggregated all five categories of manure incorporation/injection and used (acres under high-disturbance incorporation within 24 hours) + (acres under high-disturbance incorporation within 1-3 days) + (acres under low-disturbance incorporation within 24 hours) + (acres under low-disturbance incorporation within 1-3 days) + (acres under immediate injection) as the basis for comparing reported acres with verified acres.
- We aggregated all four categories of manure storage units and used (dairy manure storage units) + (beef manure storage units) + (swine manure storage units) + (poultry manure storage units) as the basis for comparing the reported number of units with the verified number of units.
- We aggregated all acres under soil conservation plans regardless of whether the plan was an Ag E&S or NRCS conservation plan or whether the plan covered row crops, hay, or pasture.
- We aggregated all acres under no-till or minimum tillage regardless of % residue cover

- We aggregated all cover crop acres regardless of whether the acres covered traditional cover crops, traditional cover crops with nutrients, or commodity cover crops.
- We aggregated all riparian buffer acres regardless of adjacent land type, vegetation type (grass or forest), and width class.

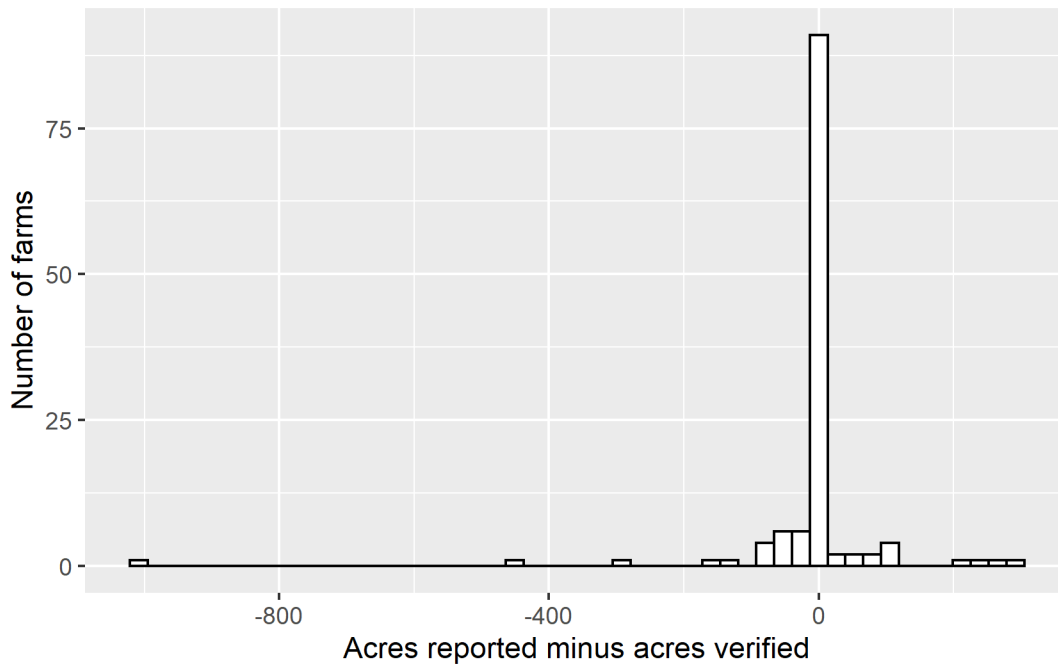
The histograms below show the distribution of unverified acres for each practice (when reported acres minus verified acres is positive, this indicates over-reporting; when the reverse is true, this indicates under-reporting):



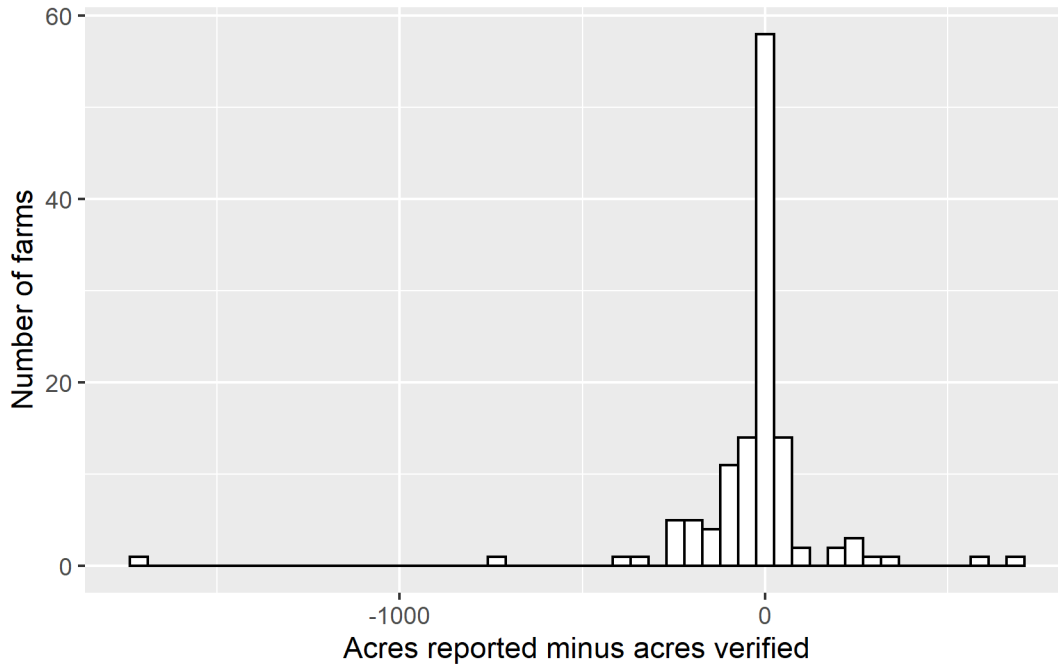
### Core Nutrient Management - Nitrogen



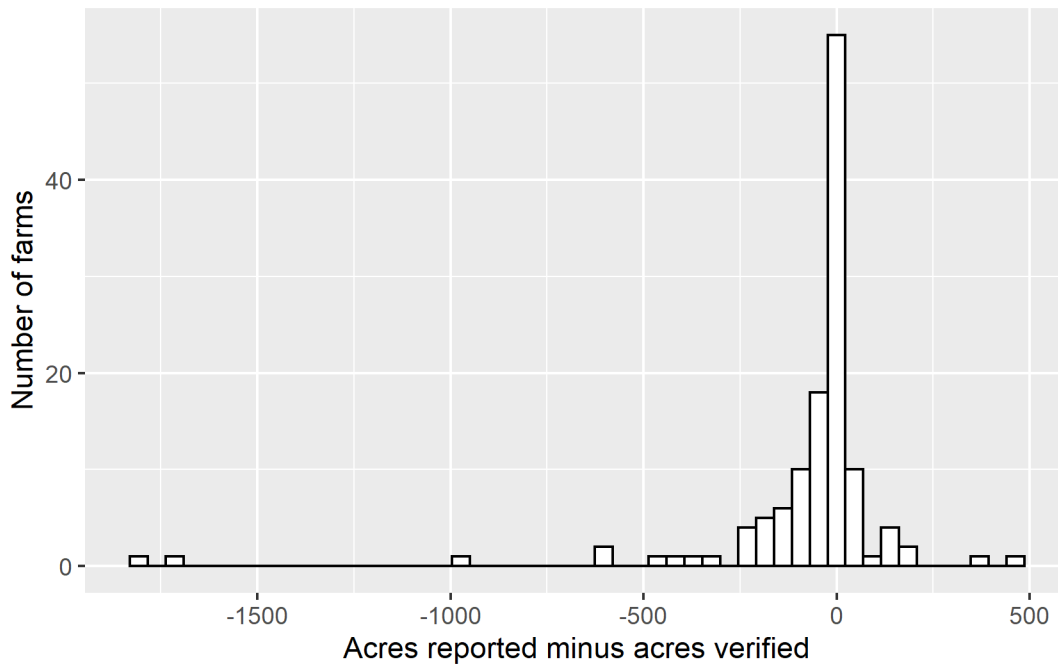
### Core Nutrient Management - Phosphorus



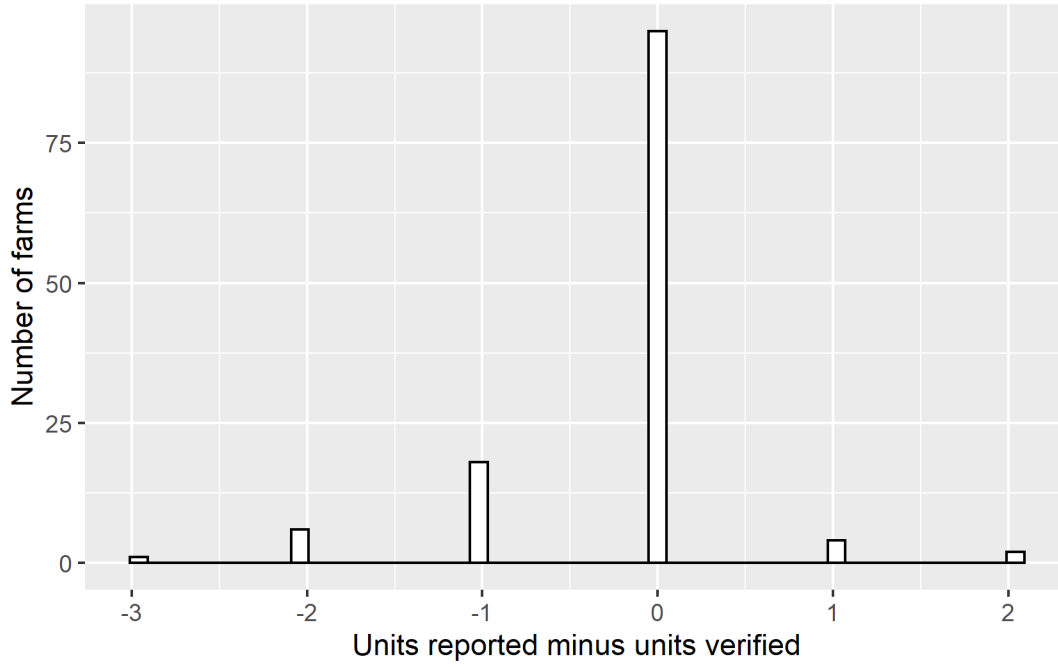
### Supplemental Nutrient Management - Nitrogen



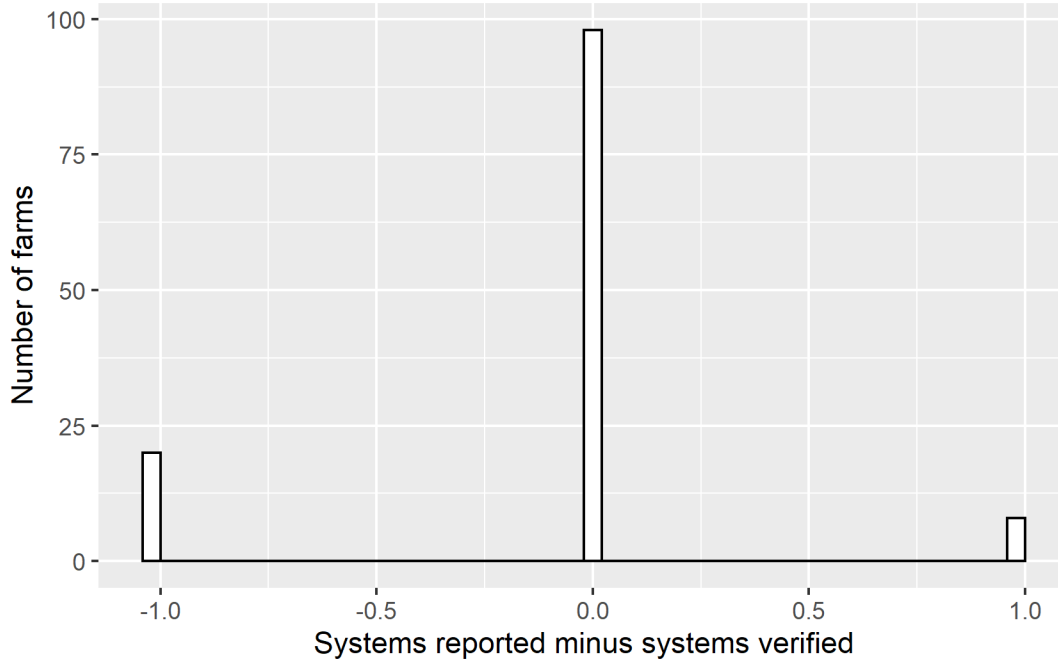
### Supplemental Nutrient Management - Phosphorus



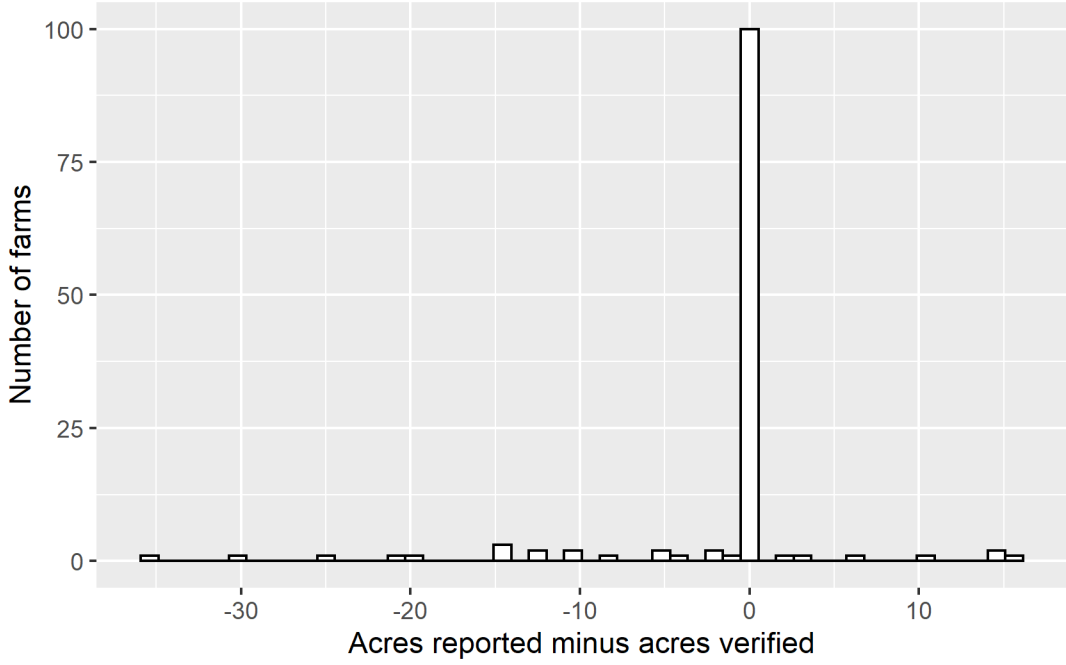
### Animal Waste Storage Units



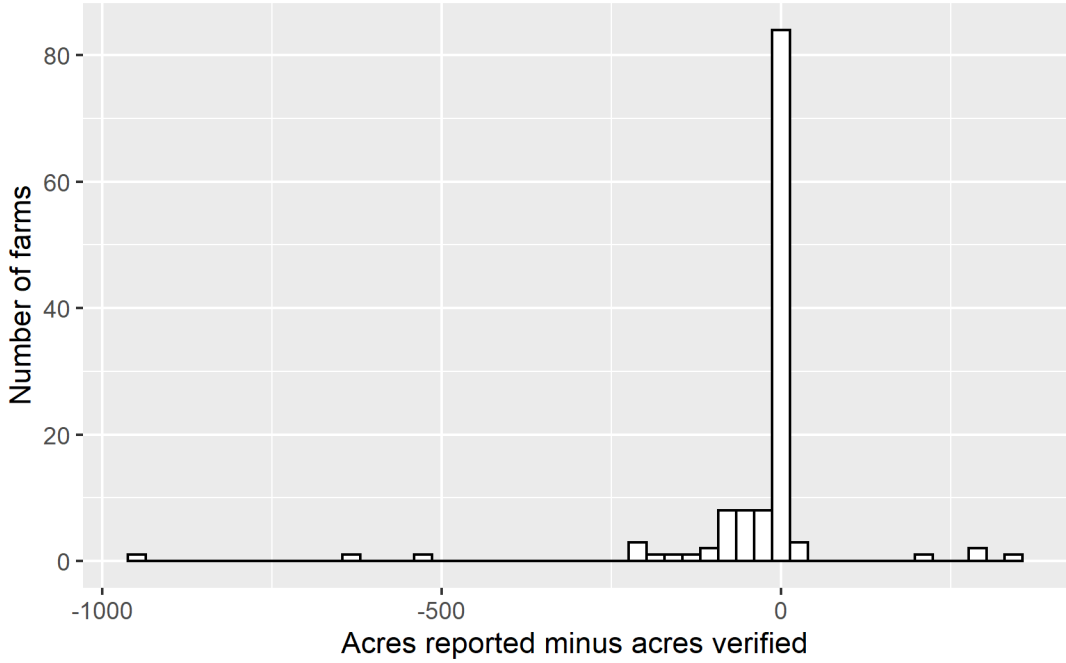
### Barnyard Runoff Control Systems



### Prescribed Grazing

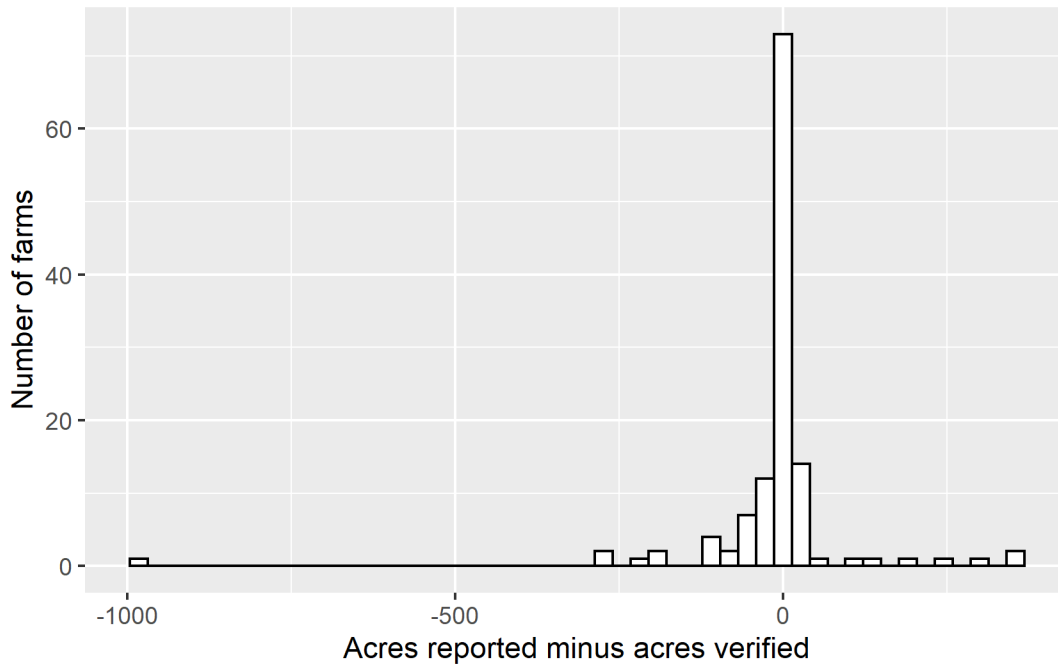


### Soil Conservation and Water Quality Plans

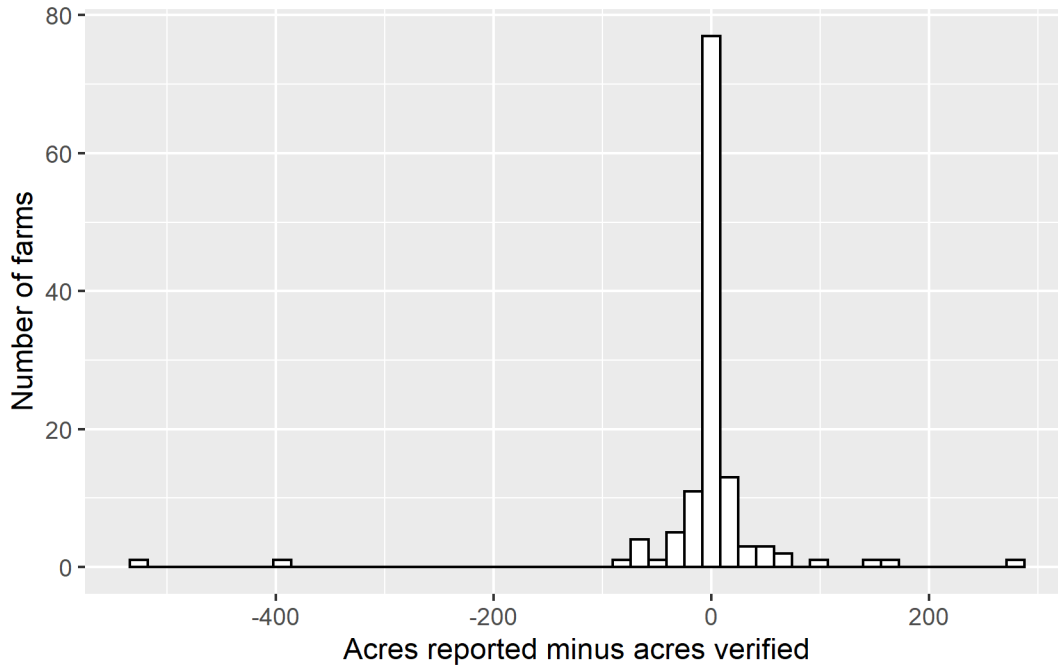




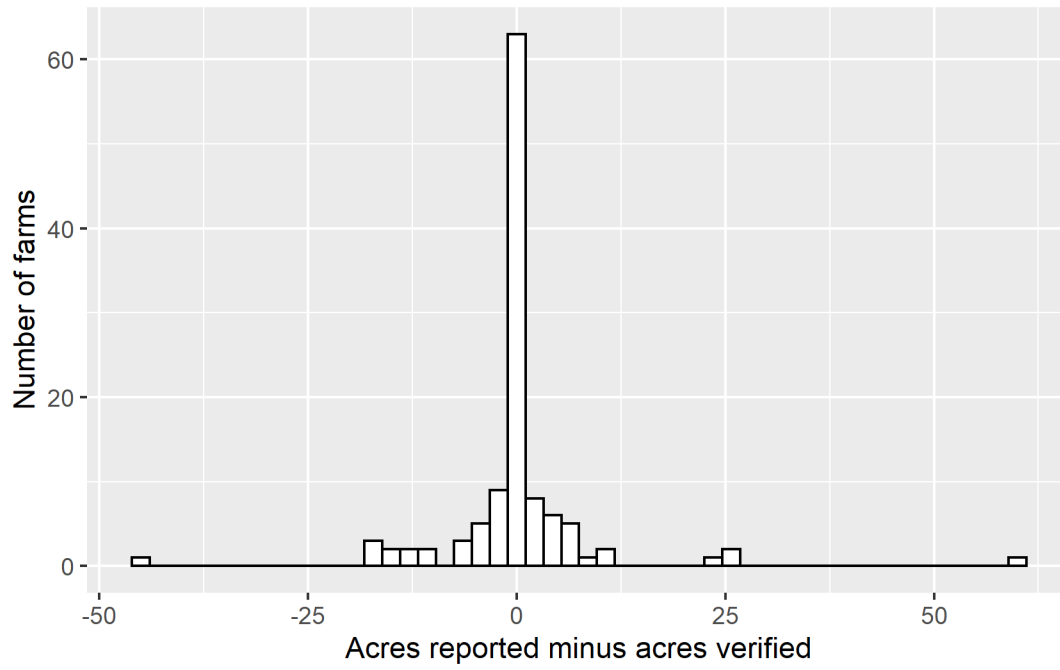
### No-till and Minimum Tillage



### Cover Crops



# Riparian Buffers



## Appendix E: Sample Calculation to Determine Estimated (Adjusted) Acres and Upper and Lower 95% Confidence Limits for Aggregate Data

The per-farm mean difference between reported and verified totals and 95% confidence intervals presented in Appendix C can be applied to the aggregate data to establish total “estimated” results as follows:

$$\text{Estimated totals} = \text{reported totals} - (\text{mean unverified acres per farm}) \times n$$

where  $n$  = total number of farms with survey returns (1,794). Using this expression, we can adjust the reported totals for certain practices to account for average over- or -under-reporting uncovered by the farm visit data. This same formula can be applied to calculate lower and upper 95% confidence bounds on the estimated totals by substituting the upper and lower 95% bounds from columns 7 and 8 of Table 6 in place of mean unverified acres per farm in the expression above.

For example, there are 63,254 acres of core nitrogen nutrient management reported for cropland in the surveyed counties.

**Reported Acres: 63,254** ( $n=1,794$ ) (Table 1)

The verification data allows us to calculate per farm mean differences and upper and lower 95% confidence bounds around this mean difference:

**Verification Data:** (for  $n=126$ ) (Appendix D, Core nitrogen management)

Mean unverified acres per farm: **+15.60 acres**

Standard deviation: **138**

Standard error of the mean: **12.3** (standard deviation/ $\sqrt{n}$ )

Critical t-value for a two-sided test at the 95% confidence level: **1.96**

Lower 95% confidence bound on unverified acres per farm: **-39.6 acres**  
(mean difference – critical t value  $\times$  standard error of the mean)

Upper 95% confidence bound on unverified acres per farm: **+8.48 acres**  
(mean difference + critical t value  $\times$  standard error of the mean)

These statistical results, which were calculated on a per-farm basis, can then be used to generate an estimate of the most likely value for cumulative totals and a range around this estimate. We calculate estimated total acres of core nitrogen nutrient management along with upper and lower 95% confidence bounds as follows:

**Estimated total acres based on mean unverified acres per farm** (for  $n=1,794$ ):

Reported acres – (mean difference per farm)  $\times$  ( $n$ )

$$\begin{aligned} &= 63,254 - (-15.60) \times (1,794) \\ &= 91,240 \end{aligned}$$

**Adjusted total acres corresponding to the upper 95% confidence bound on unverified acres per farm (for n=1,794):**

$$\begin{aligned} &\text{Reported acres} - (\text{upper 95\% confidence bound on unverified acres per farm}) \times (n) \\ &= 63,254 - (8.48) \times (1,794) \\ &= 48,040 \end{aligned}$$

**Adjusted total acres corresponding to the lower 95% confidence bound on unverified acres per farm (for n=1,794):**

$$\begin{aligned} &\text{Reported acres} - (\text{lower 95\% confidence bound on unverified acres per farm}) \times (n) \\ &= 63,254 - (-39.6) \times (1,794) \\ &= 134,296 \end{aligned}$$

This would permit us to report 91,240 acres of core nitrogen nutrient management as our “estimated” total to account for the additional 15.6 acres per farm (on average) that were verified in the farm visits (see Table 3) Table 3 also show results of calculations for the upper and lower 95% confidence bounds for core nitrogen nutrient management, and all other conservation practice types. Because for all practice types all reported results fall within the upper and lower 95% confidence bounds around these “estimated” totals, we do not recommend any reporting adjustments to the results reported in survey returns.