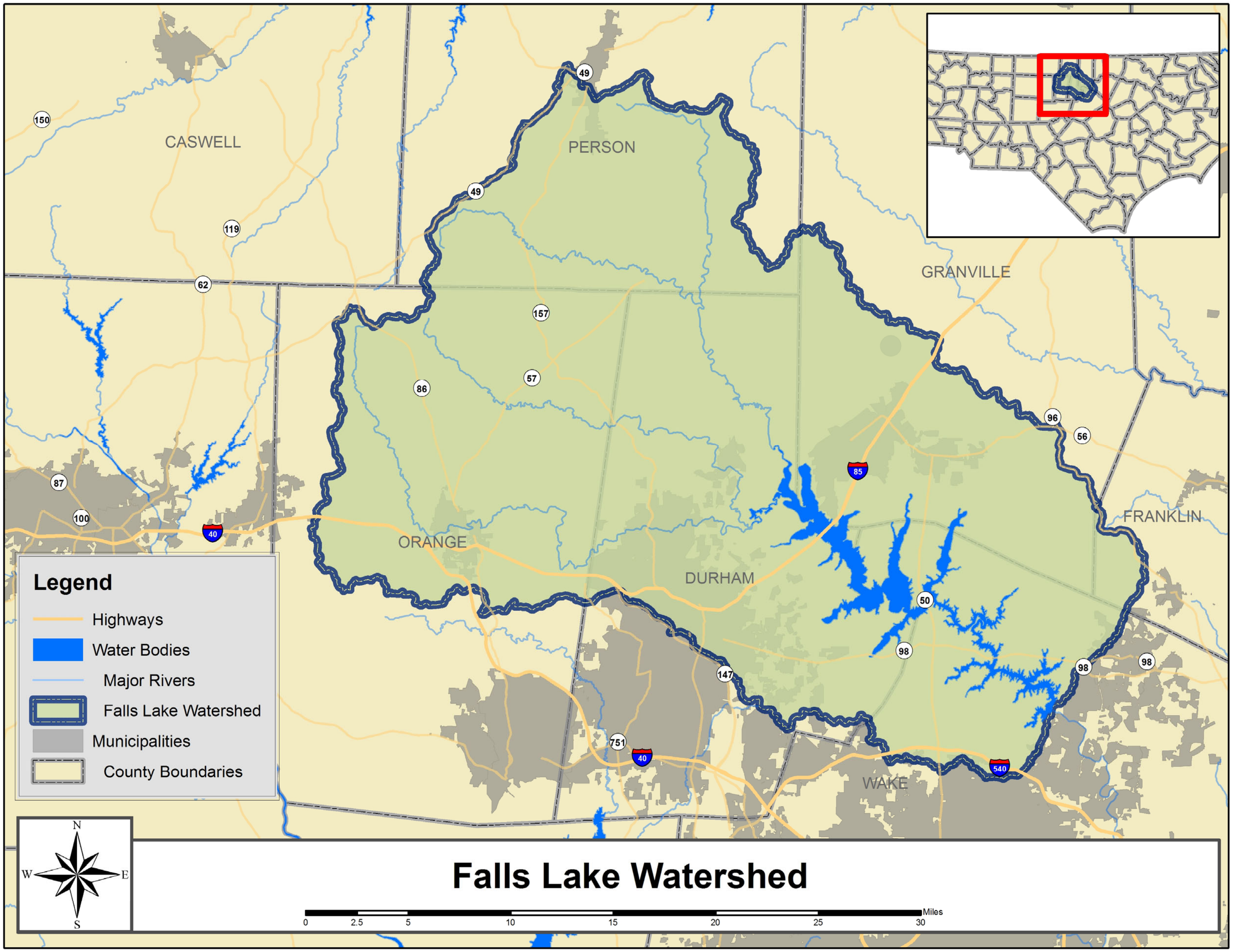
NCDA&CS

2026 Annual Progress Report (Crop Year 2024) on Agricultural Operations' Stage I and Stage II Reductions for the Falls Lake Agriculture Rule (15A NCAC 02B .0280)

A Report to the Division of Water Resources from the Falls Lake Watershed Oversight Committee: Crop Year 2024

Date approved by Falls Lake Watershed Oversight Committee: 1/28/2026
Date submitted to NC Division of Water Resources: 1/28/2026


Falls Lake Watershed
CASWELL
PERSON
GRANVILLE
ORANGE
DURHAM
FRANKLIN
WAKE
Legend
Highways
Water Bodies
Major Rivers
Falls Lake Watershed
Municipalities
County Boundaries
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Summary

This report provides the annual progress report of collective progress made by the agricultural community to reduce nutrient losses toward compliance with Stage I and Stage II of the Falls Lake Agriculture rule, a component of the Falls Reservoir Water Supply Nutrient Strategy. For this report, the Falls Lake Watershed Oversight Committee (WOC) oversaw the application of accounting methods approved by the Environmental Management Commission's Water Quality Committee in March 2012 to estimate changes in nitrogen (N) loss and phosphorus (P) loss trends in the Falls Lake Watershed. This report is for the period between the strategy baseline (2006) and Crop Year (CY) 2024.[1] To produce this report, Division of Soil and Water Conservation staff received, processed and compiled baseline and CY2024 reports from agricultural staff in six counties, for the WOC's review and approval. Agriculture has been successfully decreasing nutrient losses in the Falls Lake watershed since implementation of the Falls Reservoir Water Supply Nutrient Strategy. In CY2024, agriculture collectively exceeded its 20% Stage I and 40% Stage II nitrogen reduction goals for cropland, with a 57% cropland nitrogen reduction. Pastureland nitrogen reduction was last calculated in CY2023 reporting using 2022 Census of Agriculture data and state and federal BMP implementation data from 2017 to 2022. In this last cycle of pastureland accounting, agriculture was estimated to have achieved a 36% nitrogen reduction compared to the 2006 baseline exceeding its Stage I nitrogen reduction goal for pastureland. All six counties are estimated to have exceeded their local 20% nitrogen reduction goals set by the WOC this year.

Falls Lake Watershed Oversight Committee Composition, Falls Agriculture Rule:

1. NC Division of Soil & Water Conservation
2. USDA-NRCS
3. NCDA&CS
4. NC Cooperative Extension Service
5. NC Division of Water Resources
6. Watershed Environmental Interest
7. Watershed Environmental Interest
8. Environmental Interest
9. General Farming Interest
10. Pasture-based Livestock Interest
11. Equine Livestock Interest
12. Cropland Farming Interest
13. Scientific Community

Since the baseline, reductions in nitrogen loss have been achieved through an overall decrease in cropland production, a decrease in nitrogen application rates, and an increase in best management practices (BMPs). In CY2024, reported cropland acres in the watershed decreased by 28,430 acres from baseline acreage. It is assumed that some of the lost agricultural land was converted to development or other uses. Phosphorus qualitative indicators for CY2024 demonstrate that there is no net increased risk of phosphorus loss from agricultural lands in the watershed, with a 30% decrease in animal waste phosphorus production and a 64% increase in cropland conversion to grass and trees since the 2006 baseline.

[1] The 2024 crop year began October 1, 2023 and ended September 30, 2024.

Rule Requirements and Compliance

In January 2011, the Agriculture Rule in the Falls Reservoir Water Supply Nutrient Strategy became effective. The Agriculture Rule provides for a collective strategy for farmers to meet nitrogen (N) loss reduction goals in two stages. The strategy's goal is to reduce the average annual load of nitrogen and phosphorus (P) to Falls Lake from 2006 baseline levels. Stage I requires that agriculture reach a goal of 20% N loss reduction and 40% P loss reduction from cropland and pasture sources by year 2020. Stage II sets goals of 40% N and 77% P reductions by year 2035 from cropland and pasture sources in the watershed. A Watershed Oversight Committee (WOC) was established to guide the implementation of the rule and to assist farmers with rule compliance. Six Local Advisory Committees (LACs), previously established through the Neuse Nutrient Sensitive Waters (NSW) Management Strategy Agriculture Rule, were tasked with assisting farmers with complying with the Falls Reservoir NSW Agriculture Rule.

Falls Reservoir Nutrient Sensitive Waters (NSW) Strategy:
The Environmental Management Commission (EMC) adopted the Falls Reservoir Water Supply Nutrient Strategy rules in 2011. The strategy goal is to reduce the average annual load of nitrogen and phosphorus to Falls Lake from 2006 baseline levels. In addition to point source rules, mandatory controls were applied to protect riparian buffers and address agriculture and urban stormwater non-point source pollution. The management strategy was modeled after similar nutrient strategies for the Neuse River and Estuary, Tar-Pamlico River and Estuary, and Jordan Lake.

All Local Advisory Committees (LAC) submitted their thirteenth annual reports to the WOC in August 2025. Collectively, agriculture is meeting the cropland nitrogen loss reduction goal, with a 57% N reduction from the 2006 baseline. Qualitative indicators for phosphorus suggest there is no increased risk of phosphorus loss from agricultural land in the watershed. Pasture nitrogen loss accounting relies on USDA-NASS data which is gathered via the Census of Agriculture every five years. The pasture nitrogen loss estimation in this report was last calculated in CY2023 accounting using 2022 Census of Agriculture data and state and federal BMP implementation data from the previous five years. For the last pasture accounting cycle, the six Falls Lake counties achieved a collective 36% reduction in pastureland nitrogen loss compared to the 2006 baseline. This reduction exceeds the rule-mandated Stage I nitrogen reduction goal (20%).

Scope of Report and Methodology

The estimates provided in this report represent county-scale calculations of nitrogen loss from cropland and pastureland agriculture in the watershed made by the NC Division of Soil and Water Conservation (DSWC) using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet (NLEW) and adjusted for the percentage of each county in the Falls Lake Watershed. NLEW is an accounting tool developed to meet the specifications of the Neuse Rule and approved by the Environmental Management Commission's (EMC) Water Quality Committee in March 2012 for use in the Falls Lake Watershed. The NLEW development team included interagency technical representatives of the NC Division of Water Resources (DWR), NC Division of Soil and Water Conservation (DSWC), United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) and was led by NC State University (NCSU) Soil Science Department faculty. The NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland and pastureland. It is an "edge-of-management unit" accounting tool that estimates changes in nitrogen loss from cropland and pastureland but does not estimate changes in nitrogen loading to surface waters. Separate assessment methods were developed and approved by the Water Quality Committee of the EMC for phosphorus and are described later in the report.

Over time the NLEW tool has been updated to incorporate new data. In 2015, a web-based version of NLEW (v6.0) was created on NC Department of Agriculture and Consumer Services servers. Revised realistic yield and nitrogen use efficiency data from NCSU were incorporated, and some minor calculation errors were corrected for field corn, sweet potatoes, and sweet corn. The modernized web-based NLEW software (v6.0) was updated to automatically pull revised realistic yield and nitrogen use efficiency data from the North Carolina Realistic Yield Database.[2]

Nitrogen Reduction from Cropland from 2006 Baseline for CY2024

All counties submitted their thirteenth progress reports to the WOC in August 2025. In CY2024 agriculture is estimated to have achieved a 57% reduction in nitrogen loss from cropland compared to the average 2006 baseline. Figure 1 shows annual loss percent reductions per year since CY2011, calculated with the two different versions of NLEW. Table 1 lists each county's baseline (2006), CY2023 and CY2024 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions for those years.

The Division of Soil and Water Conservation has continued to use georeferenced Farm Service Agency cropland data for CY2024 accounting. Georeferenced FSA cropland data was first incorporated into annual reporting for the CY2023 report and provides the most accurate assessment of cropland acreage in the Falls Lake watershed. However, comparing georeferenced CY2023 and CY2024 data to baseline totals estimated using the previous best-available methodology is not straightforward, as differences in methodology and underlying assumptions can complicate the evaluation.

Additionally, for CY2024 a new spatial analysis tool was piloted to recalculate riparian buffers at 20-, 30-, 50-, and 100-foot or greater widths for georeferenced Farm Service Agency (FSA) cropland data in six counties— Durham, Franklin, Granville, Orange, Person, and Wake. The buffer recalculation was conducted in CY2024 as an initial step toward addressing cumulative inaccuracies that arose from cropland loss and other land use changes over time in urbanizing counties. The six counties in the Upper Neuse collectively reported approximately 50% fewer NLEW-reportable cropland acres in CY2024 compared to baseline conditions. The Watershed Oversight Committee (WOC) has noted in several annual reports that an accurate reassessment of remaining buffer systems for cropland is needed due to the rate at which urbanizing counties have lost agricultural land. The WOC and technical experts will need to further evaluate the tool's performance to determine its technical strengths and limitations.

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[2] The North Carolina Realistic Yield Database is the product of an extensive data gathering and review process conducted by many state and federal partners. The North Carolina Realistic Yield Database is maintained and updated by North Carolina State University.
North Carolina Interagency Nutrient Management Committee. (2014). *Realistic yields and nitrogen application factors for North Carolina crops*. North Carolina State University; North Carolina Department of Agriculture and Consumer Services; North Carolina Department of Environment and Natural Resources; Natural Resources Conservation Service.
https://realisticyields.ces.ncsu.edu

All counties in the watershed experienced wide swings in reduction achievements between CY2023 and CY2024. This is predominantly due to buffer recalculation activities previously described. The nitrogen reduction shifts seen in Table 1 are not due to major agricultural management changes or new crop cultivation trends in the watershed or within specific counties. Additionally, the limited cropland remaining in the Falls Lake watershed already tends to cause larger year to year variances in nitrogen reduction accounting as smaller systems and data sets are more sensitive to yearly fluctuations and outliers. According to FSA geospatial data, Franklin county had 82 acres of cropland in the Falls Lake watershed, an 86% drop from its baseline acreage. Wake county had 266 acres of cropland in the watershed, a 92% drop from its baseline acreage.

Nitrogen loss reductions in CY2024 were achieved through a combination of fertilization rate decreases, cropping shifts, BMP implementation, and cropland acreage fluctuations. Most significantly, NLEW-reportable production acres for all major crops (hay, corn, soybeans, tobacco, and wheat) in the Falls Lake watershed have decreased since baseline. When comparing total reported CY2024 cropland acres to baseline totals, acreage has decreased by 76% for hay, 34% for corn, 21% for soybeans, 20% for tobacco, and 34% for wheat. Some of the reported cropland acreage loss can be attributed to permanent loss of agricultural land to development. Changing crop rotations and idle land, which could return to production in the future, may account for some of the reported production acreage losses seen since baseline. It is also possible that some cropland acres are now grazed as pasture, which is accounted for in the pasture NLEW reporting framework described later in this report. Only non-grazed hay acres are accounted for in the cropland NLEW reduction calculation.

Figure 1. Collective Cropland Nitrogen Loss Reduction Percent 2011 to 2024, Falls Lake Watershed

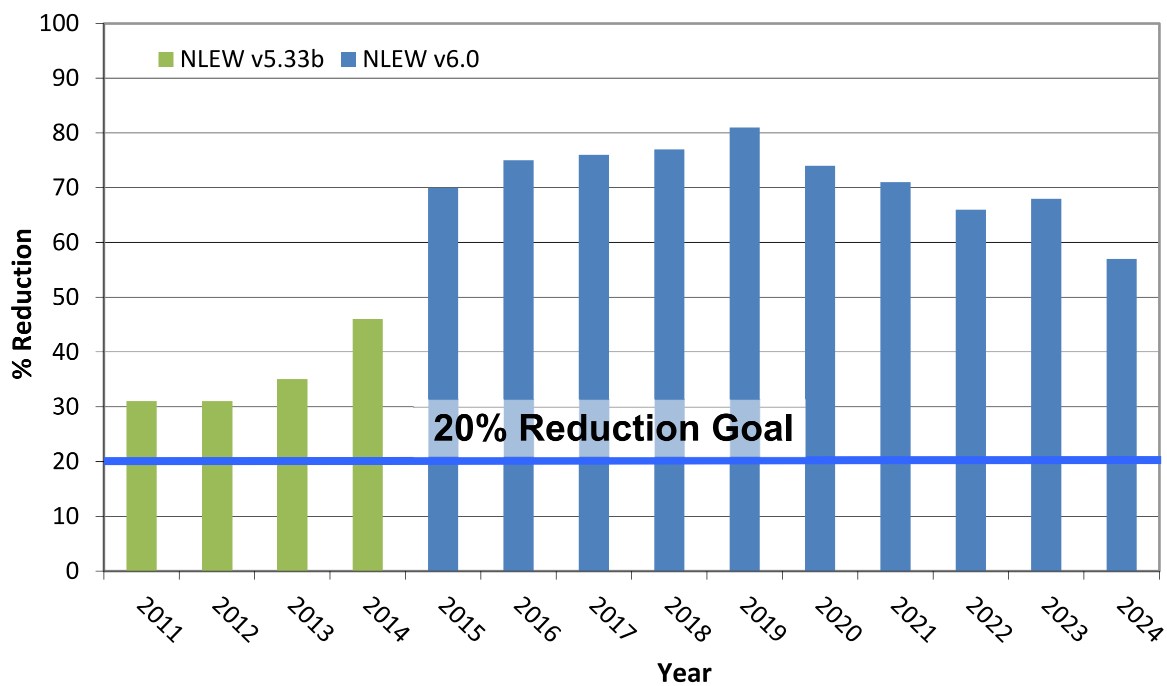


Table 1. Estimated reductions in agricultural cropland nitrogen loss from baseline (CY2006) for CY2023 and CY2024, Falls Lake Watershed

County	Baseline N Loss (lb))§¤	CY2023 N Loss (lb)§¤	CY2023 N Reduction (%)	CY2024 N Loss (lb) §Ω	CY2024 N Reduction (%)Ω
Durham	146,090	56,827	61%	33,305	77%
Franklin	11,772	†	†	3,604	69%
Granville	127,704	1,286†	99%†	35,492	72%
Orange	347,402	118,238	66%	175,686	49%
Person	484,123	195,943	60%	253,097	48%
Wake	49,746	†	†	4,510	91%
Total	1,166,837	372,294	68%	505,694	57%

§ *Nitrogen loss values are for comparative purposes. They represent nitrogen that was applied to cropland in the watershed and neither used by crops nor intercepted by BMPs in an agricultural management unit, based on NLEW calculations. This is not an in-stream loading value.*

¤ *Numbers may include some buffer acres on formerly agricultural land which has been converted to other uses.*

† *In CY23 calculation issues in NLEW arose for Franklin and Wake counties (and, to a certain extent, Granville county) due to the extremely small amount of remaining cropland acres, and the high amount of riparian buffer acreage reported for those counties. Agricultural nitrogen contributions from Franklin and Wake, due to the small amount of cropland (< 250 acres) were likely negligible compared to agricultural nitrogen losses in the overall Falls Lake watershed in CY23.*

Ω *Buffer acreage was recalculated in CY2024 piloting a new spatial analysis tool to improve nitrogen loss reduction estimation in the Upper Neuse.*

Best Management Practice Implementation

Agriculture is credited with different nitrogen reduction efficiencies, expressed as percentages, for riparian buffer widths ranging from 20 feet to 100 feet (ft). NLEW versions 5.33b and 6.0 for the Neuse River Basin provide the following percent nitrogen reduction efficiencies for buffer widths on cropland shown in Table 2. Note that these percentages represent the net or relative percent improvement in nitrogen removal resulting from riparian buffer implementation.

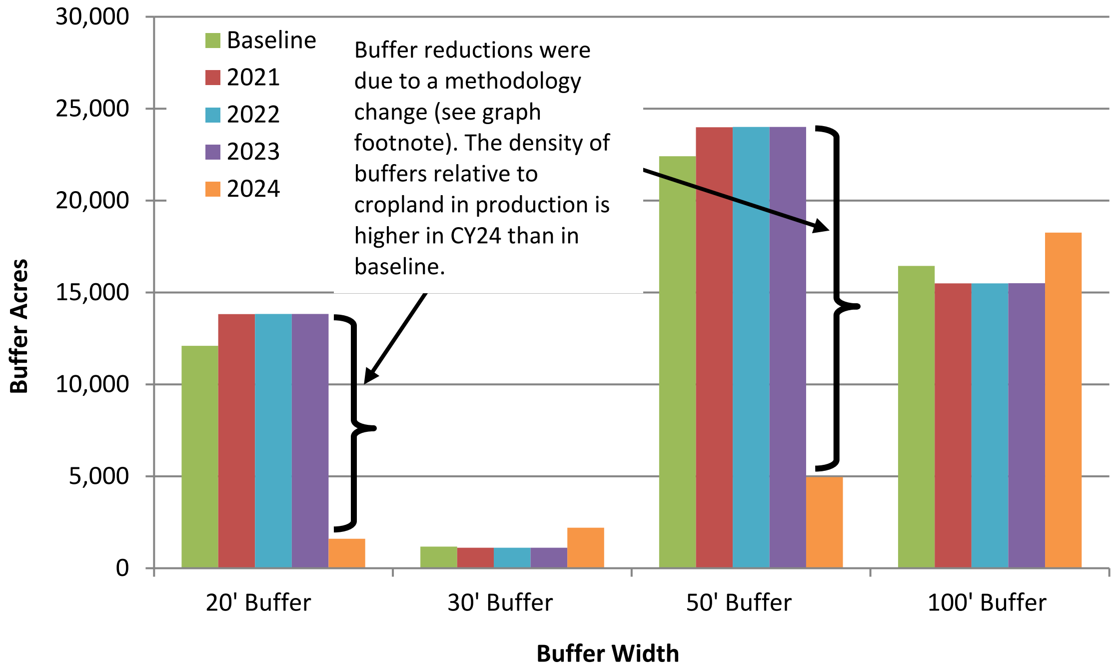
Table 2. Buffer Width Options and Nitrogen Reduction Efficiencies in NLEW

Buffer Width (feet)	NLEW % N Reduction
20 minimum	20%
30 minimum	25%
50 minimum	30%
100 minimum	35%

For CY2024, a reassessment of remaining buffer systems was conducted for all counties in the Falls Lake watershed. The Watershed Oversight Committee (WOC) has noted in several annual reports that an accurate reassessment of remaining buffer systems for cropland is needed due to the rate at which urbanizing counties have lost agricultural land. A new spatial analysis tool was piloted to recalculate riparian buffers at 20-, 30-, 50-, and 100-foot or greater widths for georeferenced Farm Service Agency (FSA) cropland data in six counties—Durham, Franklin, Granville, Orange, Person, and Wake. This pilot aimed to begin addressing cumulative discrepancies in buffer data resulting from cropland loss and land use changes over time in urbanizing counties. The six counties where buffer recalculation was conducted in CY2024 collectively reported approximately 50% fewer NLEW-reportable cropland acres in CY2024 compared to baseline. Moving forward, the WOC and technical experts will further review the accuracy and practicality of the new buffer-calculation spatial tool to determine its advantages, limitations, and potential suitability for application in the Falls Lake watershed for ongoing reporting.

Figure 2 illustrates the amount of buffers on cropland in the baseline (2006), CY2021 through CY2024. The changes in buffer acres between CY2023 and CY2024 seen in Figure 2 are due to buffer recalculation activities that were piloted in the six counties in the Falls Lake watershed. Decreases in buffer acreage between CY2023 and CY2024 do not reflect the physical removal of buffers but rather indicate that previously buffered agricultural land has transitioned to other land uses. It is important to emphasize that these reductions result from a methodological update and do not represent changes in farmer behavior or losses of BMPs on active agricultural land.

Figure 2. Nitrogen Reducing Buffers Installed on Croplands from CY2021 through CY2024, compared to Baseline (CY2006), Falls Lake Watershed*



**Buffer acreage was recalculated in CY2024 piloting a new spatial analysis tool to improve nitrogen loss reduction estimation in the Upper Neuse. Decreases in buffer acreage between CY2023 and CY2024 do not reflect the physical removal of buffers but does indicate that buffered agricultural land has transitioned to other land uses in the Falls Lake watershed.*

BMP data is collected from state and federal cost share program active contracts, and in some cases BMPs that were installed without cost share funding. While there is some variability in the data reported, LACs are reporting the best available information. As additional data is collected, the LACs will review the sources and update their methodology for reporting if warranted.

Reported riparian buffer acre estimates do not account for the entire drainage area treated by buffers in the piedmont, which is generally 5 to 10 times higher than the acres of buffer shown in Figure 2.[3] Riparian buffers have many important functions beyond nitrogen reduction effectiveness. Research has shown that upwards of 75% of sediment from agricultural sources is from stream banks and that riparian buffers, particularly trees, are important for reducing this sediment.[4,5] In addition, buffers sequester phosphorus and sediment as runoff moves through the riparian zone.[6]

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[3] Bruton, J. G. (2005). *Headwater catchments: Estimating surface drainage extent across North Carolina and correlations between landuse, near stream, and water quality indicators in the Piedmont physiographic region* (Doctoral dissertation). North Carolina State University. https://repository.lib.ncsu.edu/items/05a5b48e-2d1a-4736-80a1-6a78351123d2

[4] Sweeney, B. W., Bott, T. L., Jackson, J. K., Kaplan, L. A., Newbold, J. D., Standley, L. J., Hession, W. C., & Horwitz, R. J. (2004). *Riparian deforestation, stream narrowing, and loss of stream ecosystem services. Proceedings of the National Academy of Sciences of the United States of America, 101*(39), 14132–14137. https://doi.org/10.1073/pnas.0405895101

[5] Sweeney, B. W., & Newbold, J. D. (2014). *Streamside forest buffer width needed to protect stream water quality, habitat, and organisms: A literature review. BioScience, 64*(8), 686–699. https://doi.org/10.1093/biosci/biu100

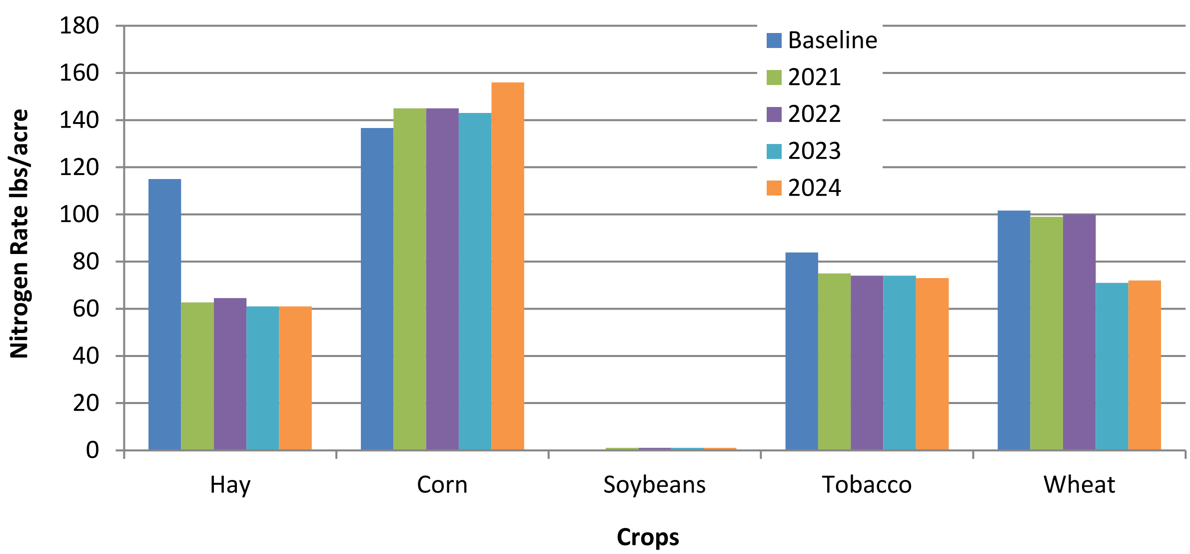
[6] Spruill, T. B. (2004). *Effectiveness of riparian buffers in controlling ground-water discharge of nitrate to streams in selected hydrogeologic settings of the North Carolina Coastal Plain. Water Science and Technology, 49*(3), 63–70.

Fertilization Management

Since baseline, reduced nitrogen application rates have resulted from improved agronomic decision making, economic conditions, and fluctuating farm incomes. Commodity prices and low profit margins have impacted the application rates of nitrogen on farms in the Falls Lake Watershed. For most crops, farmers have reduced their nitrogen application rates from baseline levels. Figure 3 displays the nitrogen application rates in pounds per acre for the major crops in the watershed. Nitrogen application rates for hay are 54 pounds/acre lower than during the baseline (2006). Fertilization application rates for corn increased by 13 pounds/acre from CY2023 rates. Wheat, soybeans, and tobacco nitrogen rates remained relatively stable (less than 5 pounds/acre fluctuations) between CY2023 and CY2024. Fertilization rates are revisited annually by county local advisory committees using data from farmers, commercial applicators and state and federal agencies' professional estimates.

Agriculture in the six counties within the Falls Lake watershed is focused primarily on pasture-based systems, with pasture ranging from 29-74% of agricultural land use.[7] On hay and pasture, nitrogen application rates are significantly less than NC State University recommendations and only small amounts of phosphorus are added. Available data suggest that hay production acres are under-fertilized in the Falls Lake watershed.[8]

Figure 3. Average Annual Nitrogen Fertilization Rate (lb/ac) on Cropland from CY2021 through CY2024, compared to Baseline (CY2006), Falls Lake Watershed



[7] Osmond, D. L., & Neas, K. (2011). *Delineating agriculture in the Neuse River Basin* (Prepared for NC Department of Environment and Natural Resources, Division of Water Quality, p. 9). North Carolina State University. http://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

[8] Osmond, D. L., & Neas, K. (2011). *Delineating agriculture in the Neuse River Basin* (Prepared for NC Department of Environment and Natural Resources, Division of Water Quality). North Carolina State University. http://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

Cropping Shifts

Cropland acreage is calculated annually by utilizing crop data reported by farmers to the Farm Service Agency. For CY2023 reporting, the Division of Soil and Water Conservation was successful in requesting georeferenced Farm Service Agency cropland data for the first time in the history of annual reporting for the Falls Lake watershed. Georeferenced cropland provides better field estimations of commodities grown in individual counties and within the entire Falls Lake watershed and has continued to be used in CY2024 accounting activities. Because each crop type requires different amounts of nitrogen and uses applied nitrogen with a different efficiency rate, changes in the mix of crops grown can have a significant impact on the cumulative yearly nitrogen loss reduction.

Fluctuating weather conditions impact annual cropping shifts by affecting farmers' ability to prepare fields for harvest and planting as well as overall crop health and yield. North Carolina entered CY2024 under abnormally dry to moderate drought conditions; however, the onset of the El Niño pattern brought a shift to warm and wet conditions from December to February.[9] Warm weather prevailed through the rest of CY2024. By June, sustained hot and dry conditions catalyzed drought conditions that devastated corn production in much of eastern North Carolina. In the fall, Tropical Storm Debby brought heavy rainfall and flooding to many counties in the Neuse Basin. Two highly destructive storms followed —Tropical Cyclone Eight and Hurricane Helene— which caused severe, unprecedented damage to regions of North Carolina outside the Neuse Basin. [10] Overall, 2024 concluded as a year marked by weather extremes – intense periods of dryness and wetness that deviated significantly from the norm – and has been described by many as the worst crop year in North Carolina's history.

Between CY2023 and CY2024, the county that experienced the largest hay acreage fluctuation was Orange, which saw a 265 acre increase. For corn, Durham experienced the largest change with a 495 acre decrease between crop years. Soybeans saw more variability. The county with the greatest increase was Durham with 621 acres, but Person also saw a 239 acre increase and Orange experienced a 467 acre decrease in soybeans. Tobacco and wheat only saw moderate changes in acreage between CY2023 and CY2024 (less than 200 acres) in all counties.

Annual cropping shifts seen in CY2024 can be explained by regular crop rotations, which are necessary to minimize the risk of disease from year to year. A host of other factors from individual choice to global markets can impact annual selection. Between CY2023 and CY2024, in total, corn, tobacco, and wheat decreased by 421 acres, 130 acres, and 71 acres respectively. In the same period, total hay, cotton, and soybean acres increased by 479 acres, 71, and 302 acres. The WOC anticipates that the basin will see additional crop shifts in the upcoming year based on changing commodity prices and weather.

Figure 4 shows crop acres and shifts for CY2024 compared to the baseline. When comparing CY2024 totals to baseline, NLEW reported production acreage for major crops in the Falls Lake watershed (hay,

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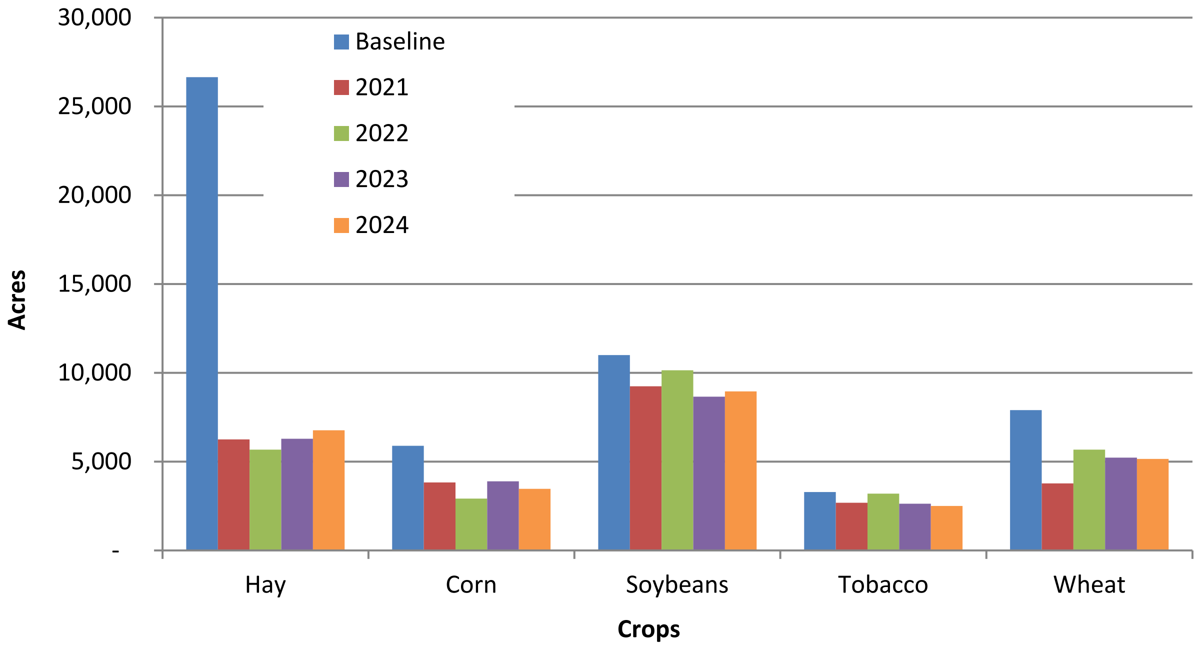
[9] Davis, C. (2024, March 18). *Winter recap 2023–24: Rain returns, but snow stays away*. North Carolina State Climate Office. https://climate.ncsu.edu/blog/2024/03/winter-recap-2023-24-rain-returns-but-snow-stays-away/

[10] Davis, C., & Dello, K. (2025, January 21). *The weather year in review: Heat, Helene, and weather whiplash in 2024*. North Carolina State Climate Office. https://climate.ncsu.edu/blog/2025/01/the-weather-year-in-review-heat-helene-and-weather-whiplash-in-2024/

corn, soybeans, tobacco, and wheat) has declined by nearly 28,000 acres in total since baseline. None of the hay acres reported in Figure 4 are grazed by livestock.

Figure 4. Reported Acreage of Major Crops from CY2021 through CY2024, compared to Baseline (CY2006), Falls Lake Watershed

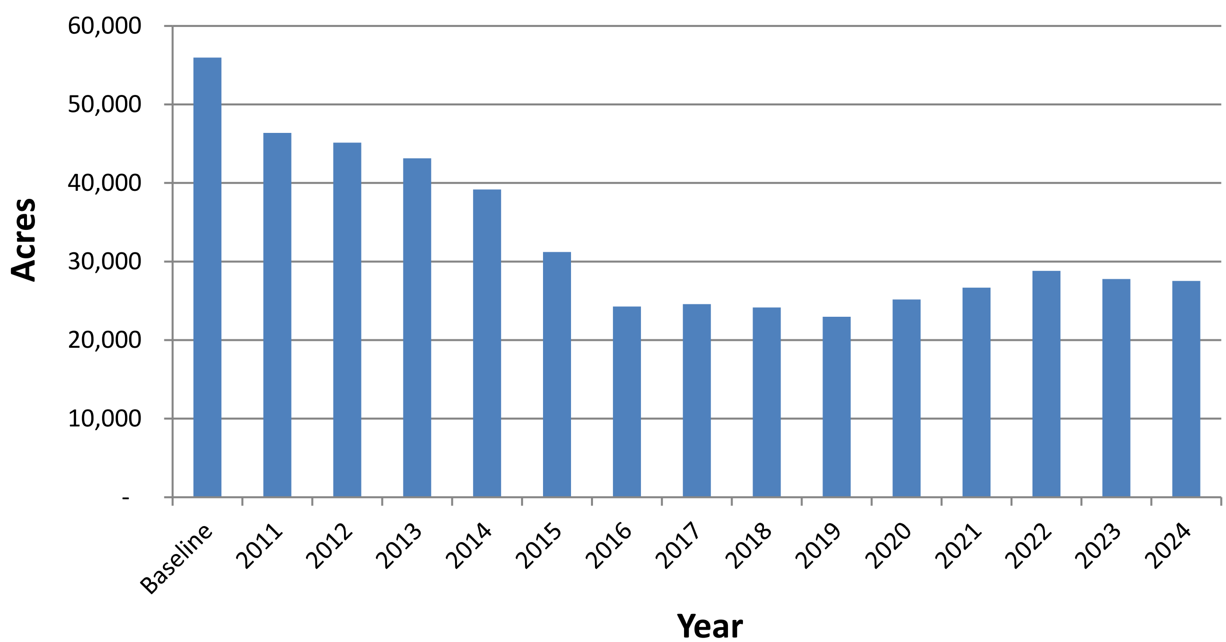


Land Use Change to Development and Cropland Conversion

The number of cropland acres fluctuates every year in the Falls Lake Watershed. Each year, some cropland is either permanently lost to development, converted to grass or trees and likely to be ultimately lost from agricultural production, or temporarily taken out of production. Idle land represents agricultural land that is currently out of production but could be brought back into production at any time. In CY2024, 27,539 NLEW-accountable crop acres were reported in the Falls Lake Watershed along with 9,745 acres of idle land.

As shown in Figure 5, it is estimated that since the 2006 baseline there has been a decrease in 28,430 acres of NLEW-accountable crops (50% of total reported cropland in baseline). Reported cropland in Figure 5 does not include idle land acreage. Based on accounting methodologies developed at the county level and best available data, between baseline and CY2015, 4,708 acres of agriculture land were estimated to have been permanently converted to development. Agriculture land acres lost to development have not continued to be tracked since CY2015 due to ongoing reporting inconsistencies between local governments and an inability to separate cropland and pastureland losses. The georeferenced cropland data from FSA that the DSWC now incorporates in annual reporting is a major advancement for the WOC to report active agricultural land in the Falls Lake watershed. The piloting of a new spatial analysis tool for buffer recalculation in CY2024 is another enhancement the WOC has pursued in recent years to address buffer inaccuracies resulting from rapid loss of agricultural land. However, additional review of the accuracy and practicality of the new buffer-calculation spatial tool for incorporation into annual reporting activities is needed. Cropland conversion totals supported by state or federal cost-share funds continue to be tracked and updated annually. From baseline to CY2024, 2,497 cropland acres in the Falls Lake watershed have been converted to grass or trees.

Figure 5. Total Reported Cropland Acres in the Falls Lake Watershed, Baseline (2006), 2011-2024



Phosphorus Indicators for CY2024

The Phosphorus Technical Advisory Committee (PTAC) was created to establish a phosphorus accounting method for agriculture in the Tar-Pamlico River Basin. In 2005, the PTAC determined that a defensible, aggregated, county-scale accounting method for estimating phosphorus losses from agricultural lands was not feasible due to "the complexity of phosphorus behavior and transport within a watershed, the lack of suitable data required to adequately quantify the various mechanisms of phosphorus loss and retention within watersheds of the basin, and the problem with not being able to capture agricultural conditions as they existed in 1991 [baseline year]."[11] The PTAC instead developed recommendations for qualitatively tracking relative changes in practices in land use and management related to agricultural activity that either increase or decrease the risk of phosphorus loss from agricultural lands on an annual basis. In 2010, the PTAC reconvened to make minor revisions for the tool's use in the Falls Lake Watershed, all of which were approved by the Water Quality Committee of the EMC. The qualitative indicators included in Table 3 show the relative changes in land use and management parameters and their relative effect on phosphorus loss risk in the watershed for baseline (CY2006) and CY2022 through CY2024.

Most of the parameters in Table 3 indicate less risk of phosphorus loss from agricultural management units than in the baseline period. Factors significantly contributing to the reduced risk of phosphorus loss in the Falls Lake watershed include:

- Fifty percent reduction in cropland from baseline;
- Thirty percent decrease in Animal waste P from livestock and poultry from baseline; and
- Cropland conversion to other uses.

Based on field office reports, conservation tillage acres remain high even after contracts expire due to farmer satisfaction with the practice after implementation. Additionally, because some farmers have adopted the use of conservation tillage without cost share assistance, a higher percentage of agricultural land is currently being cultivated with reduced tillage than was reported during the baseline due to the overall reduction in agricultural acres. Agricultural survey results indicate counties that are part of the Falls Lake watershed have a high percentage of pasture and hay land use and conservation tillage management is common, particularly in Orange, Durham, and Person counties.[12] With this reasoning, the phosphorus loss risk is reduced for the conservation tillage parameter.

The soil test phosphorus median number reported for the watershed fluctuates each year due to the nature of how the data is collected and compiled. The soil test phosphorus median numbers shown in Table 3 are generated by using North Carolina Department of Agriculture and Consumer Services (NCDA&CS) soil test laboratory results from voluntary soil testing on agriculture land and the data is reported by the NCDA&CS. The number of samples collected each year varies but was approximately

[11] Johnson, A. M., & Osmond, D. L. (2005, October 21). Final report: Accounting method for tracking relative changes in agricultural phosphorus loading to the Tar-Pamlico River (Prepared with concurrence and consent of the Phosphorus Technical Advisory Committee). North Carolina State University, Soil Science Department. https://content.ces.ncsu.edu/pdf/accounting-method-for-tracking-r/2014-09-29/accounting-method-for-tracking-relative-changes-in-agricultural-phosphorus-loading-to-the-tar-pamlico-river.pdf

[12] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. (pp. 49 – 50). https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

19% higher in CY2024 than the number of samples used to determine the soil test phosphorus median number in baseline. The data does not include soil tests that were submitted to private laboratories. The soil test results from the NCDA&CS database represent data from entire counties in the watershed and have not been adjusted to include only those samples collected in the Falls Lake Watershed.

Although CY2024 vegetated buffer accounting indicates fewer total buffer acres in the Falls Lake watershed than in the baseline year (2006), the proportion of buffer acres to reported cropland acres (the density of buffers relative to land in production) is higher in CY2024 than in the baseline year. As a result, phosphorus loss risk from agricultural land remains reduced relative to baseline conditions for the vegetated buffers parameter. As discussed in the Best Management Practice Implementation section of this report, a new spatial analysis tool was piloted in the six counties in the Falls Lake watershed in CY2024 accounting to recalculate buffers in an initial step to address discrepancies resulting from cropland losses in urbanizing counties. Decreases in buffer acreage between CY2023 and CY2024 do not reflect the physical removal of buffers but rather indicate that previously buffered agricultural land has transitioned to other land uses. The buffer reductions between CY2023 and CY2024 are the result of a methodological update and do not represent changes in farmer behavior or losses of BMPs on active agricultural land.

Table 3. Relative Changes in Land Use and Management Parameters and their Relative Effect on Phosphorus Loss Risk in the Falls Lake Watershed

Parameter	Units	Source	Baseline 2006	CY2022	CY2023	CY2024	% change '06-'24	P Loss Risk +/-
Reported Cropland (annual)	acres	FSA, LAC	55,969	28,807	27,780	27,539	-51%	-
Cropland conversion to Grass & Trees (cumulative)	acres	USDA-NRCS & NCACSP	1,527	2,410	2,437	2,497	+64%	-
Conservation tillage (active contract)	acres	USDA-NRCS & NCACSP	277	3,668†	2,619†	2,664	+862%	-
Vegetated buffers (cumulative)	acres	USDA-NRCS & NCACSP	52,139	54,449¤	54,456¤	27,016Ω	-48%Ω	-
Unfertilized Cover Crop (annual)	acres	LAC	0	1,626	1,531	970	+970%‡	N/A
Tobacco (annual)	acres	FSA, LAC	3,288	3,194	2,631	2,501	-24%	-
Animal waste P (annual)	lbs of P/ yr	NC Ag Statistics	586,612	454,608	415,769	413,383	-30%	-
Soil test P median (annual)	P Index	NCDA&CS	77	78	74	64	-17%	-

† *Conservation tillage is being practiced on additional acres, but this number only reflects estimated acres under active cost share contracts approximated by a rolling ten-year window (2014 – 2024).*

¤ *These values may include some buffer acres on formerly agricultural land which has been converted to other uses (see page 7).*

‡ *The percent change for unfertilized cover crop acres is assumed to have increased from the number one due to the problem with calculating a percentage difference from zero.*

Ω *Buffer acres decreased in CY2024 accounting due to the piloting of a new spatial analysis tool. Buffer acreage was recalculated in CY2024 to improve nitrogen loss reduction estimation in the Upper Neuse. Decreases in buffer acreage between CY2023 and CY2024 do not reflect the physical removal of buffers but does indicate that buffered agricultural land has transitioned to other land uses in the Falls Lake watershed.*

Given the key role of phosphorus in the Falls Lake nutrient strategy, the Falls WOC recommends that phosphorus accounting and reporting follow a two-pronged approach:

1. Annual Qualitative Accounting: Conduct annual qualitative assessment of likely trends in agricultural phosphorus loss in the Falls watershed relative to 2006 baseline conditions using the method established by a 2005 PTAC report that added tobacco acres and removed water control structures.
2. Improved understanding of agricultural phosphorus management through studies using in-stream monitoring: Quantitative in-stream monitoring should be conducted. Such monitoring is contingent upon the availability of funding and staff resources. An appropriate water quality monitoring design would be a paired-watershed study of sub-watersheds with only agricultural land use. This design would allow estimates of phosphorus loading for different management regimes and load reductions after conservation practices have been implemented. However, funding for this study is currently unavailable.

The WOC recommends that no additional management actions be required of agricultural operations in the watershed at this time to comply with the phosphorus goals of the agriculture rule. The WOC will continue to track and report the identified set of qualitative phosphorus indicators to DWR annually, and as directed by the Environmental Management Commission's rule. The WOC expects that BMP implementation may continue to increase throughout the watershed in future years, and notes that BMPs installed for nitrogen, pathogen and sediment control often provide significant phosphorus benefits as well.

Pasture Accounting

Pasture nitrogen loss is also calculated using NLEW and is based on the total number of pasture acres, pastured livestock, and implemented livestock exclusion systems in the watershed. Pasture acres and pastured livestock numbers are gathered from USDA-NASS Census of Agriculture data which is published every five years. The next pasture-based nitrogen loss calculations will be included in a future report when the 2027 Census of Agriculture is published. The information included in Table 4 was last updated in the CY2023 Annual Report with pasture data from the 2022 Census of Agriculture and livestock exclusion system implementation data from 2017 through 2022. As of the 2022 pasture reporting cycle, counties in the Falls Lake watershed achieved a 36% nitrogen loss reduction from baseline, which exceeds the rule-mandated 20% goal. More information about the pastureland nitrogen loss reductions calculated in the 2022 cycle can be found in the CY2023 Annual Report.

Table 4. Estimated reductions in agricultural (pastureland) nitrogen loss from baseline (2007) for 2017 and 2022 Cycles, Falls Lake Watershed*

County	Baseline N Loss (lbs)	2017 N Loss (lbs)	2017 N Reduction (%)	2022 N Loss (lbs)	2022 N Reduction (%)
Durham	55,564	36,348	35%	35,414	36%
Franklin	1,600	1,631**	-2%**	689	57%
Granville	104,474	59,288	43%	80,138	23%
Orange	47,689	23,864	50%	16,539	65%
Person	50,088	29,078**	42%	32,048	36%
Wake	5,747	3,795	34%	3,890	32%
Total	**265,162**	**154,004****	**42%**	**168,717**	**36%**

**The reduction percentages reported above result from a combination of pastureland loss, fertilization decreases, stocking rate changes, and BMP implementation.*

*** These values match the numbers in NLEW v.6.0. These are slightly different from the values that appeared in the 2020 Annual Progress report for Crop Year 2018 that first detailed pasture accounting information from the 2017 cycle. The overall pasture N loss reduction for the 2017 cycle (42%) did not change.*

BMP Implementation Not Tracked by NLEW

Not all types of conservation BMPs are tracked by NLEW such as: livestock-related nitrogen and phosphorus reducing BMPs, BMPs that reduce soil and phosphorus loss, and BMPs that do not have enough scientific research to support estimating a nitrogen reduction benefit. The WOC believes it is worthwhile to recognize implementation of these practices. Table 5 identifies BMPs and tracks their implementation in the watershed since the end of the baseline period. Table 6 indicates the total number of BMPs not accounted for in NLEW, which are under active contract (approximated by a rolling ten-year window from CY2014 to CY2024).

Table 5. Best Management Practices Not Accounted for in NLEW, Baseline to CY2024, Falls Lake Watershed*

BMP	Units	2006 – 2022	2023	2024
Critical Area Planting	Acre	558	558	558
Composting Facility	Number	12	13	13
Diversion	Feet	32,224	35,909	35,909
Dry Stack	Number	9	9	9
Fencing (USDA programs)	Feet	85,510	86,559	88,284
Field Border	Acre	30,286	30,287	30,287
Grassed Waterway	Acre	120	125	125
Nutrient Management Plan	Acre	906	906	906
Pasture Renovation	Acre	326	326	326
Stream Crossing	Number	6	6	6
Sod-Based Rotation	Acre	17,517	19,700	19,755
Tillage Management	Acre	5,172	5,172	5,514
Terraces	Feet	4,988	4,988	4,988
Trough or Tank	Number	102	107	112
Waste Storage Facility	Number	5	5	5

**Cumulative data quantified by adding BMPs implemented with State and Federal cost share program funding each Crop Year to cumulative totals reported the previous Crop Year. Additional BMPs may exist in the watershed as practices may be installed by farmers without cost share assistance.*

Table 6. Best Management Practices Not Accounted in NLEW installed from CY2014 to CY2024, Falls Lake Watershed*

BMP	Units	BMPs Installed (CY2014-CY2024)
Critical Area Planting	Acre	553
Composting Facility	Number	9
Diversion	Feet	17,708
Fencing (USDA programs)	Feet	30,600
Field Border	Acre	701
Grassed Waterway	Acre	41
Nutrient Management Plan	Acre	425
Stream Crossing	Number	5
Sod-Based Rotation	Acre	12,565
Tillage Management	Acre	2,665
Trough or Tank	Number	55
Waste Storage Facility	Number	3

**Values represent active contracts in State and Federal cost share programs quantified by subtracting CY2014 cumulative totals from CY2024 cumulative totals. Additional BMPs may exist in the watershed as producers may maintain practices after the life of a cost share contract, and other practices are installed by farmers without cost share assistance.*

Looking Forward

The Falls Lake WOC will continue to report on and encourage rule implementation, relying heavily on the local Soil and Water Conservation Districts working directly with farmers to assist with best management practice design and installation.

Because cropping shifts are susceptible to various pressures, the WOC is working with all counties to continue BMP implementation on both cropland and pastureland that provides for lasting reductions in nitrogen and phosphorus loss in the watershed while monitoring cropping changes.

The WOC recognizes several factors affecting agriculture:

- Urban encroachment
- Market Fluctuations
- Changes in government programs (e.g., commodity support or environmental regulations)
- Weather (e.g., long periods of drought or rain)
- Scientific advances in agronomics (e.g., production of new types of crops or improvements in crop sustainability)
- Plant disease or pest problems (e.g., viruses or foreign pests)

Funding

Ongoing agriculture rule reporting has incorporated data processing efficiencies and improvements over time. NLEW upgrades have allowed LAC members to more actively participate in the compilation of data and analysis of nitrogen loss trends, and the Division of Soil and Water Conservation's digital contracting system has helped optimize BMP documentation efforts.

In CY2024, Soil and Water Conservation Districts spent over $119,500 through the Agriculture Cost Share Program for nutrient-reducing BMP implementation in the Falls Lake Watershed. The Natural Resources Conservation Service spent over $906,500 through the Environmental Quality Incentives Program for BMP implementation in the counties lying in the Falls Lake Watershed. Funds were also expended for installation of these practices by local farmers and landowners either through participation in these cost share programs, or by installing practices at their own cost. Participation by so many members of the local agricultural community demonstrates a commitment toward achieving the nutrient strategy's long-term goals.

Sufficient funding for technical assistance and BMP implementation incentivization is indispensable for continued achievement and maintenance of agricultural nitrogen reduction and phosphorus loss risk reduction goals. Local demand for funding, to support experienced staff versed in conservation planning and cost-share program implementation in addition to supporting adoption of water-quality improving BMPs, far outstrips existing resources. Local levels of technical assistance for BMP implementation have changed since the Falls Reservoir Water Supply Nutrient Strategy Rules were adopted in 2011. As of Fiscal Year (FY) 2016, previously funded basin and watershed technicians assisting farmers with nutrient reducing BMP implementation are no longer supported by granting state entities. Concurrent budget changes at the USDA also resulted in statewide restructuring of North Carolina NRCS field staff, leading to a reduction in federally funded technical capacity at the local level. Consequently, ongoing responsibility for conservation practice planning and installation now largely depends on local Soil and Water Conservation District staff with escalating workload and capacity demands. Additionally, while two EPA 319(h) grants ($238,643 in total) were obtained between 2012 and 2017 to support livestock exclusion system implementation and BMP implementation on equine operations, more funding, through existing cost-share programs or outside grants, continues to be needed to incentivize conservation activity in the Falls Lake Watershed. In FY2025, Soil and Water Conservation Districts lying within Falls Lake Watershed requested over three times more Agriculture Cost Share Program funding beyond the fiscal year's allocation. Funding of state and federal cost share programs is essential for continued progress in reducing nutrient losses from agricultural land.

Funding is also necessary for continued agricultural data collection and annual reporting. There has been no grant-supported basin and watershed technicians as of FY2016. Annual data collection, compilation and reporting duties for the Falls Lake Watershed and all other basins and watersheds subject to existing NSW Management Strategies with Agriculture Rules were assigned to the NCDA&CS Division of Soil and Water Conservation's Nonpoint Source Planning Coordinator. The Division of Soil and Water Conservation expends approximately $90,000 on agricultural reporting staff support annually, using funds received through an EPA 319(h) grant administered by the Department of Environmental Quality. Annual agricultural reporting is required by the rules; therefore, continued funding for the DSWC Nonpoint Source Planning Coordinator position is essential for compliance.

Reductions in funding and staffing necessitate implementing a more centralized approach to agricultural data collection and verification for annual progress reports. This evolving approach may include developing additional GIS analysis tools, streamlining FSA acreage documentation, and training LACs on how to handle changing methods. New tools will be vetted by the WOC and may be incorporated into the agriculture rule accounting methodology. While necessary with existing funding and staffing limitations, centralizing and automating data collection and verification may come at the expense of local knowledge.

Previously, funding was available for research on conservation practice effectiveness. Due to grant eligibility changes and other funding constraints, new data can only be developed intermittently. Prior funding sources for such research, which provided much of the scientific information on which NLEW was based, are no longer available. As new funding is made available, additional North Carolina-specific research information will be incorporated into future NLEW updates. The NLEW software (v6.0) is currently configured to pull revised realistic yield and nitrogen use efficiency data from the North Carolina Realistic Yield Database, which is intermittently updated when new research becomes available. The WOC also sees the need for additional research on accounting procedures for pasture operations, and supports such research being conducted. Should readily accessible information from DEQ become available for permitted biosolids applications to agricultural acres in the watershed, including rate, nutrient content, and spatial application information, the WOC will consider whether separate accounting for those applications of nutrients is feasible and appropriate.

Phosphorus accounting and reporting will continue to address qualitative factors and evaluate trends in agricultural phosphorus loss annually. Periodic land use surveys with associated use of PLAT may be needed if trends indicate increased phosphorus loss risk from agricultural lands. Additionally, an understanding of agricultural phosphorus management could be improved through in-stream monitoring contingent upon the availability of funding and staff resources.

Lastly, members of the Falls Lake WOC will continue working with DWR on issues regarding nutrient offsets that arise from trades involving agricultural land.

Conclusion

The Falls Lake WOC will continue to monitor and evaluate crop trends. The current shift to and from crops with higher nitrogen requirements may continue to influence the yearly reduction. Significant progress has been made in agricultural nitrogen loss reduction, and the agricultural community is achieving its 20% Stage I and its 40% Stage II nitrogen reduction goals for cropland. The agricultural community is achieving its 20% Stage I nitrogen reduction goal for pastureland and is very close to achieving its 40% Stage II nitrogen reduction goal for pastureland. However, the measurable effects of implemented BMPs on overall in-stream nitrogen reduction may take years to develop due to the nature of non-point source pollution. Nitrogen reduction values presented in this annual summary of agricultural reductions reflect “edge-of-management unit” calculations that contribute to achieving the staged nitrogen loss reduction goals. Significant quantities of agricultural BMPs have been installed since the adoption and implementation of the nutrient management strategy, and agriculture continues to fulfill its obligations toward achieving the overall nutrient reduction goals for Falls Lake.