Poultry and Manure Production on Virginia's Eastern Shore

Rapid Growth and Poor Environmental Compliance Threaten Waterways in Accomack County

ENVIRONMENTAL INTEGRITY PROJECT

EMBARGOED FOR RELEASE:

APRIL 22, 2020

ACKNOWLEDGEMENTS

Written and researched by Mariah Lamm of the Environmental Integrity Project, with research assistance from Fangxing Liu and Zach Villari.

THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (http://www.environmentalintegrity.org) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws.

CONTACTS:

For questions about this report, please contact:

Tom Pelton, Environmental Integrity Project, (202) 888-2703 or tpelton@environmentalintegrity.org

PHOTO CREDITS: PHOTOS ON COVER FROM AND ON PAGES 2 AND 7 FROM INSPECTION REPORT OF POULTRY OPERATION IN ACCOMACK COUNTY, VIRGINIA, FROM THE VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY. PICTURES ON PAGES 1, 4 AND 6 OF POULTRY HOUSES BY TOM PELTON. PHOTO ON PAGE 8 OF CHINCOTEAGUE INLET FROM WIKIMEDIA COMMONS.

Poultry and Manure Production on Virginia's Eastern Shore

Executive Summary

The Eastern Shore of Virginia, which consists of Northampton and Accomack counties, is historically an area of concentrated poultry production on the Delmarva Peninsula. Although family-owned poultry farms have been a part of life in this region for decades, the size and number of industrial-scale factory farms have exploded in recent years, especially in Accomack County. In 2014, Accomack County had 254 chicken houses on 51 farms. Between July 1, 2014, and December 31, 2019 that number nearly doubled to a total of 480 chicken houses on 83 farms, with another 19 houses permitted but not yet built, according to the Accomack County Planning Commission.[1] While the old generation of houses (about twenty years ago) were around 450 feet long and could hold 20,000 to 30,000 birds each, the new facilities are two hundred feet longer and can hold up to 45,000 chickens.[2]

The Environmental Integrity Project (EIP) analyzed poultry farm fertilizer management records (called "nutrient management plans") obtained through a public records request from the Virginia Department of Environmental Quality (VDEQ). We found that 70 of the 83 farms in Accomack County for which records were available have the capacity to produce over 85 million birds per year with a manure output of approximately 137,000 tons.[3] Most of this manure is spread on cropland at other farms in Accomack County.[4] Manure in such large amounts overwhelms the capacity of crops to utilize the phosphorus and remove it from the soil. This overload leads to runoff of phosphorus into groundwater, waterways, and ultimately, the Chesapeake Bay and coastal bays, feeding algae blooms and low oxygen "dead zones." Manure over-application also contributes to unhealthy levels of fecal bacteria and pathogens in streams and rivers on the Eastern Shore, rendering them unsafe for swimming.

The number of poultry houses in Accomack County has nearly doubled over the last five years. Many of the operations are not following state rules regarding the handling of manure and the maintenance of accurate records.

This report summarizes the state of the poultry industry on Virginia's Eastern Shore and the State's enforcement efforts to minimize the impact on Virginia's water and people. EIP analyzed four years of water monitoring data for 82 stream and river monitoring locations

provided by VDEQ. We also examined 117 inspection reports for the 76 poultry farms for which these records were available on the state's Eastern Shore, as well as 70 poultry farm nutrient management plans) and litter transfer records. For a full discussion of methodology, see Appendix A.

Compliance with and enforcement of manure management rules for these poultry operations has been a problem. In a review of inspection reports provided by VDEQ, EIP found that 74 percent of inspected farms had a compliance problem from May 2017 through April 2019. (This was for 56 of the 76 poultry operations for which these records were available.) Despite these widespread problems, state regulators imposed no penalties on any of the poultry operations.[5] The majority of violations were cases in which poultry farms had outdated or absent paperwork, with 45 percent of the 76 farms in violation. Thirty-eight percent of the inspected poultry farms had residual manure found around poultry houses, storage areas, or on manure pads, and 29 percent improperly managed their dead birds. Residual manure left around the farm and dead chickens exposed to the elements or predators increases the chances of these hazards becoming a pollution or public health concern.

Runoff from a compost pile with dead chickens on an Accomack County poultry farm. Photo from an inspection by the Virginia Department of Environmental Quality.

EIP's analysis of VDEQ water monitoring data showed that several rivers and streams on Virginia's Eastern Shore were unsafe for swimming due to high levels of bacteria. While some of the high levels of bacteria are likely from manure, some of it could also be coming from geese or other wildlife or from other sources. Twenty-two percent of monitoring locations tested by the state (17 of 76) on Virginia's Eastern Shore were contaminated with *E. coli* and 21 percent (15 of 71) were contaminated with enteroccocus at levels that exceeded state recreational standards, according to the past four years of state data (see Tables 2 and 3). Animal feeding operations were listed as the cause of impairment for one of the rivers on Virginia's Eastern Shore (Lower Nassawadox Creek).[6] However, most of the monitoring sites (about 77 percent) were not sampled frequently enough to determine whether water was safe for human contact. According to Virginia's 2018 Water Assessment Integrated Report, 96 percent of miles of rivers and 92 percent of square miles of estuaries have not been assessed for recreational uses (see Appendix D).

Virginia can solve the environmental and public health problems detailed in this report if state regulators take stronger action to protect the Eastern Shore and its residents. More adequate enforcement, penalties, and monitoring for violations from industrial-scale poultry operations would help reduce pollution and bacterial contamination. VDEQ should also increase its assessments of rivers and estuaries so that citizens have reliable public information about the safety of water for recreational activity. Also helpful would be more robust tracking of manure and additional funding from the poultry industry to truck excess waste out of the Chesapeake Bay watershed.

A Texas-based company, working on contract for Tyson Foods, built 24 poultry houses, each 600 feet long, on Pungoteague Road in Accomack County in 2018. The facilities hold a total of about one million birds at a time.

Large Amounts of Manure Produced by Poultry

Accomack County's Planning Department reports that the county had 254 poultry houses on 51 farms as of July 1, 2014, and 480 house on 83 farms as of December 31, 2019, with another 19 houses permitted but not yet built.[7] The county has projected that the number of poultry houses will rise to 577 by 2023.[8] In response to a public information request in April of 2019, VDEQ sent EIP nutrient management plans for 70 large Animal Feeding Operations (AFOs) that were active in Accomack County from May 2017 through April 2019.[9] These plans serve as guiding documents for manure management and the application of poultry litter to fields if the farms also grow crops. Nutrient management plans are tailored to each farm's land, management style, and size. The plans for these 70 operations show that these farms can produce up to 85 million birds and 137,000 tons of manure per year. [10] This is a significant increase over the 60 million bird-capacity that farms had in 2017, according to state records. (The data from these state records, county reports, and the U.S. Department of Agriculture's farm census are different, and for a discussion of this issue, see Appendix B.)

Very few of the poultry farms on the Eastern Shore of Virginia have enough cropland to absorb all the manure produced by their chickens. Only one poultry operation in Accomack County reported to the state that it planned to apply its manure to its own fields, according to the nutrient management plans for 2017-2019 that EIP examined.[11] This means that most

of the poultry operations must export their manure to other farms. However, this manure does not travel far. Most of the litter is sent to other farms in Accomack County, with less than half of one percent (about 600 tons) exported to neighboring Northampton County. Other locations that received exported manure included Suffolk and Fairfax counties in Virginia, and North Carolina.[12] Exactly what happens to exported manure – how much is spread per acre of farmland -- is not clear because VDEQ does not require all receiving farms to provide records that would show how that manure was applied.[13]

Most of the poultry operations in Accomack County do not apply manure to their own fields, but instead export the litter to spread as fertilizer on the fields of other farms. .

Phosphorus Output and Crop Removal

Nutrient management plans provide farmers with land-specific manure application rates based on the nutrient content of the manure they are spreading and the capacity of their crops to remove these nutrients from the soil. A number of soil factors are also taken into account, such as temperature, soil moisture, acidity levels, and the amount of nutrients already available in the soil.[14] The goal of these plans is to safeguard against nutrient runoff by avoiding over application.

The plans for poultry farms active in Accomack County in 2017 show that 55 had the capacity to produce over 100,000 tons of manure containing 1,150 tons of phosphorus.[15] Records provided by VDEQ of litter transfers show that 72 percent of the manure produced by Accomack County poultry operations remained in the county.[16] According to crop production estimates from the 2017 USDA Census of Agriculture, and crop phosphorus removal rates determined by the Virginia Department of Conservation and Recreation, Accomack County's harvested cropland is only capable of removing 609 tons of phosphorus from the soil annually.[17] That suggests that farmers are applying perhaps 200 tons more phosphorus to the county's fields than the crops can absorb on an annual basis.

It should be noted, however, that this does not take into account how much phosphorus is already present in the soil from previous applications, which would also reduce the ability of

crops in Accomack County to absorb the nutrient.[18] Areas with a long history of producing poultry often have a legacy of over-application of manure, and as a result, high soil phosphorus levels. According to a 2010 report by the Environmental Working Group, between 75 and 100 percent of soil samples from Accomack and Northampton counties showed excessive levels of phosphorus.[19] It can take years or decades for excessive phosphorus levels to decrease, even when farmers stop applying poultry litter to fields.

Enforcement

EIP examined records for 76 farms that produce chickens for the meat industry (called "broiler" chickens) on the Eastern Shore of Virginia. All of these farms are categorized by the state as Animal Feeding Operations (AFOs), meaning they are facilities where "animals are stabled or confined for a total of 45 days or more in any 12-month period." [20] The inspection reports from the 76 operations provide valuable insight into VDEQ's investigatory and enforcement efforts, as well as an indication of how often farmers are complying with regulations. The state agency conducts the majority of its inspections remotely by examining paperwork and ensuring it is up to date.[21] For farms that have outdated manure samples, litter transfer records, or other documents, inspectors may visit to inspect the property.[22] These visits are essential for ensuring that farmers follow the standards and regulations set by the state to protect people and the environment.

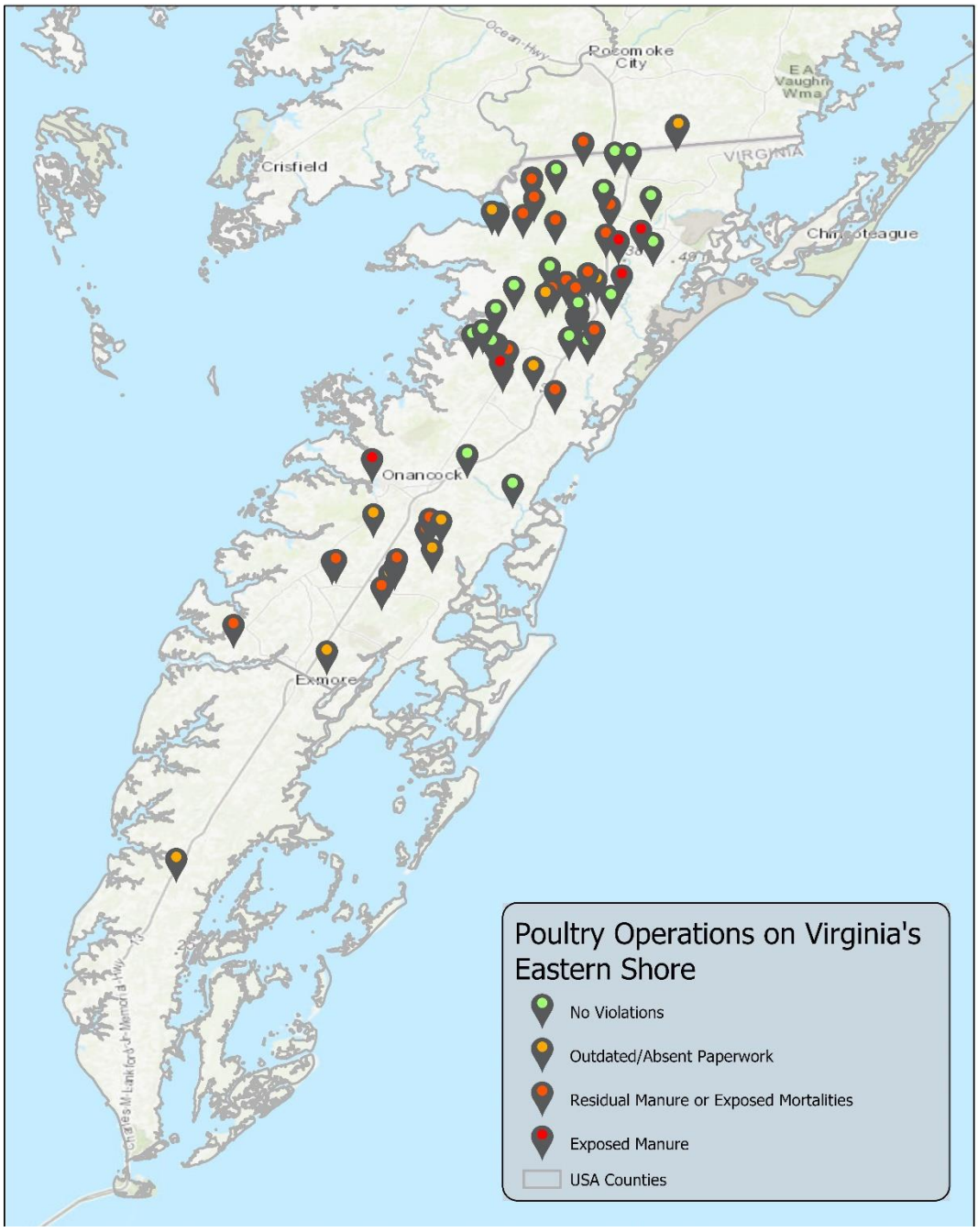
Exposed manure as a result of a hole in the manure shed of a poultry operation in Onancock, Virginia.

Many of the farms in Accomack County that state regulators inspected had compliance problems, with 74 percent (56 of 76 farms) having a violation of some kind between May 2017 and April 2019. However, the state did not impose any penalties on any poultry operations on the Eastern Shore over this time period, according to VDEQ.[23]

The most common violations found in these inspection reports included outdated or absent paperwork, dead birds left exposed to predators and the elements, and residual manure found outside of manure storage areas. Paperwork-related noncompliance issues included the failure of farmers to submit required forms; late submissions; and outdated or incorrect information on manure or soil samples, transfer records, or nutrient management plans. Farmers' neglect to properly submit these documents undermines the ability of state regulators to monitor and keep agricultural pollution sources in check. Poor reporting by

poultry operations also undermines the agricultural sector's claims that farmers are "doing their share" to clean up the Chesapeake Bay.

Figure 1. Map of Poultry Operations and Violations on Virginia's Eastern Shore



The map above shows the locations of poultry farms in Accomack County, with the red and orange dots showing those that had violations in 2017-2019. Source: VDEQ inspection reports.[24]

At seven poultry operations, inspectors found more birds on site than the number indicated by the farms' nutrient management plans and registration statements. This is a clear violation, and means that more manure is produced than is accounted for by the farm's nutrient management plan. For example, according to a 2018 inspection report for one farm in Belle Haven, Virginia, the farmer had double the number of chickens on site than was stated on the farm's nutrient management plan or state permit registration statement. A month later, the state accepted an amended registration statement for the farm to retroactively reflect this expansion, from three to five chicken houses. But because the expansion occurred years earlier, the change could not have allowed the required advance public notification and comment period for neighbors who might have objected before birds were placed in the new houses.

According to state regulations,[25] farmers must properly dispose of dead birds and keep them covered in compost sheds to limit exposures to potential disease vectors, like predatory birds.[26] Of the farms inspected from May 2017 through April 2019, 22 failed to properly compost their dead chickens, with problems that included allowing water to enter compost sheds, according to state records.[27] Animal mortalities that have not been properly disposed of can encourage the growth of pathogens and become public health problems. Comments from state inspectors examining poultry operations describe uncovered mortalities resulting in strong odors and liquid sludge leaking from compost piles. By properly composting manure and mortalities, producers can avoid rotting and putrefaction in their sheds.

Manure left exposed in any part of the farm can be flushed by rain into streams and seep into groundwater. The waste can also grow fly larvae and pathogenic bacteria and viruses.[28] By following proper procedures, farm operators can prevent these consequences and contamination of waterways and groundwater.[29]

State regulators usually do not penalize farms for these violations. Instead, poultry operations are asked to take corrective actions within a certain period, usually within a few months for manure or mortality violations, or by the next inspection date for incomplete or outdated paperwork. The majority of VDEQ's inspections are only performed once per year. This means accurate records might not be available for review until the following year, creating gaps in data and reducing the state's ability to monitor these facilities.

Some farms are repeat offenders, with one Accomack County farm physically inspected six separate times between May 2017 through April 2019. State regulators found the farm to be in violation during all but one of those inspections for having residual manure around houses or storage areas. For a poultry farm to be inspected this often, and then to repeatedly ignore warnings from VDEQ, is an example of the weakness in the state's system of not penalizing farms for violations.[30] As stated previously in this report, VDEQ did not take any enforcement actions or impose any penalties on any poultry operations in Accomack County from May 2017 to April 2019. However, the state agency did take a more modest step by sending warning letters to 13 of the 56 poultry operations that violated regulations during this time. The compliance problems outlined in those letters include for exposed manure, improper waste storage, missing paperwork, and improper composting.

Damaged Waterways

Several inlets and waterways in Accomack County are impaired by bacteria, which could come from manure runoff, wildlife, or other sources.

Exposed poultry litter and improperly managed waste can result in runoff of pollution into nearby streams and rivers. VDEQ is responsible for monitoring the waterways of Northampton and Accomack counties and maintains several monitoring locations upstream and downstream of large farms.[31] Several sites tested by the state between 2016 and 2019 had especially high levels of bacteria. One monitoring location on Sandy Bottom Branch had 8,000 enterococci bacteria per 100mL of water near a poultry farm in Accomack County in 2016.

In order to meet Virginia's health standards for swimming and other water-contact recreation, no more than ten percent of samples can exceed 235 *E. coli* in freshwater or 104 enterococci bacteria in saltwater.[32] *E. coli* and enterococci are found in human and farm animal manure, as well as in waste from wildlife. High levels of *E. coli* and enterococci can indicate the presence of other pathogens. If a waterway exceeds Virginia's recreational standards for these indicator bacteria, the state recommends avoiding any recreational contact— even rafting or fishing.[33] Waterways are tested for the presence of *E. coli* in freshwater and the presence of enterococci in saltwater (*E. coli* die in saltwater, while enterococci can live in saltwater). Brackish waterways may be tested for both types of bacteria.

Between January 2016 and July 2019, water quality monitoring by the state on Virginia's Eastern Shore showed that 22 percent of monitoring locations (17 of 76) were contaminated with *E. coli* and 21 percent (15 of 71) were contaminated with enteroccocus at levels too high to be considered safe for water contact recreation. See Tables 2 and 3, below, for the waterways tested for bacteria. It should be noted that while some of these polluted waterways were downstream from poultry operations, others were in areas with no factory farms anywhere nearby – for example, near the Eastern Shore of Virginia National Wildlife Refuge. This suggests that waste from geese and other wildlife, or other land uses, could be contributing to the bacteria levels.

Table 2. Virginia Eastern Shore Waterways Monitored for *E. Coli* Bacteria, 2016-2019

Waterbody	Station ID	Total Samples	Number of Samples Over the Recreational Standard	Percent of Samples Over Standard	Highest Value Measured (*E. coli* per 100mL)
Parker Creek	7-PAR003.09	22	16	73%	2,064
Hunting Creek	7-HUN001.88	20	11	55%	6,131
Little Mosquito Creek	7-LTM000.80	20	10	50%	5,794
Pettit Branch (Accomack Co)	7-PET000.80	22	11	50%	3,076
Assawoman Creek	7-ASW003.36	22	10	45%	19863
Holdens Creek	7-HLD002.67	21	9	43%	588
Nassawadox Creek	7-NSS001.62	21	9	43%	14136
Gargathy Creek	7-GAR001.80	20	8	40%	4,352
Pungoteague Creek	7-PUN002.12	20	8	40%	633
Kings Creek	7-KNS000.40	21	8	38%	3,088
Occohannock Creek	7-OCH003.82	21	8	38%	7,270
X-Trib. To Pitts Creek (Ptt)	7-XAE001.42	24	9	38%	9,208
Sandy Bottom Branch	7-SBB000.17	22	8	36%	3873
Parting Creek	7-PRT001.30	20	7	35%	561
Cape Charles Harbor	7-CCH000.43	21	7	33%	1,261
Hungars Creek	7-HUG001.24	21	7	33%	1,725
The Gulf	7-THG000.36	21	7	33%	1,067

Note: A waterway exceeds Virginia's recreational water quality standard for bacteria when more than 10 percent of samples in an assessment period exceed 235 "colony forming units" of E. coli *per 100 milliliters of water (235 CFU/100 mL) or 104 number of bacteria per 100 milliliters of water (No./100mL). The sampling stations listed in this table exceeded that standard more frequently, with 10 percent of samples or more containing at least 235 CFU/100 ml of* E. coli. *Waterways are generally sampled every other month. This table only includes waterways which are considered to have levels of bacteria higher than is considered safe for recreational activity. Waterways with fewer than 20 samples taken in this four-year period are excluded.*

Table 3. Virginia's Eastern Shore Waterways Monitored for Enterococcus Bacteria, 2016-2019

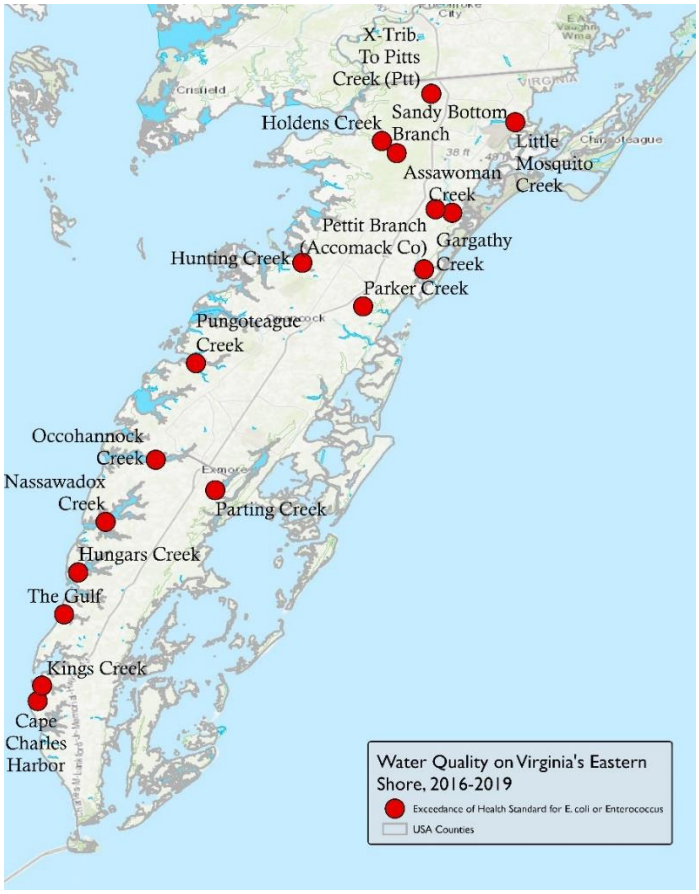
Waterbody	Station ID	Total Samples	Total Samples Over the Recreational Standard	Percent of Samples Over Standard	Highest Value Measured (enterococci per 100mL)
Parker Creek	7-PAR003.09	22	20	91%	825
Holdens Creek	7-HLD002.67	21	17	81%	1,100
Pettit Branch (Accomack Co)	7-PET000.80	22	17	77%	4,700
X-Trib. To Pitts Creek (Ptt)	7-XAE001.42	24	16	67%	8,000
Sandy Bottom Branch	7-SBB000.17	22	13	59%	8000
Assawoman Creek	7-ASW003.36	22	9	41%	800
Nassawadox Creek	7-NSS001.62	21	6	29%	800
Hunting Creek	7-HUN001.88	20	5	25%	800
Cape Charles Harbor	7-CCH000.43	21	4	19%	330
Parting Creek	7-PRT001.30	20	3	15%	340
Kings Creek	7-KNS000.40	21	3	14%	550
Occohannock Creek	7-OCH003.82	21	3	14%	170
Hungars Creek	7-HUG001.24	21	2	10%	60
Little Mosquito Creek	7-LTM000.80	20	2	10%	130
The Gulf	7-THG000.36	21	2	10%	100
Gargathy Creek	7-GAR001.80	20	1	5%	440
Pungoteague Creek	7-PUN002.12	20	1	5%	190

Note: A waterway exceeds Virginia's recreational water quality standard for bacteria when more than 10 percent of samples in an assessment period exceed 104 number of enterococcus per 100 milliliters of water (No./100mL). The sampling stations listed in this table exceeded that standard more frequently, with 10 percent of samples or more containing at least 104 No./100mL of enterococci. Waterways are generally sampled every other month. This table only includes waterways which are considered to have levels of bacteria higher than is considered safe for recreational activity. Waterways with fewer than 20 samples taken in this four-year period are excluded.

VDEQ doesn't always monitor frequently throughout the year, resulting in monitoring results which may not accurately represent a waterway's impairment status. Seventy-eight percen (or 59 of 76) of locations monitored for *E. coli* and 76 percent of those monitored for

enterococcus were not monitored frequently enough between 2016 and 2019 to reliably determine whether they met recreational health standards. Another resource that the public can use to decide whether or not to go swimming or rafting in a waterway is VDEQ's "Water Quality Assessment Integrated Report."[34] According to the 2018 report, about six square miles of estuaries and 28 miles of rivers on Virginia's Eastern Shore were designated as impaired for recreational uses. The impairment of one estuary, Lower Nassawadox Creek, was directly attributed to animal feeding operations. However, the state agency has never assessed more than 90 percent of rivers and estuaries to determine whether they meet recreational standards (see Appendix C). This leaves the public with no reliable and comprehensive source to determine if waterways are safe for recreation, and it slows action to clean up polluted waterways.

Figure 2. VDEQ Sampling Locations that Failed to Meet Bacteria Standards, 2016-2019



Note: This map depicts monitoring stations that are monitored by the Virginia Department of Environmental Quality on Virginia's eastern shore. The waterways that these stations are monitoring are labelled. Each point is a monitoring station where sample results exceeded Virginia Department of Conservation and Recreation's threshold for recreation activity due to exceedingly high levels of bacteria (either E. coli *or enterococcus).*

Conclusion and Recommendations

The number of poultry houses in Accomack County has nearly doubled over the last five years. The growing concentration of birds, producing millions of pounds of manure, is contributing to poor water quality on Virginia's Eastern Shore. Local residents deserve waterways that are clean and healthy for swimming, fishing, boating, tourism and aquaculture. Virginia can help protect its citizens and the environment by better monitoring industrial-scale poultry operations and ensuring that pollution management standards set by the state are enforced meaningfully. Runoff from manure undermines the Commonwealth's ability to meet its pollution reduction targets for the year 2025 under the EPA's regional Chesapeake Bay cleanup plan (also called the Bay Total Maximum Daily Load.)

State records show that over a quarter of the poultry operations inspected on Virginia's Eastern Shore did not properly manage dead birds from May 2017 to April 2019. This can create an odor nuisance and bacteria threat for neighbors. Another common problem is residual manure left exposed to the rain on poultry farms, allowing pollutants to run off into nearby streams. Virginia needs to impose more penalties on poultry operations that do not properly manage their manure and dead birds. VDEQ should also work harder to ensure that industrial-scale poultry operations are properly reporting their bird and manure production to state regulators, as required by law, and turning in factual and timely paperwork. Without accurate reporting, it is impossible for Virginia to conduct proper oversight and protect public health and the environment.

Robust tracking of where manure is transported from Virginia's poultry operations would allow regulators to accurately monitor and assess the spreading of manure on fields and the impact on waterways. Virginia has a program that provides a financial reward to poultry operations that transport their manure from farms that are already overloaded to other farms outside of the Chesapeake Bay watershed.[35] This program, called the Poultry Litter Transport Incentive Program, is a step in the right direction, but it is limited[36] and purely voluntary – meaning that it will never accommodate all the farms or deal with the bulk of the problem.

The Virginia's Department of Environmental Quality's failure to penalize violations by poultry farms encourages the operations that ignore the law. Lax enforcement imposes a burden on the land, water, and the people of Virginia's Eastern Shore. By more actively enforcing pollution control rules for large livestock operations, and more frequently monitoring water quality in streams and rivers, Virginia will be able to better prevent manure runoff into its waterways. The result will be an improvement in water quality, so that residents of the Eastern Shore can once again safely swim and fish in their waterways without concerns about contamination.

Appendix A: Methodology

Manure and Phosphorus Production

EIP estimated phosphorus content of manure (from the manure production capacity in Nutrient Management Plans) using estimation factors from Virginia Department of Conservation and Recreation's Nutrient Management Standards and Criteria.[37]

- We assumed that broiler chickens generated 1.25 tons of litter per 1,000 birds, according to DCR's Nutrient Management Standards and Criteria. We also assumed that broiler litter contained an average of 52.18 pounds of phosphate per ton of litter (22.8 lbs. phosphorus/ton) on an as-is basis, according to estimates from the Virginia Cooperative Extension.[38]

Crop and pastureland acres are from the Census of Agriculture's tables 8, 25, and 26.[39] Phosphorus removal rates are from the Virginia DCR's Nutrient Management Standards and Criteria, and we adjusted them from phosphate to phosphorus using a factor of 0.4364 (elemental phosphorus accounts for 43.64% of the molecular weight of phosphate). We included the following crops in our analysis, where data was available: Barley, corn for grain, hay, alfalfa hay, sorghum for grain, soybeans, and wheat.

Number of acres spread with manure fertilizer, number of farms applying manure fertilizer, and total acres of cropland are from the 2017 Census of Agriculture's tables 1 and 40.[40]

Water Quality

EIP requested monitoring data for all water quality monitoring stations in the Northampton and Accomack counties from January of 2016 through July of 2019 from the Virginia Department of Environmental Quality. Since some stations are not monitored frequently enough to calculate a monthly geometric mean, our analysis of *E. coli* data was conducted using Virginia's criteria of no more than ten percent of samples exceeding 235 CFU/100mL and the enterococci standard of 104 CFU/100mL.[41] The Virginia Department of Environmental Quality uses a screening level of 50 micrograms of phosphorus per liter of water to identify potential sources of benthic impairments. The state agency is currently working on a water quality standard for phosphorus. Sampling locations with fewer than 20 samples taken over the four-year period were excluded.

Appendix B: Data Differences Between State Records, County Reports, and U.S.D.A. Farm Census

The U.S. Department of Agriculture conducts a national agricultural census every five years, most recently in 2017. EIP examined the farm census data for Accomack County that year and found that the numbers were incomplete, missing some poultry farms that are documented in more detailed state and county records and reports for the same year. So EIP decided to use the figures in the more complete and current state and local records for this report.

According to the 2017 Agricultural Census, there were 53 poultry farms in Accomack County that produced a total of 29,254,833 chickens for the meat industry that year. [42] However, the census's poultry production numbers are questionable because they do not correlate with the poultry production capacity stated in the nutrient management plans of the farms that should have been captured in the 2017 USDA Census.[43]

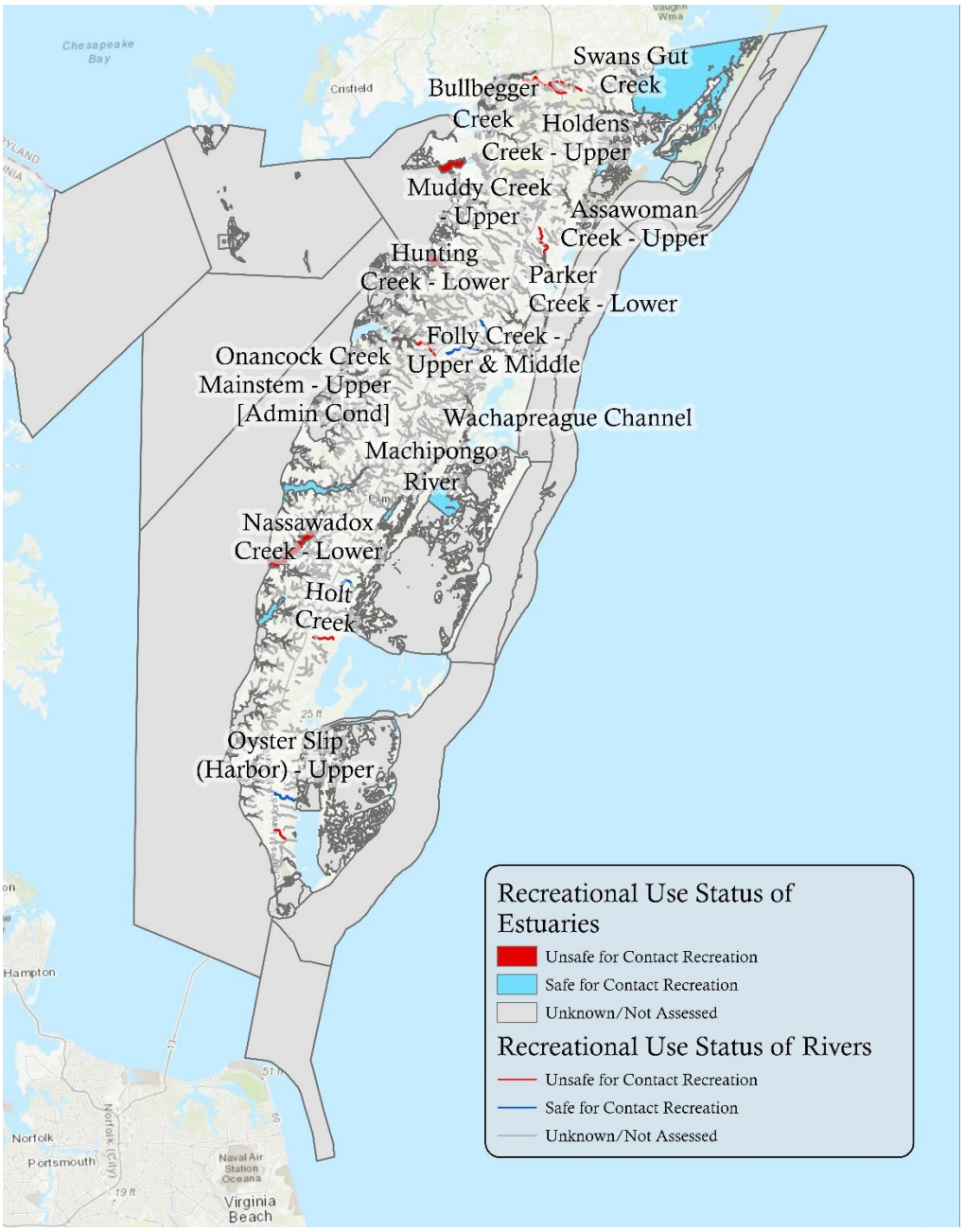
Virginia Department of Environmental Qualty (VDEQ) records (nutrient management plans) for that same year show 57 poultry farms with the capacity to produce more than twice as many birds, 60,011,437. VDEQ nutrient management plans for 2019 show 70 poultry farms with the capacity to produce 85,732,237 birds.

Accomack County's Planning Department issued a report indicating that the county had 51 farms and 254 poultry houses as of July 1, 2014, and 83 farms with 480 poultry houses as of December 31, 2019.[44]

The 2017 U.S. Department of Agriculture farm census undercounted the number of chickens and farms, so EIP relied on more accurate state and county records.[45]

Appendix C:

Recreational Use Status of Rivers and Estuaries on Virginia's Eastern Shore, 2018



Note: Map of rivers and estuaries impaired for recreational use by E. coli *in freshwater rivers or enterococcus in saltwater estuaries, as reported by the Virginia Department of Environmental Quality in their 2018 Water Assessment Integrated Report.*

NOTES

[1] "2020 Annual Poultry Report", Accomack County Planning Commission, February 12, 2020. Link: https://www.co.accomack.va.us/home/showdocument?id=12505.
[2] Nutrient Management Plans provided by the Virginia Department of Environmental Quality for poultry operations in Accomack County in April of 2019.
[3] Ibid.
[4] Poultry litter transfer records for 2017 from an email response from the Virginia Department of Environmental Quality, February 5, 2020, from Betsy Bowles, Land Application Program, to Mariah Lamm, EIP Research Analyst. Farmers in Accomack and Northampton counties apply manure to a total of 14,000 acres of cropland in both counties.
[5] Email response from the Virginia Department of Environmental Quality, February 5, 2020, from Betsy Bowles, Land Application Program, to Mariah Lamm, EIP Research Analyst. "There were no enforcement actions taken on permitted poultry operations in the counties in question within the dates…requested".
[6] "Final 2018 305(b)/303(d) Water Quality Assessment Integrated Report", Virginia Department of Environmental Quality, available at: https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2014305(b)303(d)IntegratedReport.aspx
[7] "2020 Annual Poultry Report", Accomack County Planning Commission, February 12, 2020. Available at: https://www.co.accomack.va.us/home/showdocument?id=12505.
[8] "2018 Annual Poultry Report – DRAFT", Accomack County Planning Commission, March 22, 2018. Available at: https://www.co.accomack.va.us/home/showdocument?id=9092
[9] Livestock and Poultry, Virginia Department of Environmental Quality, accessed April 9, 2020, available at: https://www.deq.virginia.gov/Programs/Water/LandApplicationBeneficialReuse/LivestockPoultry.aspx.
[10] Nutrient Management Plans provided by the Virginia Department of Environmental Quality for poultry operations in Accomack County in April of 2019.
[11] Nutrient Management Plans provided by the Virginia Department of Environmental Quality for poultry operations in Accomack County in April of 2019. One operation listed 3,700 acres of land managed under its NMP. The other farms did not have an NMP and so the acreage which could potentially receive manure is unknown.
[12] Poultry litter transfer records for 2017 from an email response from the Virginia Department of Environmental Quality, February 5, 2020, from Betsy Bowles, Land Application Program, to Mariah Lamm, EIP Research Analyst.
[13] "Virginia Poultry Waste Management Requirements", Virginia Department of Environmental Quality. Available at: https://www.deq.virginia.gov/Programs/Water/LandApplicationBeneficialReuse/LivestockPoultry/VirginiaPoultryWasteManagementRequirement.aspx.
[14] Sharpley, Andrew, "Fate and Transport of Nutrients: Phosphorus", USDA Agricultural Research Service, October 1995. Available at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs143_014203
[15] Nutrient Management Plans provided by the Virginia Department of Environmental Quality for poultry operations in Accomack County in April of 2019.
[16] Poultry litter transfer records for 2017 from an email response from the Virginia Department of Environmental Quality, February 5, 2020, from Betsy Bowles, Land Application Program, to Mariah Lamm, EIP Research Analyst. This figure also represents the one operation in Accomack with applies manure to its own land.
[17] Tables 25 and 26, USDA Census of Agriculture, 2017, available at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_US_State_Level/.
"Virginia Nutrient Management Standards and Criteria", Virginia Department of Conservation and Recreation, Revised July 2014, available at: https://www.dcr.virginia.gov/document/standardsandcriteria.pdf.

[18] In Accomack County, we found that farmers spread manure on over 10,000 acres, or 18 percent, of the cropland in 2017. This number has remained relatively stable over the last decade, with farmers applying manure to 13 percent of acres in 2012 and 17 percent of cropland acres in 2007. This is despite only half of the previous 42 farms in 2007 applying manure to their fields.
[19] "Bay out of Balance," p. 7., Environmental Working Group, 2020. Available at: https://www.ewg.org/sites/default/files/report/bay_out_of_balance_full_report.pdf
[20] Virginia Department of Environmental Quality. Livestock and Poultry, available at: https://www.deq.virginia.gov/Programs/Water/LandApplicationBeneficialReuse/LivestockPoultry.aspx.
[21] Inspection Reports provided by the Virginia Department of Environmental Quality for poultry operations in Accomack County in April of 2019.
[22] Ibid.
[23] Email response from the Virginia Department of Environmental Quality, February 5, 2020, from Betsy Bowles, Land Application Program, to Mariah Lamm, EIP Research Analyst. "There were no enforcement actions taken on permitted poultry operations in the counties in question within the dates…requested."
[24] The addresses of nineteen farms are not pictured in this map. The records received from VDEQ listed addresses (home or office) which are not on Virginia's Eastern Shore.
[25] § 10.1-1408.1 of the Virginia Waste Management Act, Chapter 14 (§ 10.1-1400 *et seq*) of Title 10.1 of the Code of Virginia, available at: https://law.lis.virginia.gov/vacodefull/title10.1/chapter14/.
[26] James J. Golden, "On-Site Composting of Routine Animal Mortality", Virginia Department of Environmental Quality, 2009, available at: https://townhall.virginia.gov/L/GetFile.cfm?File=C:\TownHall\docroot\GuidanceDocs\440\GDoc_DEQ_3968_v1.pdf.
[27] Eldridge R. Collins, Jr., Composting Dead Poultry, Publication 424-037, Virginia Cooperative Extension, 2009.
[28] M.D. Sobsey, et al., "Animal Agriculture and the Environment: National Center for Manure and Animal Waste Management White Papers", 2006, available at: https://fyi.extension.wisc.edu/manureirrigation/files/2014/03/ASABE_2006_Pathogens-in-Animal-Wastes-and-Impacts-of-Waste-Management-Practices.pdf
[29] Eldridge R. Collins, Jr., Composting Dead Poultry, Publication 424-037, Virginia Cooperative Extension, 2009.
[30] Email response from the Virginia Department of Environmental Quality, 4/9/2020, from betsy Bowles, Land Application Program, to Mariah Lamm, EIP Research Analyst. "DEQ…staff perform on-site inspections…every one (1) to two (2) years."
[31] For more information about DEQ's water quality monitoring programs, see their Surface Water Monitoring page: https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring.aspx
[32] "9VAC25-260-170. Bacteria; Other Recreational Waters.", Virginia Law, available at: http://law.lis.virginia.gov/admincode/title9/agency25/chapter260/section170/
[33] Ibid.
[34] "Final 2018 305(b)/303(d) Water Quality Assessment Integrated Report", Virginia Department of Environmental Quality, available at: https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2014305(b)303(d)IntegratedReport.aspx
[35]"Virginia's Poultry Litter Transport Incentive Program", Virginia Department of Conservation and Recreation, available at: http://consapps.dcr.virginia.gov/htdocs/agbmpman/PoultryTransport/LitterTransport_2020.pdf.
[36] The program does not protect Atlantic coastal bays.
[37]"Virginia Nutrient Management Standards and Criteria", Virginia Cooperative Extension and the Virginia Department of Conservation and Recreation, Revised July 2014, available at: https://www.dcr.virginia.gov/document/standardsandcriteria.pdf
[38] Ibid.

[39] "States by Table", USDA Census of Agriculture, 2017, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_US_State_Level/.
[40] Ibid.
[41] 9VAC25-260-170. Bacteria; Other Recreational Waters. http://law.lis.virginia.gov/admincode/title9/agency25/chapter260/section170/
[42] "Table 19", U.S.Department of Agriculture Agricultural Census, 2017, available at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Virginia/st51_2_0019_0019.pdf
[43] VDEQ sent documents for at least thirteen farms that began operations after December 2017, as noted in their Nutrient Management Plans. Since these AFOs went into operation after December 2017, they would not be included in the census which is taken in December.
[44] "2020 Annual Poultry Report", Accomack County Planning Commission, February 12, 2020. Available at: https://www.co.accomack.va.us/home/showdocument?id=12505.
[45] The U.S. Department of Agriculture's farm census figures for Accomack County are questionable because they do not correlate with the poultry production capacity stated in the state nutrient management plans of the farms that should have been captured in the 2017 USDA Census. The combined maximum production capacity of Accomack's broiler operations as stated on their nutrient management plans in 2017 was 60 million birds. This is twice the 29 million birds recorded by the USDA Census in 2017.