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REPORT

THROUGH THE CRACKS:

HOW UNREGULATED STORMWATER RUNOFF IS PREVENTING A SUCCESSFUL CHESAPEAKE BAY CLEANUP

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I. Executive Summary

The Chesapeake Bay is a national treasure, but it's in bad shape. Pollution sources across the watershed dump millions of pounds of nitrogen and phosphorus and billions of pounds of sediment into the Bay each year. When that pollution enters the Chesapeake and its tributaries, it creates "dead zones," causing massive damage to ecosystems and threatening public health and local economies dependent on recreation, tourism, and fishing.

In 2010 the Environmental Protection Agency adopted a far-reaching cleanup plan for the Bay, one of the most ambitious federal watershed restoration programs in our nation's history. The plan establishes target limits on nitrogen, phosphorus, and sediment loads issued from industrial operations, farms, sewage treatment plants, air emissions, and stormwater runoff from the urban landscape in the Bay watershed, which includes parts of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia.

But a loophole in federal law threatens the success of this critical effort. Because the Clean Water Act doesn't regulate all sources of stormwater, huge amounts of pollution are slipping through the cracks. The Clean Water Act requires federal pollution control permits only for stormwater discharges in densely populated urban areas. As a result, more than three million acres of developed land across the Bay watershed face no federal requirements to reduce the harmful storm runoff coming from buildings, roads, parking lots, and lawns.

This gap in regulation is an enormous problem. Pollutant load models show that unregulated stormwater actually carries more pollution into the Bay than does permit-regulated stormwater. Across the watershed, 60 percent of stormwater-related nitrogen pollution comes from unregulated areas. And in some states, that proportion is much higher.

The federal, state, and local government agencies charged with the Bay clean-up know that unregulated stormwater is a big problem. They've taken small steps to address the issue, but none of them have developed a comprehensive plan to solve it. Without the legal framework of federal stormwater permits to drive mandatory pollution reductions, current efforts are weak, underfunded, and ineffective. As a result, unregulated stormwater pollution in the Chesapeake continues to increase year after year, threatening the success of the entire Bay restoration program.

This paper lays out the full scope of the unregulated stormwater problem and provides a road map for fixing it. A menu of policy solutions—including regulatory reforms, incentive programs, robust public funding, technical assistance, and education—can help advocates and decision makers chart a path forward on this challenging issue. These policies can succeed if they are developed strategically and tailored to local conditions. Perhaps most important, our leaders must find the political will to implement them.

Ignoring the problem of unregulated stormwater won't make it go away. Neither will it provide communities in the Chesapeake region with clean water. On the other hand, scientists and economists estimate that taking comprehensive action to fully clean up the Bay would provide billions of dollars in economic benefits each year. If we want to restore this ecosystem so that we can enjoy those benefits today and for generations to come, it's time to get serious about addressing unregulated stormwater.

II. Stormwater in the Chesapeake Bay Watershed

One of the greatest water quality challenges in the Chesapeake Bay watershed—and nationwide—is stormwater runoff from the built environment.[1] Over the past four centuries, the mid-Atlantic region has lost millions of acres of natural landscape to urban development. Under natural conditions, when rain or snow falls, most of the water soaks into the soil or is absorbed by plants. But when the landscape is paved over and meadows and forests are replaced with parking lots, streets, and buildings that are impervious to water, rain and snowmelt have nowhere to go but into local waterways. This runoff carries pollutants like trash, chemicals, oils, fertilizers, and dirt along with it—whatever it comes into contact with as it travels over the ground.[2] This contaminated stormwater—together with pollution from other sources such as agriculture, wastewater, air emissions, and septic systems—has overwhelmed the Chesapeake Bay and its tributaries with too much nitrogen, phosphorus, and sediment.[3]

In excess, these pollutants cause significant damage to aquatic ecosystems.[4] They cause algae blooms that consume oxygen and create "dead zones" where fish and shellfish cannot survive, block sunlight needed for underwater grasses, and smother aquatic life on the bottom. At the same time, the disruption of the natural water cycle can cause what's called urban stream syndrome, where high volumes and velocities of stormwater entering normally placid urban streams blow out stream banks and disrupt streambed sediment, sending dirt downstream in pollution plumes.[5] As a result, communities that rely on a clean, sustainable Chesapeake watershed are suffering. Fisheries have failed, taking local jobs with them.[6] Drinking water sources have become degraded.[7] Every year, beach closures result in lost income for tourism-based economies.[8]

Moreover, more stormwater runoff from an increasingly impervious environment means more frequent and more severe urban flooding.[9] Urban flooding causes hundreds of millions of dollars of property damage each year, and the costs are especially disruptive to lower-income and minority residents who are more likely to live in flood-prone areas and less likely to have flood insurance.

A massive effort is underway to reduce runoff and restore this treasured ecosystem. In 2010 the Environmental Protection Agency (EPA) developed the largest-ever water pollution cleanup plan in the nation's history.[10] Known as the Chesapeake Bay Total Maximum Daily Load (TMDL),

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the plan establishes the maximum amount of nitrogen, phosphorus, and sediment that can be discharged into the Bay and its tributaries each year while still keeping those waterways healthy. Specifically, the TMDL sets watershed-wide limits of 185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus, and 6.45 billion pounds of sediment per year. Relative to 2010 pollutant levels, these limits amount to a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus, and 20 percent reduction in sediment. Scientists and economists estimate that reaching the TMDL targets would provide billions of dollars in economic benefits each year.[11]

These pollution targets are divided up among the jurisdictions located within the Bay watershed: Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia. Each jurisdiction determines how best to reach its targets by reducing discharges from the various pollution sources within its borders. The TMDL requires that each jurisdiction have in place by 2025 all pollution control measures needed to fully restore the Bay and its tidal rivers.

Unlike many other sources of water pollution that have declined in recent decades, contamination from stormwater runoff continues to increase around the Chesapeake and nationwide due to population growth, rapid land development, and climate change.[12] Nationwide, urban stormwater is estimated to be the primary reason for failure to meet water quality standards in 13 percent of rivers, 18 percent of lakes, and 32 percent of estuaries. These numbers are especially shocking given that urban areas cover only 3 percent of United States land.[13]

In the Chesapeake Bay watershed, stormwater contributes a significant proportion of the nitrogen, phosphorus, and sediment loads impairing the Bay: about 16 percent overall.[14] While jurisdictions have made progress on reducing pollution from other sources, such as wastewater treatment facilities, efforts to curb runoff from the built environment have not been as successful, and stormwater-related pollution continues to increase across the watershed—especially in areas not regulated under the Clean Water Act's stormwater permitting program.[15]

Ultimately, it is unlikely that this nationally prized estuary will ever be fully restored if unregulated stormwater pollution is allowed to continue flowing into the Bay unchecked. Closing this gap in the Bay cleanup effort is necessary in order for communities to enjoy the full benefits of this decades-long, resource-intensive undertaking.

III. How Stormwater Is—and Isn't—Regulated

Despite the wide-ranging and damaging environmental consequences of stormwater runoff, discharges from smaller towns and rural areas are not adequately regulated under federal law, making it difficult to carry out federal programs such as the Chesapeake Bay TMDL.

The Clean Water Act generally prohibits the discharge of pollution from a point source except in compliance with a permit issued under the National Pollutant Discharge Elimination System, or NPDES.[16] However, this provision applies only to certain categories of stormwater such as runoff from industrial and construction activity and urbanized areas, leaving out runoff from smaller cities and towns.

In regulating these specific types of stormwater discharges, permits are typically issued to the dischargers by state environmental agencies.[17] The most comprehensive form of permit is the municipal separate storm sewer system (MS4) permit; unlike industrial and construction stormwater permits that regulate only specific kinds of sites, the MS4 permit regulates stormwater discharges across broad geographic areas. An MS4 permit requires a municipality to take steps to reduce the amount of stormwater pollution that it discharges through its storm sewer system into local waterways. The Clean Water Act requires every MS4 permittee, at a minimum, to implement "controls to reduce the discharge of pollutants to the maximum extent practicable."[18] If these baseline "practicable" controls are not sufficient to protect local water quality from becoming degraded, MS4 permits may also include more stringent requirements to ensure compliance with water quality standards.[19]

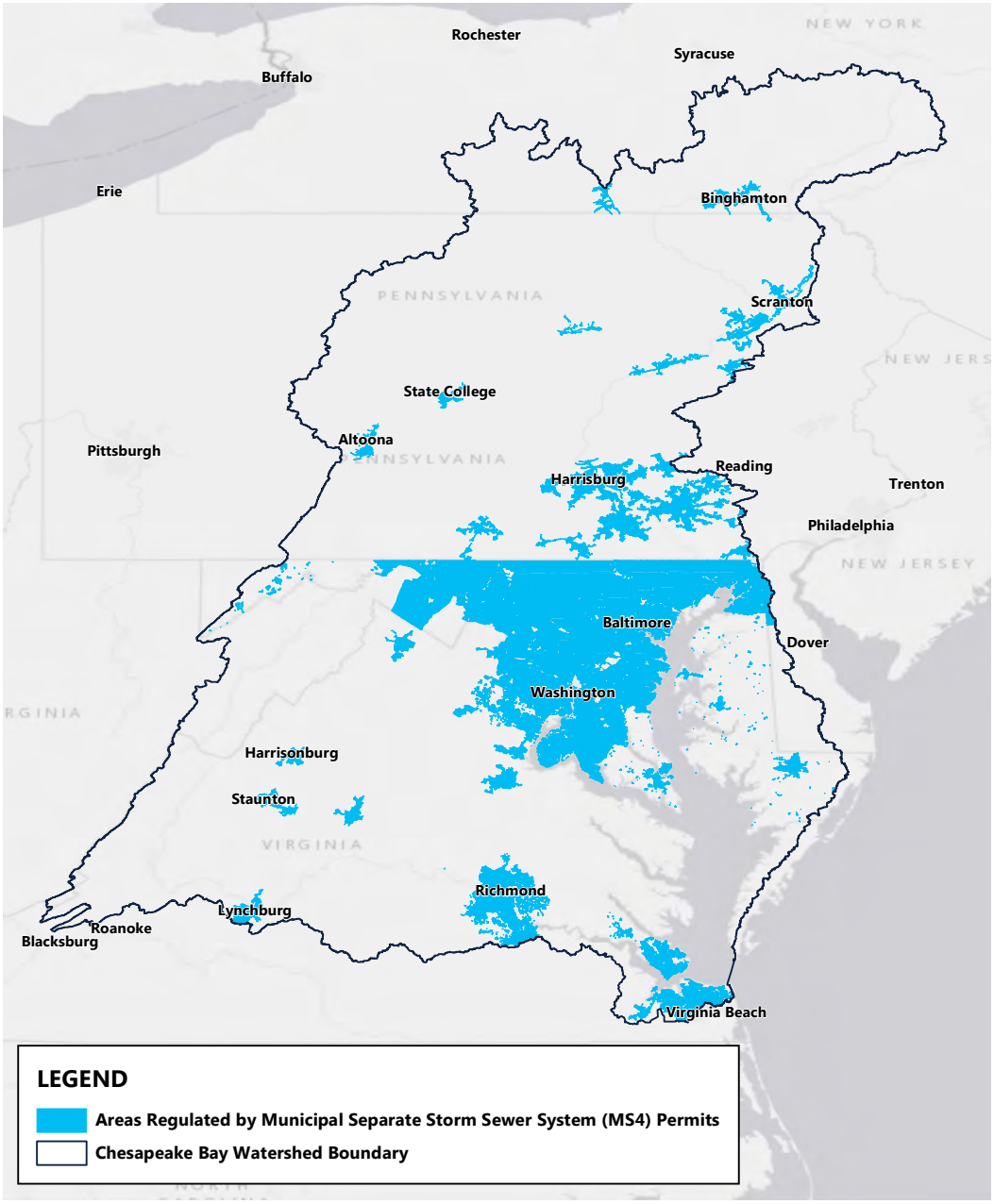
In practice, these permits are not always as stringent as they need to be to stem pollution, and stormwater contamination continues to worsen even in regulated areas across the Bay watershed.[20] Nonetheless, MS4 permits remain the primary vehicle for reducing stormwater pollutant loads in accordance with federal impaired waterway cleanup plans, including the Chesapeake Bay TMDL. In the places they regulate, MS4 permits are an important—though imperfect—tool for achieving pollutant reductions.

However, MS4 permits are not required for stormwater discharges from jurisdictions with fewer than 100,000 people that are not located within "urbanized areas." These areas are considered "unregulated." Note that the term *unregulated*, as used in this context, does not necessarily mean that there are no limitations or requirements for stormwater discharges in these locations, simply that they are unregulated under the MS4 permitting program. State and local governments manage stormwater through a variety of other regulatory and incentive programs. However, as discussed below in section V, those approaches tend to be piecemeal, underfunded, and ineffective compared with the enforceable and relatively comprehensive requirements of the Clean Water Act MS4 permitting program.

TABLE I: CATEGORIES OF STORMWATER REGULATED BY FEDERAL PERMIT REQUIREMENT

Requirement established by statute[21]	Discharges associated with industrial activity (including discharges from large construction sites)
	Discharges from municipal stormwater systems that serve a population of 100,000 or more
	Any discharge that is determined (by the EPA or a state) to contribute to a violation of a water quality standard, or to be a significant contributor of pollutants to waters of the United States
Requirement established by EPA regulation[22]	Discharges from smaller construction sites
	Discharges from small municipal stormwater systems with populations under 100,000 that are located within "urbanized areas" as defined by the Census Bureau
	Discharges from "other" public storm sewer systems, such as those operated by state departments of transportation (DOTs), public universities, and federal military bases

FIGURE I: AREAS REGULATED BY MS4 PERMIT IN THE CHESAPEAKE BAY WATERSHED



WHEN REGULATED AREA BECOMES UNREGULATED: THE MYSTERIOUS CASE OF THE SHRINKING MS4s

In recent years, communities around the Chesapeake have increasingly attempted to limit the geographical scope of their MS4 permit obligations. The result of this trend is to leave more pollution unregulated.

These communities justify their actions on the basis of the language of the Clean Water Act, which says that a permit is required for a "discharge *from* a municipal separate storm sewer system."[23] They claim that this language does not obligate them to control discharges of stormwater that flow directly from developed land into waterways without first traveling through the municipal storm sewer system, even if those discharges occur within an MS4-regulated community's jurisdictional boundaries. Maryland's highest state court endorsed that interpretation of the law in a 2019 ruling.[24] And Virginia's statewide MS4 permit explicitly states that municipalities have this authority to limit the geographical areas where their permit requirements apply.[25]

This kind of regulation-dodging is encouraged by the wastewater/stormwater utility trade association National Association of Clean Water Agencies (NACWA), which urges MS4 jurisdictions to exclude as much area as possible from their pollution control obligations: "As a practical matter, compliance costs for various common MS4 permit requirements have a proportional relationship to the size of the area served by the MS4. Permittees may be able to reduce their compliance costs by carefully reviewing their MS4 service area maps to ensure that they do not include areas that are not actually served by the MS4."[26] In a policy guide, NACWA lists examples of areas that municipalities should seek to exclude, such as the water flow "off a parking lot directly to an adjacent stream."[27]

In response, some jurisdictions, like Loudoun County, Virginia, have undertaken extremely granular, detailed reviews of their service areas to include as little land as possible.[28] Others, like Virginia's Arlington County, which place a greater priority on cleaning up their waterways, have continued to implement stormwater controls in areas that they would technically be eligible to exclude.[29]

It's not known exactly how much previously regulated land area has been excluded from permit coverage in recent years. While it's unlikely that tinkering with the margins of MS4-regulated areas has resulted in a significant shift of land from regulated to unregulated within the Chesapeake watershed as a whole, the trend is unquestionably harmful to local waterways and the Bay.

IV. Chesapeake Stormwater Loads From Unregulated Sources

As the principal legal mechanism for enforcing runoff pollution reduction requirements, the MS4 permitting program receives the lion's share of attention from regulatory agencies and advocacy organizations. Yet the majority of the stormwater pollution entering the Chesapeake Bay and its tributaries comes from areas that are not regulated by MS4 permits.

The best source of pollution source data in the Chesapeake Bay region is the Chesapeake Assessment Scenario Tool (CAST), a tool developed for the Chesapeake Bay Program partnership.[30] According to CAST estimates of 2019 pollution loads (displayed in Table 2 below), stormwater from unregulated areas is contributing more than one and a half times as much nitrogen to the Chesapeake Bay as stormwater from MS4-regulated areas. Overall, 60 percent of all stormwater-related nitrogen pollution in the Bay comes from unregulated runoff. This misalignment between pollution sources and the tools available to address them is one reason why solving the stormwater problem in the Bay watershed and beyond has proved so challenging.

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A CLOSER LOOK: UNREGULATED STORMWATER POLLUTION BY JURISDICTION

The amount of stormwater pollution that's unregulated varies significantly from one jurisdiction to the next. The significance of the problem in each state depends on the extent of MS4 permit coverage, which in turn depends on the proportion of the population living in densely populated areas.

Maryland and the District of Columbia, with comparatively more land area regulated by MS4 permits, have the smallest proportion of stormwater nitrogen loads generated from unregulated discharges. In fact, these are the only two Bay watershed jurisdictions where stormwater nitrogen loads

from regulated areas exceed those from unregulated areas. On the other end of the spectrum, Delaware and New York, with the least extensive MS4 permit coverage, have by far the greatest ratio of unregulated stormwater nitrogen loads to regulated nitrogen loads within their states' portion of the Bay watershed. Pennsylvania, Virginia, and West Virginia all fall somewhere in the middle. Table 2 presents the nitrogen loadings to the Bay from regulated and unregulated stormwater in each jurisdiction and across the watershed as a whole. (The entries in the loadings columns do not sum exactly to the Bay-wide totals due to rounding.)

In 2018–2019, each jurisdiction in the Chesapeake Bay watershed developed a Phase III Watershed Implementation Plan (WIP) laying out how it would meet its Chesapeake Bay TMDL load reduction targets by 2025. These plans provide additional information clarifying how much of each jurisdiction's stormwater pollution comes from unregulated areas, a proportion that is largely a function of development patterns within each state's portion of the Bay watershed.

- According to **Delaware**'s Phase III WIP, 25 percent of the state's total land area is regulated under the MS4 permitting program, but only a "small portion" of the state's *Chesapeake Bay watershed* land area has MS4 permit coverage.[31] Delaware's geographical MS4 permit coverage is shown in Appendix A, Figure 1.
- The **District of Columbia**'s Phase III WIP states that there are only "a few areas" in the jurisdiction where runoff flows as "direct drainage" into rivers and streams rather than through a regulated sewer system. The "vast majority" of spaces contributing unregulated pollution in the District are owned by the federal government, and much of these areas are parkland where little development has occurred.[32] The District's drainage areas and MS4 permit coverage are shown in Appendix A, Figure 2.
- Based on an analysis of spatial data, **Maryland**'s Phase III WIP concludes that only a small fraction of the state's developed impervious acreage—about 10 percent—is not covered under an MS4 permit.[33] Maryland's MS4 permit coverage is shown in Appendix A, Figure 3.
- **New York**'s Phase III WIP states that there are only two "relatively small" urbanized areas, covering 32 municipalities, within the Chesapeake Bay watershed that are regulated by MS4 permit.[34] New York's geographical MS4 permit coverage is shown in Appendix A, Figure 4.
- In **Pennsylvania**, despite the fact that there are more than 350 regulated MS4s in the state's portion of the Bay watershed, most of the state's municipalities are too small to meet the criteria for regulation. Nearly 75 percent of developed acres in the watershed are located in an unregulated area.[35]
- **Virginia**'s Phase III WIP finds that unregulated developed area accounts for 13.1 percent of the state's total land area within the Bay watershed, compared with only 5.6 percent for MS4-regulated developed area.[36] Seen another way, 70 percent of Virginia's developed land area within the Bay watershed is unregulated.
- Finally, **West Virginia**'s Phase III WIP states that only two localities within the Chesapeake Bay watershed (one city and one county) are regulated by an MS4 permit.[37]

Between CAST pollution estimates and the information provided in each state's Phase III WIP, it is clear that while the magnitude of the unregulated stormwater problem varies from jurisdiction to jurisdiction, it unambiguously poses a significant challenge for the Chesapeake Bay watershed as a whole.

TABLE 2: CHESAPEAKE BAY NITROGEN LOADINGS (2019)[38]

State	Regulated stormwater nitrogen loads (lbs.)	Unregulated stormwater nitrogen loads (lbs.)	Ratio of unregulated stormwater loads to regulated stormwater loads	Unregulated stormwater nitrogen loads as a percentage of all stormwater nitrogen loads	Unregulated stormwater nitrogen loads as a percentage of total nitrogen loads from all sources
Delaware	67,516	593,429	8.8	92%	8.9%
DC	140,674	32,240	0.2	19%	1.6%
Maryland	6,948,651	2,536,011	0.4	27%	4.9%
New York	248,067	1,843,364	7.4	89%	13.3%
Pennsylvania	4,309,127	10,992,212	2.6	72%	10.0%
Virginia	3,913,505	6,972,036	1.8	67%	11.9%
West Virginia	376,436	809,370	2.2	74%	10.0%
Bay-wide	**16,003,977**	**23,778,660**	**1.5**	**60%**	**9.5%**

V. Why Current Efforts to Tackle Unregulated Stormwater Are Failing

Chesapeake Bay watershed jurisdictions are failing to reduce stormwater pollution from unregulated areas, mostly because they aren't allocating enough resources to address the problem.

States in the watershed are focusing the majority of their stormwater-related resources, tools, and capacities on regulated communities—and this is true even in states where most stormwater pollution comes from unregulated areas. To some degree, this emphasis on regulated areas is understandable. The MS4 permit provides a straightforward, enforceable way to impose mandatory pollution reduction requirements in regulated areas. Conversely, there are no comprehensive mechanisms to mandate pollution reductions in unregulated areas, even though unregulated areas have roughly the same rates of pollution per acre as regulated areas.[39] These factors have led Bay watershed jurisdictions to concentrate most or all of their stormwater efforts on MS4 areas. This narrow focus is misguided for three reasons.

First, it isn't fair to place the entire burden of stormwater cleanup costs on people who live within regulated areas while requiring little or nothing of unregulated communities. Most stormwater costs are borne locally by municipal governments, private landowners, and local taxpayers. Communities that face steep pollution reduction mandates in MS4 permits—often communities of color living in densely populated areas—thus have to bear far greater costs than communities that aren't regulated, even though unregulated stormwater pollution exceeds pollution from regulated areas watershed-wide. This is not an equitable division of responsibility or resources.

Second, in states where MS4 permits cover only a small fraction of the developed area, it may not realistically be possible to reduce pollution from regulated areas to a degree sufficient to meet the Bay TMDL's stormwater load targets. Even in states where MS4 coverage is more extensive, focusing exclusively on regulated areas means that the "low-hanging fruit" of pollution reductions in unregulated areas may be missed.

Third, the people and communities living in unregulated areas deserve clean and healthy waters too. Focusing implementation on regulated areas and ignoring unregulated ones means that stormwater will continue to cause localized flooding and degrade local rivers and streams in unregulated jurisdictions. These impacts cause real harm to people and communities, and states should not ignore them just because it is easier in the short term to enforce action through MS4 permits.

Despite the clear need to reduce stormwater pollution from unregulated areas, most jurisdictions are not doing nearly as much as they could. As a result, stormwater pollutant loads in those areas are increasing, threatening the success of the whole Bay restoration effort.

CAST modeling estimates show that pollution loads from unregulated stormwater have risen steadily over the last decade even as watershed jurisdictions have worked to achieve the Bay TMDL's pollution reduction goals. According to CAST, between 2009 and 2019, unregulated stormwater nitrogen loads in the Chesapeake watershed increased by about 1.4 million pounds (a 6.2 percent increase), while nitrogen from regulated areas increased by only 450,000 pounds (a 2.9 percent increase). This was not because of a net shift in acres from regulated to unregulated.[40] Rather, this unequal rise in pollution is a direct result of land development with inadequate stormwater controls in unregulated areas. Changes in Bay-wide loadings, along with statewide data, are presented in Table 3.[41] (The entries in the 2019 loadings column do not sum exactly to the Bay-wide total due to rounding.)

TABLE 3: CHANGE IN NITROGEN LOADINGS FROM UNREGULATED STORMWATER BETWEEN 2009 AND 2019[42]

	2009 nitrogen loads from unregulated stormwater (lbs.)	2019 nitrogen loads from unregulated stormwater (lbs.)	Change from 2009 to 2019
Delaware	593,342	593,429	+0.01%
District of Columbia	31,744	32,240	+1.5%
Maryland	2,382,615	2,536,011	+6.4%
New York	1,680,132	1,843,364	+9.7%
Pennsylvania	10,489,465	10,992,212	+4.8%
Virginia	6,452,507	6,972,036	+8.1%
West Virginia	766,806	809,370	+5.6%
Bay-wide	**22,396,611**	**23,778,660**	**+6.2%**

Each of these jurisdictions has taken some steps to address unregulated stormwater pollution, as will be discussed in more detail below, but those policies do not go far enough. The EPA's Chesapeake Bay TMDL Midpoint Summary, published in 2018, urges the jurisdictions with more unregulated area "to either implement additional voluntary programs or consider broadening their regulatory authorities to reduce runoff pollution from these areas."[43] The EPA has also criticized some states, including Virginia and Pennsylvania, for failing to develop sufficient plans for reducing stormwater pollution from unregulated areas.[44]

A few common challenges explain why jurisdictions' current efforts have fallen short. First, because unregulated communities have faced few requirements to meaningfully reduce their overall runoff pollution or to track and monitor activity that is underway, states and localities frequently lack local data about controls that are already in place. This data gap can make it difficult to develop forward-looking plans. Many jurisdictions also lack localized data on pollution sources, pollutant loadings, and impervious surfaces that generate runoff. While some of this information is available through CAST, municipal staff often have not been trained to access or extract data from this complex model.

Second, unregulated municipalities face serious funding and administrative challenges. By definition, unregulated stormwater originates in smaller and more rural communities that are not "urbanized." These jurisdictions have smaller tax bases, smaller budgets, and smaller staffs. Unregulated communities are unlikely to have a designated municipal employee to oversee stormwater reduction efforts; as it is, many localities struggle to carry out basic public works and other municipal functions. Rural areas may also lack private contractors to which they can outsource this work, something that larger municipal governments often do. On the whole, unregulated areas have fewer resources available for implementing stormwater projects, for developing new policies, and for enforcing requirements against private parties—a duty that typically falls to municipal governments even when the requirements are adopted at the state level.

Finally, these financial hurdles make stormwater management in unregulated areas a political challenge, compounded by a widespread lack of understanding about the stormwater problem and the reasons why communities should devote their scarce resources to addressing it. Particularly troubling is the negative public messaging spread by certain polluters who oppose any new requirements or costs and by politicians at all levels who seek political advantage by fighting new regulations and fees.[45] These negative messages can suppress the political will to tackle this major pollution source.

Within the context of these widespread challenges, the remainder of this section surveys the specific actions the Bay watershed states are taking to address unregulated stormwater and explains why they aren't getting the job done. Certain efforts are regulatory in nature, while others provide funding, assistance, or incentives for pollution reduction activities. Many nonregulatory actions cannot be evaluated quantitatively in terms of pounds of pollution avoided, so it can be difficult to gauge their effectiveness. However, what's clear is that no state in the watershed is tackling the unregulated stormwater problem in a fully comprehensive way—and as a result, the problem is only getting worse.

REGULATION OF LAND DEVELOPMENT

Many states and localities have requirements for implementing permanent stormwater controls on newly developed sites (i.e., greenfield development) and, in some cases, on redeveloped sites. These post-construction stormwater requirements typically establish design standards and/or performance measures that the site must meet in perpetuity after it is developed or redeveloped, with the goal of achieving specific water quality or quantity goals. Such requirements might include controls to remove a certain percentage of pollutants from runoff before it leaves the site, or to manage a specific volume of runoff or rainfall depth by slowing the water down or retaining it on the site, or a combination of these solutions.

In theory, post-construction stormwater requirements can be an effective mechanism to force private properties in unregulated areas to implement runoff controls. In practice, most of the current standards in place across the Bay watershed are inadequate, for two reasons.

First, the current standards are too weak. The requirements that apply to newly developed sites *at best* require a site to "replicate pre-development hydrology"—in other words, to hold the line and prevent stormwater discharges from increasing when the natural landscape is paved over. Because they are designed to keep stormwater volumes the same as before, these standards almost never result in an *improvement* in runoff conditions.[46] Many jurisdictions apply standards that are even weaker—and then use excessively high size thresholds to exclude most development sites from even those restrictions, thereby allowing pollutant loads and volumes to get worse after the site is developed. Each jurisdiction's current standards are presented in Table 4.

TABLE 4: STATEWIDE POST-CONSTRUCTION STORMWATER STANDARDS IN THE BAY WATERSHED[47]

State	Performance standard for new development	Performance standard for redevelopment	Size threshold (area of land disturbance)
Delaware	Retain or manage the difference in volume from predeveloped to post-developed condition, up to 1 inch of rainfall[48]	Reduce impervious cover by 15% from existing conditions[49]	5,000 square feet[50]
District of Columbia	Retain 1.2 inches of rainfall (at least half on-site; remainder can be achieved through credit purchase)[51]	Same as new development[52]	5,000 square feet[53]
Maryland	Use Environmental Site Design practices to manage the water quality volume (0.9–1.0 inch) to the maximum extent practicable (ESD to the MEP)[54]	Same as new development if <40% impervious; otherwise, volume control (ESD to the MEP) required for 50% of existing imperviousness, or reduction of impervious area by 50%[55]	5,000 square feet[56]
New York	Runoff reduction of water quality volume (0.8–1.2 inches); any volume not retained must be treated[57]	Same as new development, but if not possible, reduce impervious cover by 25% or treat/reduce 25% of water quality volume[58]	1 acre[59]
Pennsylvania	For all sites, no increase in total runoff from the 2-year/24-hour storm; alternatively, for small sites, manage 2 inches of runoff from impervious surfaces, of which the first 1 inch must be fully retained[60]	Same as new development, except that 20% of existing impervious cover may be treated as "meadow" for purposes of calculating requirements[61]	1 acre[62]
Virginia	Limit phosphorus loadings to no more than 0.41 pounds per acre, per year, via the "runoff reduction" method[63]	Reduce phosphorus from existing conditions by 20% (large sites) or 10% (small sites)[64]	1 acre, or 2,500 square feet in Chesapeake Bay Preservation Area[65]
West Virginia	No statewide standard	No statewide standard	N/A

The situation is not much better when it comes to redevelopment. Requirements for redeveloped sites have the potential to make a big difference in overall pollution by requiring stormwater controls in older urban areas whose buildings were originally constructed without them. However, most Bay watershed states have adopted weak standards for redeveloped properties because of a largely exaggerated perception about the cost and difficulty of meeting stormwater requirements in the densely developed urban environments where redevelopment projects are often located. These weak standards represent a huge missed opportunity.

Moreover, even if states adopted redevelopment standards that were strong enough to meaningfully reduce pollution, those requirements kick in only when redevelopment occurs. In many places, both regulated and unregulated, redevelopment activity is not happening quickly enough for jurisdictions to rely on these requirements as a primary mechanism for meeting TMDL pollution reduction deadlines. For example, only 187 acres are projected to be redeveloped in the District of Columbia's MS4 area each year over the next quarter-century, out of a total land area of nearly 44,000 acres.[66] At that rate, it would take more than a century for post-construction requirements alone to reduce pollution enough to meet local water quality standards in the District.[67]

Beyond post-construction stormwater requirements, riparian buffer laws are another type of land development regulation that jurisdictions use to control runoff pollution. A riparian buffer is a vegetated zone alongside a stream or wetland that filters runoff and traps pollutants before they can enter the water body. Various jurisdictions in the Bay watershed mandate the preservation of riparian buffer zones of a certain width between developed land and waterways; some also specify the type of vegetation that must be maintained in those areas. For example, within statutorily-defined resource conservation areas, Maryland law designates a minimum buffer of 200 feet along tidal lands and 100 feet along tributary streams.[68] However, not all Bay watershed jurisdictions have buffer zone requirements, and those that do generally do not cover all waterways, do not mandate a large enough buffer zone, and provide too many exemptions and waiver opportunities to be adequately protective of water quality.[69]

REGULATION OF SPECIFIC ACTIVITIES THAT AFFECT STORMWATER

All jurisdictions within the Chesapeake Bay watershed—regulated and unregulated areas alike—are subject to programs designed to reduce stormwater pollution from three specific kinds of activities that affect stormwater quantity and quality: construction activity, industrial activity, and nonagricultural application of fertilizer.

The Clean Water Act and EPA regulations require permits for stormwater discharges from construction activities that disturb one or more acres, as well as discharges from smaller construction sites that are part of a larger development plan.[70] This nationwide requirement applies regardless of whether the construction site is located within an MS4 area. Additionally, some states require permits for construction activities below the one-acre federal threshold. For example, Delaware's construction stormwater program regulates all construction activities that disturb more than 5,000 square feet of land.[71] Construction site discharge permits require site operators to take steps to reduce runoff pollution from construction activities, with a particular emphasis on sediment and debris. These permits are important to protect waterways from the short-term impacts of construction activity. However, the runoff-reducing measures they require are mostly temporary, and the permit obligations terminate when the construction activity has concluded. As a result, runoff control requirements for construction sites can't be relied on to reduce polluted runoff in any permanent way.

The Clean Water Act also requires permits for stormwater discharges associated with 11 categories of industrial activity.[72] This requirement applies to stormwater discharges that are "directly related to manufacturing, processing or raw materials storage areas at an industrial plant" but not to runoff from associated areas like office buildings and parking lots.[73] Similar to the construction stormwater permit program, this permit requirement applies whether or not the industrial site is located within an MS4-regulated area. Within the Chesapeake watershed, there are about 4,000 industrial facilities whose stormwater discharges are regulated by permit.[74] However, the National Research Council (NRC) has found that the industrial stormwater program suffers from poor accountability and that industrial permits' one-size-fits-all requirements haven't been effective at improving the quality of the nation's waters.[75] In particular, the NRC faults industrial permits for giving regulated parties too much discretion and "wiggle room" in determining how to comply with their requirements.[76] This seems to hold true around the Bay as well: a recent report found widespread violations of Maryland's industrial stormwater program due to weak enforcement and inadequate permit conditions.[77] And in West Virginia, of the 871 permitted industrial facilities in the state, 576 were delinquent in complying with their monitoring requirements.[78]

Except for Pennsylvania and West Virginia, all state governments in the Chesapeake Bay watershed have adopted laws or regulations that govern the nonagricultural application of fertilizer (e.g., for residential lawns and parks), both within and outside MS4-regulated areas.[79] Fertilizer contains high levels of nutrients that can run off into waterways and damage them. To mitigate this damage, turf grass fertilizer rules typically specify who can apply it, how much can be used, and how often it can be applied.

However, enforcement of state fertilizer rules is often insufficient to guarantee compliance.[80] Also, experts have argued that existing requirements do not go far enough because they do not ban the use of residential fertilizer altogether.[81]

While these efforts to regulate specific stormwater pollution sources are helpful, they are not enough on their own to prevent runoff from degrading local waterways and the Bay.

GOVERNMENT IMPLEMENTATION OF STORMWATER MANAGEMENT PRACTICES

In some parts of the watershed, state and local governments are taking modest action to reduce pollution in unregulated areas by directly implementing stormwater management practices. These efforts are often funded through federal or state grants and/or Clean Water State Revolving Fund loans. However, due to the cost of project implementation and the lack of a regulatory mandate in areas without MS4 permits, none of the Bay watershed states rely on direct action by public agencies as a strategy to meaningfully reduce unregulated stormwater loads.

As an example, Virginia's Stormwater Local Assistance Fund (SLAF) provides matching grants to help local governments carry out stormwater projects. Since the program began in 2014, the Virginia Department of Environmental Quality has awarded approximately $100 million in grants to more than 200 projects.[82] However, because regulated communities get bonus points when they apply for funding, and because very few unregulated communities have even submitted applications, only a small percentage of the funds have gone to projects in unregulated areas.[83] As a result, this program has had little to no impact on reducing pollution from unregulated sources. Other local programs face similar hurdles.

INCENTIVE PROGRAMS TO PROMOTE VOLUNTARY STORMWATER CONTROLS BY NONGOVERNMENTAL ENTITIES

Instead of implementing stormwater controls themselves, it is more common for governments in the Chesapeake Bay watershed to operate incentive programs that pay or otherwise encourage nongovernmental entities such as property owners and nonprofit organizations to implement such controls voluntarily. Examples of incentive mechanisms include expedited permitting, grants, rebate and installation financing, and awards and recognition. These programs are typically operated jurisdiction-wide so that they provide incentives for projects in both regulated and unregulated areas. For example:

- **Delaware** provides Community Water Quality Improvement Grants for homeowners' associations, community organizations, and other nonprofits to implement water quality improvement projects with state matching funds.[84]
- The **District of Columbia** offers various incentives through its RiverSmart programs, which provide financial support to retrofit homes, schools, faith-based institutions, and other facilities in the District. So far, these programs have resulted in projects that control stormwater runoff from about 16 acres per year, District-wide.[85]
- Grant programs make up the bulk of **Maryland**'s pollution reduction strategy in unregulated areas, so the state is issuing a common application to make it easier for grant seekers to access funding from a variety of sources at once, including the Chesapeake and Atlantic Coastal Bays Trust Fund, EPA's Chesapeake Bay Implementation Grants, and other state and federal funds.[86]
- **Pennsylvania** provides funding to stormwater management projects that reduce pollutant loads from urban runoff through its "Growing Greener" grant program.[87]
- The **Virginia** Conservation Assistance Program (VCAP) is an urban cost-share program that provides financial incentives to property owners who install stormwater management practices in participating Soil and Water Conservation Districts.

Critically, funding for these programs is typically quite limited, relative to both the number of projects seeking funding and the lofty pollution reduction goals that the states have for these programs. Some, such as the VCAP, lack a consistent source of funding, meaning that grants are not just limited but often unavailable.[88] This underfunding has hampered the ability of incentive programs to make a dent in unregulated stormwater loads across the Bay watershed.

One kind of financial incentive that deserves special mention are stormwater fee rebate or credit programs (not to be confused with credit *trading* programs, discussed below).[89] Dozens of jurisdictions around the Chesapeake watershed operate stormwater utilities that charge user fees for stormwater services based on the amount of impervious surface on each property. Programs that include a fee rebate, credit, or discount for properties that implement stormwater controls can incentivize the voluntary installation of runoff reduction practices. Nationwide, about half of stormwater utilities report that they have implemented fee credit programs.[90] However, the fees are often set too low for the rebate to cover the cost of installing the controls, particularly for smaller properties. This reduces the credit's effectiveness as an incentive mechanism and leads to low participation rates.[91]

TECHNICAL ASSISTANCE

In addition to providing some financial support for runoff controls, Chesapeake Bay jurisdictions also encourage best management practice (BMP) implementation by offering technical assistance to both local governments and private parties. Technical assistance can take the form of expert help with identifying and developing projects, staff training workshops, education and outreach materials for private landowners, and sample design plans for stormwater controls.

For example, West Virginia's Department of Environmental Protection has two stormwater specialists on staff who provide technical assistance for design and implementation projects and help local communities—regulated and unregulated—identify solutions to stormwater runoff problems.[92] In New York, where the majority of communities in the Bay watershed are small and have limited capacity, the state provides technical expertise and services; the Phase III WIP further recommends the establishment of a network of "circuit rider" stormwater experts who can be shared among local governments that lack funding to hire their own dedicated stormwater staff.[93]

Technical assistance is a helpful and necessary element of stormwater management in unregulated areas. However, decision makers in the watershed need to move beyond technical assistance as a stand-alone strategy if they want to achieve meaningful reductions in polluted runoff.

VI. Unregulated Stormwater Policy Solutions

The list of current approaches that Bay jurisdictions are using to tackle unregulated stormwater may seem comprehensive when taken at face value. However, most of these programs are not robust enough to meet the Bay's pollution reduction goals. Implementation is often weak and tends to match the level of available funding and political will—which has generally been low.

It is clear that we need a better strategy to manage stormwater outside regulated areas in order to clean up the Chesapeake Bay and the thousands of rivers, streams, and lakes that are polluted by runoff across the watershed.

The problem of unregulated stormwater may be daunting, but tools exist to solve it. Moreover, notwithstanding the challenges discussed above, communities can take advantage of a few key opportunities that are unique to stormwater management in unregulated areas.

First, these less densely developed "non-urbanized" areas usually contain more available space in which to implement BMPs. A number of cost-effective BMPs have been developed or adapted for application in rural settings, such as retrofitting roadside ditches often found in unregulated areas to help them slow down and soak up water.[94] Moreover, technical hurdles tend to be lower there, and land is usually cheaper than it is in dense urban environments, reducing the cost of implementation.[95]

Additionally, communities not already regulated under their own individual permits have the opportunity to think more creatively about partnerships. Unregulated jurisdictions in the same local watershed could use collaborative, interjurisdictional efforts to plan and

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implement stormwater controls. This strategy can reduce financial burdens by allowing smaller municipalities to take advantage of approaches that are cost effective at a watershed scale. It also allows resources to be shared, and budgets and expertise to be pooled.

By selecting a strategic combination of policies tailored to local conditions, decision makers can turn the ship around and stop unregulated stormwater from polluting the Bay and its tributaries. The key word here is *strategic*. Government decision makers need to design policies with a specific water quality outcome in mind, rather than choosing policies based on other factors such as cost or technical simplicity and then waiting to see how much pollution reduction those policies achieve—an approach that has not been successful in the Chesapeake Bay

watershed or elsewhere. Critically, robust enforcement of both new and existing policies will be essential to achieving success.

This section presents a menu of policy solutions for decision makers to consider as they develop a strategy to clean up unregulated runoff.

REGULATORY POLICIES

A regulatory policy is a policy that uses laws, rules, or permits to establish an enforceable mandate to reduce stormwater pollution.

Expansion of MS4-permitted areas

Given that the MS4 permitting program is the nation's foremost regulatory mechanism for requiring stormwater pollution reductions, the simplest solution to the unregulated stormwater problem in many places may be to expand—not contract—the geographical extent of MS4 permit coverage to include more land area.

However, it is important to keep in mind that much of the stormwater runoff generated in rural communities—for example, runoff flowing into and moving through an open ditch system or directly into waterways—does not flow through a municipal sewer system. This is not regulated via the MS4 program. In other words, expanding MS4 permit coverage works only in places where stormwater is channeled through municipal sewer pipes before it's discharged.

The legal framework of the Clean Water Act provides a few methods to expand MS4 coverage. First, a state permitting agency can revise its statewide criteria for automatically designated MS4s. Federal regulations state that all MS4s located in urbanized areas, as determined by the latest Census, require permit coverage; additionally, the rules require states to develop criteria to evaluate whether stormwater discharges from MS4s in non-urbanized areas harm local water quality, which would then subject them to mandatory permit coverage.[96] Permitting agencies must apply their adopted criteria "at a minimum" to MS4s serving a jurisdiction with a population of more than 10,000 and a population density greater than 1,000 per square mile.[97] However, this language ("at a minimum") gives states the authority to apply their criteria to MS4s below the population and density thresholds. As a result, a state can expand the geographical area of MS4 permit coverage either by revising its criteria or by applying its existing criteria to MS4s smaller than the federal regulatory minimum. As an example of the latter approach, outside the Bay watershed, Minnesota automatically designates municipalities for MS4 permitting that have populations of 5,000 to 10,000 and discharge to special or impaired waters.[98]

The second way for a state to expand its MS4-permitted areas is to reduce the number of waivers granted to small municipal storm sewer systems that would otherwise be required to obtain permits. Federal regulations allow states to waive permit requirements for certain small municipal systems under specific circumstances.[99] However, the granting of these waivers is discretionary, not mandatory. That means the state can decide not to grant a waiver even if the specified circumstances exist, or to rescind existing waivers, as long as it provides a reasoned, factual rationale for doing so.[100]

The third way to expand permitted areas is through a permitting agency's "residual designation authority." This authority is complex enough to be discussed separately in its own section, below.

Residual designation authority

Apart from designation of MS4s under standardized statewide criteria, discussed above, permitting agencies also have authority under the Clean Water Act to designate stormwater sources for NPDES permitting on a targeted, case-by-case basis. This authority is known as residual designation authority, or RDA.

Under the Clean Water Act, in addition to the predefined categories of stormwater discharges that require permits, a permit is required for any "discharge for which the Administrator or the State, as the case may be, determines that the stormwater discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States."[101] This determination can be made by either the state permitting agency or the EPA regional administrator, and it can encompass either a single discharge or a "category of discharges within a geographic area."[102] A designation can be applied to entire municipal storm sewer systems as well as to other stormwater discharges from specific sites, land uses, or areas.[103]

Residual designation authority has been used to require watershed-wide permits for stormwater discharges in Maine and Vermont and to designate new MS4s in New Mexico.[104] More recently, the EPA has recommended that New York State use this authority to designate new MS4s in order to meet Chesapeake Bay TMDL goals.[105]

The EPA and the states can exercise this authority whenever they choose. However, and critically for advocates, the EPA's regulations also provide for "any person" to petition the EPA or a state agency to exercise this authority.[106] As a result, RDA can be an important tool for communities and watershed groups to use when an unregulated stormwater discharge or category of discharges is contributing to local water quality problems.

A permitting agency's legal duties when responding to an RDA petition have been litigated and clarified in recent years. Federal district courts in California and Maryland have ruled that if an agency agrees with the petitioner that the stormwater discharge is contributing to a water quality violation, the agency must either designate the discharge for permitting (i.e., grant the petition) or prohibit the discharge; it cannot do nothing and allow the discharge to go unregulated.[107] The agency is not allowed to consider the existence of other regulatory programs as part of this process; that is, it can't pass the buck and hope the discharge is regulated under a different authority.[108] Moreover, if a petition is filed, the agency cannot refuse to answer the scientific question of whether the discharge is contributing to a violation.[109] These court decisions underscore the power of RDA petitions to force agencies to regulate harmful stormwater discharges.

Non-NPDES state permitting programs

Another way that states can establish requirements for stormwater discharges in unregulated areas is to set up a state stormwater permitting program that, unlike MS4 permitting, is not carried out under the auspices of the federal Clean Water Act.

Generally speaking, federal law is a floor, not a ceiling, and the Clean Water Act expressly provides that states have authority to establish requirements that exceed its own.[110] Setting up state-law pollution permitting programs for federally unregulated stormwater discharges could be an effective way to address these sources in the Chesapeake. Outside the Bay watershed, New Jersey provides an example of how such a program could be structured. The New Jersey Department of Environmental Protection issues and administers two statewide permits for municipal stormwater discharges. The first, the Tier A permit, is a small MS4 general permit administered under the federal Clean Water Act. The second, the Tier B permit, is a state-law permit that regulates municipalities too small to qualify for regulation under the federal rules. Acknowledging that these municipalities are smaller and more rural, the Tier B permit's requirements are less stringent than those that apply to Tier A permittees. Between these two permits, every municipality in the state of New Jersey is subject to some form of stormwater regulation.[111]

It is worth noting that some states have self-imposed restrictions on their own ability to go beyond federal minimums. Within the Chesapeake Bay watershed, Maryland, Pennsylvania, Virginia, and West Virginia have adopted state laws, regulations, and/or executive orders that make it more difficult for state agencies to regulate more stringently than federal programs do (while Delaware, New York, and the District of Columbia have no such limitations). None of these restrictions fully bar the state from going beyond federal minimums, but they all impose procedural obligations requiring the state agency to provide some explanation or justification for why doing so is necessary, based on public need or a compelling state benefit.[112] Luckily, this is a fairly easy hurdle to clear.

Statewide laws and rules regulating private activity

Outside of any municipal permitting program, states can adopt laws and regulations governing stormwater discharges from private property, which would apply equally in regulated and unregulated areas. The most direct way to require private actors to reduce runoff pollution is to mandate that all development sites implement controls to retain, treat, or manage stormwater. As discussed above and summarized in Table 4, all jurisdictions in the watershed except for West Virginia enforce jurisdiction-wide post-construction standards for stormwater management. However, none of these standards are as strong as they could or should be. As a result, statewide requirements present a significant opportunity for improved pollution control throughout the Bay watershed.

Specifically, states should require sites to retain rainfall on-site without discharging it, or strengthen their requirement if one already exists. They should apply that mandate to redevelopment sites as well as new development, with a narrow technical infeasibility exemption if necessary. And they should reduce the site size threshold so that smaller sites must also meet these requirements. These changes will not only reduce stormwater runoff but also ensure that the parties producing pollution—such as private land developers—are held responsible for mitigating or paying for the damage done to the natural environment, rather than foisting the costs of cleanup onto the general public.

States throughout the watershed can also significantly strengthen other statewide laws and rules that relate to stormwater. They could establish stormwater control requirements for construction sites and industrial sites that are more stringent than those stipulated in federal permits. They could also tighten restrictions on the use of fertilizer, including banning its use on residential lawns for aesthetic purposes. Finally, they could establish stronger riparian buffer laws that apply to all types of waterways with few or no exceptions, with a preference for buffers that are forested. As an example, the Pennsylvania Land Trust Association recommends keeping all development away from the water's edge, requiring wider protected strips to provide greater benefits, prioritizing forested buffers over grassy ones, and focusing efforts on establishing forested buffers in headwater areas.[113]

Critically, all of these statewide laws and regulations must be enforced in order to work, and jurisdictions must make implementation a priority. Pennsylvania's Act 167 serves as a cautionary tale on this point. This law, adopted in 1978, requires each of the state's counties to prepare watershed

stormwater management plans in consultation with municipalities, and to review and revise the plans at least every five years.[114] Advocates in Pennsylvania have reported that the law's provisions are not being enforced, with many counties failing to complete and/or update their required plans, as a result of the state underfunding implementation and enforcement efforts.[115]

Local stormwater requirements

All states in the Chesapeake Bay watershed have adopted laws that give local governments the authority to adopt their own stormwater management requirements. Municipalities can generally establish requirements above and beyond what applies at the statewide level, provided the requirements are based on whatever factual findings or studies the state calls for.[116]

Municipalities in unregulated areas can and should use this authority to reduce pollution at the local level. They can impose post-construction development standards that are stricter than state requirements.[117] They can adopt their own requirements where no statewide standards exist.[118] Municipalities can also adopt ordinances requiring runoff pollution controls at municipally owned properties, such as parks, storage yards, and waste disposal facilities, and they can institute stormwater best practices in municipal operations like road deicing and right-of-way maintenance.

Localities can also exert significant influence over stormwater through their zoning ordinances and land use policies, as allowed under state law. Through those policies, municipal governments can encourage site designs that reduce impervious surface and preserve natural open space (including ecologically valuable landscapes like forests and wetlands), thereby reducing the amount of runoff generated. For example, Virginia's Accomack County allows clustering for development within certain districts, a practice that bunches buildings together on smaller lots to preserve open space.[119]

Not recommended: Pollution credit trading programs

Some jurisdictions within the watershed, including Maryland, have adopted credit trading programs that allow unregulated jurisdictions (and other kinds of pollution dischargers) to implement pollution controls and sell "credits" that these controls earn to MS4s and other regulated parties. States often frame these programs as creating a financial incentive for unregulated areas to reduce loadings.[120] However, trading programs don't create new pollution reductions; rather, they only shift those reductions from one location or sector to another.[121] As a result, they're not a silver bullet solution in places where *additional* reductions are needed in order to meet water quality goals, such as in the Chesapeake watershed.

While NRDC has supported certain narrowly circumscribed water quality trading programs in the past, trades between MS4s and other kinds of pollution dischargers have been riddled with verification problems that have undercut confidence in their effectiveness. Watchdog groups have concluded that existing pollution credit trading programs in the Bay watershed are more of an obstacle than an asset because they do not incentivize additional pollution controls. In fact, these programs may actually be causing net increases in pollution loads.[122]

Moreover, when trading programs span large geographical areas, they can shift pollution control efforts away from urban areas and into rural areas, where implementation is cheaper. Allowing rural stormwater controls to substitute for reductions in more demographically diverse urban areas can have environmental justice implications. Given the disproportionate pollution burdens that low-income communities and communities of color bear in this country, it is critical that stormwater pollution reduction efforts not exacerbate existing injustices. Reducing the impacts of stormwater pollution and flooding must be done equitably, with efforts benefiting urban and rural areas alike.

NONREGULATORY POLICIES

A nonregulatory policy is one that encourages stormwater pollution reduction measures without requiring them outright. The most common types of nonregulatory policies are funding programs and development incentives.

Funding for stormwater controls outside of regulated areas

One of the greatest obstacles to stormwater control in unregulated rural areas is a lack of funding. Resources are needed for on-the-ground stormwater implementation efforts as well as important pre-project planning and analysis. Increasing funding for stormwater projects would also return benefits to states and communities beyond reducing pollution, including mitigation of flood damage caused by sea level rise and changing precipitation trends.

Many stormwater funding programs already exist throughout the Bay watershed, as mentioned in section V of this paper. Most of these programs are currently underfunded; as a first step, all jurisdictions should increase funding significantly. If a jurisdiction does not already operate a grant program for stormwater projects, it should establish one as soon as possible. Private foundations and nongovernmental organizations can also play an important role by supplementing public funds with additional private financial support.

Jurisdictions should ensure that an adequate proportion of funding for unregulated areas is directed to communities that lack local resources. Waiving or reducing local match

requirements for state assistance may help to increase participation. Jurisdictions also need to advertise their funding programs more robustly, as many unregulated communities do not even know that funds are available.[123]

Crucially, all funding programs should be structured to promote equity and justice in the distribution of public resources, so that projects in disadvantaged communities and communities that have faced historical underinvestment receive funding priority. For example, in the summer of 2020, New York proposed changes to its water infrastructure financing programs to prioritize projects in environmental justice communities and make more municipalities eligible for zero-interest financial assistance.[124]

Beyond grant and loan programs, jurisdictions should also explore rebate and installation financing programs, which include funding, tax credits, or reimbursements to property owners who install stormwater BMPs. These programs typically offer a list of specific eligible practices, such as installation of cisterns, permeable pavement, or green roofs.[125] For example, Montgomery County, Maryland, coordinates RainScapes Rewards Rebates, a program that provides rebates to property owners in regulated areas based on the amount of runoff they capture.[126] Similar programs could be implemented in unregulated communities. However, communities should note that grants or rebates to private entities for implementing stormwater controls may be considered taxable income, which could limit their popularity.[127]

Finally, as discussed above, many jurisdictions in the Chesapeake Bay region generate funding for local stormwater programs by operating stormwater utilities that charge stormwater management fees based on the amount of impervious surface on a user's property. Dedicated stormwater fees can provide a steady funding stream for municipalities to carry out pollution reduction efforts. And, if combined with a fee discount or credit program, they can have the double benefit of creating an incentive for private properties to implement stormwater controls to lower their fee obligations.[128] As that paper explains, jurisdictions must find a balance between setting stormwater fees high enough to pay for needed stormwater programs and function as an incentive for properties to implement controls, and setting them low enough to avoid imposing an undue burden on low-income members of the community. Jurisdictions should also invest significant time and resources into public education before proposing the adoption of a utility fee in order to avoid the stiff opposition that some municipalities in the watershed have faced.[129] This education does not need to be complex; one survey of 1,000 Pennsylvania residents found that opposition to stormwater fees was reduced from 35 percent to 19 percent just by showing participants photos of the improvements the fees would fund.[130]

Nonmonetary incentives

Nonmonetary incentive programs provide benefits to property owners for installing stormwater BMPs when they would otherwise not be required to do so. For example, incentives for voluntarily implementing stormwater controls during development include expedited permitting, application review fee waivers, zoning upgrades, density bonuses, and awards and recognition. The EPA has developed an extensive guidebook on incentive mechanisms that interested municipalities can consult.[131] Incentive programs are already relatively widespread in the Bay watershed, but municipalities across the region could reap additional water quality benefits by expanding those programs, especially in unregulated areas.

DIRECT IMPLEMENTATION BY THE PUBLIC SECTOR

Another important piece of the stormwater puzzle is direct implementation of pollution reduction controls by government agencies (as opposed to passing government funding to nongovernmental actors to carry out stormwater projects). Although this approach is not utilized much in the unregulated portions of the Chesapeake Bay watershed, it gives decision makers direct control over environmental outcomes (and avoids the disincentivizing tax implications of grants to private entities discussed above). It should be included in the mix whenever a comprehensive runoff pollution reduction strategy is being developed.

Direct implementation by the public sector often takes place at the local government level—for example, municipalities may retrofit public buildings and impervious surfaces in the public right-of-way or implement street-sweeping or tree-planting programs. But it is also important, especially in unregulated areas where local budgets may be small, for state government agencies to be directly involved, such as through state highway stormwater management programs. BMPs can be cost-effectively deployed as part of a public works activity that's already planned: permeable pavement could be used in the parking lanes when rehabilitating a street, for example, or bioretention units included when creating a new parking facility for a municipal building or public library.

This approach is linked to conversations about funding; public agencies choosing this approach will need to dedicate a portion of their budgets for these projects, either through general funds, bonds, stormwater fee revenues, state or federal grants, or other sources. Citizens and watershed groups can support these efforts by helping their local governments advocate for the resources they need.

TECHNICAL ASSISTANCE AND EDUCATION

Improving the public's understanding of local stormwater needs and building implementation capacity within government agencies will not in themselves reduce pollution. However, they are necessary prerequisites to carrying out on-the-ground projects that clean up waterways.

Technical assistance

Unregulated communities often need help with the technical aspects of planning and implementing stormwater controls. Local officials need to be trained in adopting new regulatory requirements, analyzing current stormwater loads and pollution reduction needs, developing cleanup strategies, and planning and carrying out projects. This training could be provided by federal, state, or nongovernmental experts or through a regional "circuit rider" program in which a single expert is hired to help a consortium of local governments with technical tasks.[132] Training could take the form of manuals, training modules, webinars, workshops, model ordinances, standardized procedures and BMP designs, inspection checklists, fact sheets, or any other guidance that would improve implementation efforts. In the past, the EPA has provided technical assistance to communities on green stormwater infrastructure, and this could provide a model for future assistance efforts.[133] The nonprofit Chesapeake Stormwater Network also provides training to communities on BMP implementation and other stormwater-related issues.[134] So does the Municipal Online Stormwater Training (MOST) Center at the University of Maryland.[135] The Center for Watershed Protection also provides technical assistance.[136]

In particular, unregulated communities need access to modeling tools that are simple enough for local officials to use to develop effective pollution reduction plans without requiring in-depth technical expertise. The traditional planning process for larger regulated communities is too difficult, complex, time-consuming, and expensive for most small communities to follow. Government agencies and nonprofits should work together to develop a streamlined modeling tool for unregulated communities that provides simplified information regarding current land use and land cover, growth projections and development scenarios, pollutant load reductions needed to meet local and Bay-wide water quality goals, stormwater control practices already in place, and options for BMP implementation moving forward.

Relatedly, there is a widespread need for additional research into the effectiveness of different BMPs, so communities have the information they need to make a plan for meeting their water quality goals. In some instances, information on BMP performance already exists, but small localities may not be aware of it.[137] Even so, more information is needed. By monitoring locally implemented practices and sharing data, government agencies, nonprofit organizations, and research institutions can facilitate greater design standardization to reduce the technical design costs that are such a barrier to unregulated communities.[138]

Education

Finally, it is critical to educate several distinct audiences about the importance of reducing stormwater pollution in unregulated areas, and each of these audiences needs to hear a carefully tailored message.

Local officials need education about the stormwater problem and why they should dedicate time and resources to address it, especially when they aren't subject to any permit requirements. Targeted advocacy by citizens and watershed groups will be necessary to build political will among local officials to take on this issue. Universities can also be helpful on this score, as government officials often rely on them as trusted sources of information. For example, Penn State Extension provides stormwater educational resources specifically for local public officials.[139]

Members of the general public require education about polluted runoff as well. Ultimately, property owners and taxpayers will bear at least some portion of the cost of stormwater control efforts. In order to foster public support for those efforts and avoid opposition, localities and nonprofit organizations should work to share messages about the benefits—to communities, families, and individuals—of investing in clean water programs. Areas that have experienced significant public hostility to stormwater programs, including stormwater fees, are typically those that have not first laid a solid foundation of support through public education. One useful resource in this arena is the stormwater education and community outreach guide created by the Northern Middlesex Council of Governments, a Massachusetts regional planning agency.[140]

Citizen and watershed groups can play a key role in on-the-ground project implementation and maintenance. However, in unregulated areas where urban runoff has not been a significant focus of watershed restoration efforts, these groups may not see stormwater as a priority. Targeted outreach to local organizations can encourage them to tackle runoff control projects in their watersheds even outside regulated areas.

VII. Conclusion

Unregulated stormwater is a significant and growing problem in the Chesapeake Bay watershed. Polluted runoff from the built environment contaminates drinking water sources; creates fish-killing, low-oxygen dead zones in the Bay; erodes small streams; floods homes; and fouls beaches. While some communities' stormwater discharges are regulated by Clean Water Act permits, many less populated areas are allowed to dump unlimited amounts of runoff into local waterways. As of 2019, according to publicly available modeling data, stormwater from unregulated areas contributes 1.5 times more nitrogen pollution to the Bay than does runoff from areas regulated by permit. And thanks to unchecked land development and climate change, that pollution keeps growing.

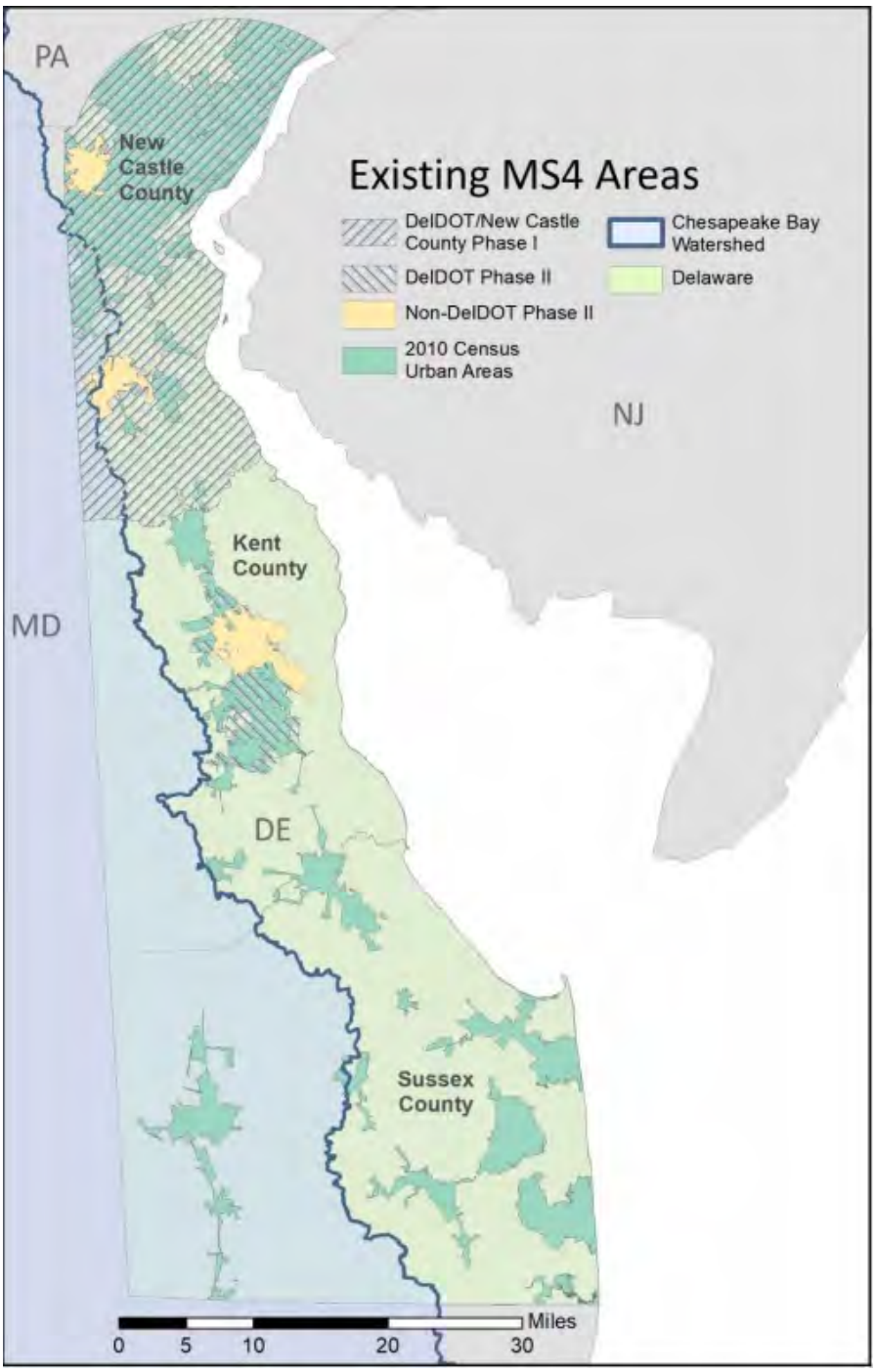
We cannot clean up the Chesapeake Bay unless we take more aggressive action to control unregulated stormwater discharges. Yet most of the jurisdictions in the watershed have adopted a narrower approach, focusing their regulatory resources on runoff controls in regulated communities. Even where jurisdictions have implemented programs to reduce stormwater loads from unregulated areas, those programs are scattershot, under-resourced, and inadequate to restore the Bay to health.

Unregulated stormwater must be the focus of a more comprehensive and intentional strategy. The good news is that a diverse, flexible, and adaptable array of policy tools are available to tackle this challenge and restore the region's waterways. Decision makers and advocates throughout the watershed should work together to increase the funding, resources, regulatory coverage, and attention given to areas not currently regulated under MS4 permits. With the sustained focus of all levels of government, working together with private citizens, we can reduce unregulated stormwater pollution and truly solve the water quality problems in the Bay and its tributaries.

VIII. Appendix

MS4 Permit Coverage in Chesapeake Bay States: Images and Graphics From Jurisdictions' Phase III WIPs[a]

FIGURE I: DELAWARE'S EXISTING MS4 AREAS AND 2010 CENSUS-IDENTIFIED URBAN AREAS

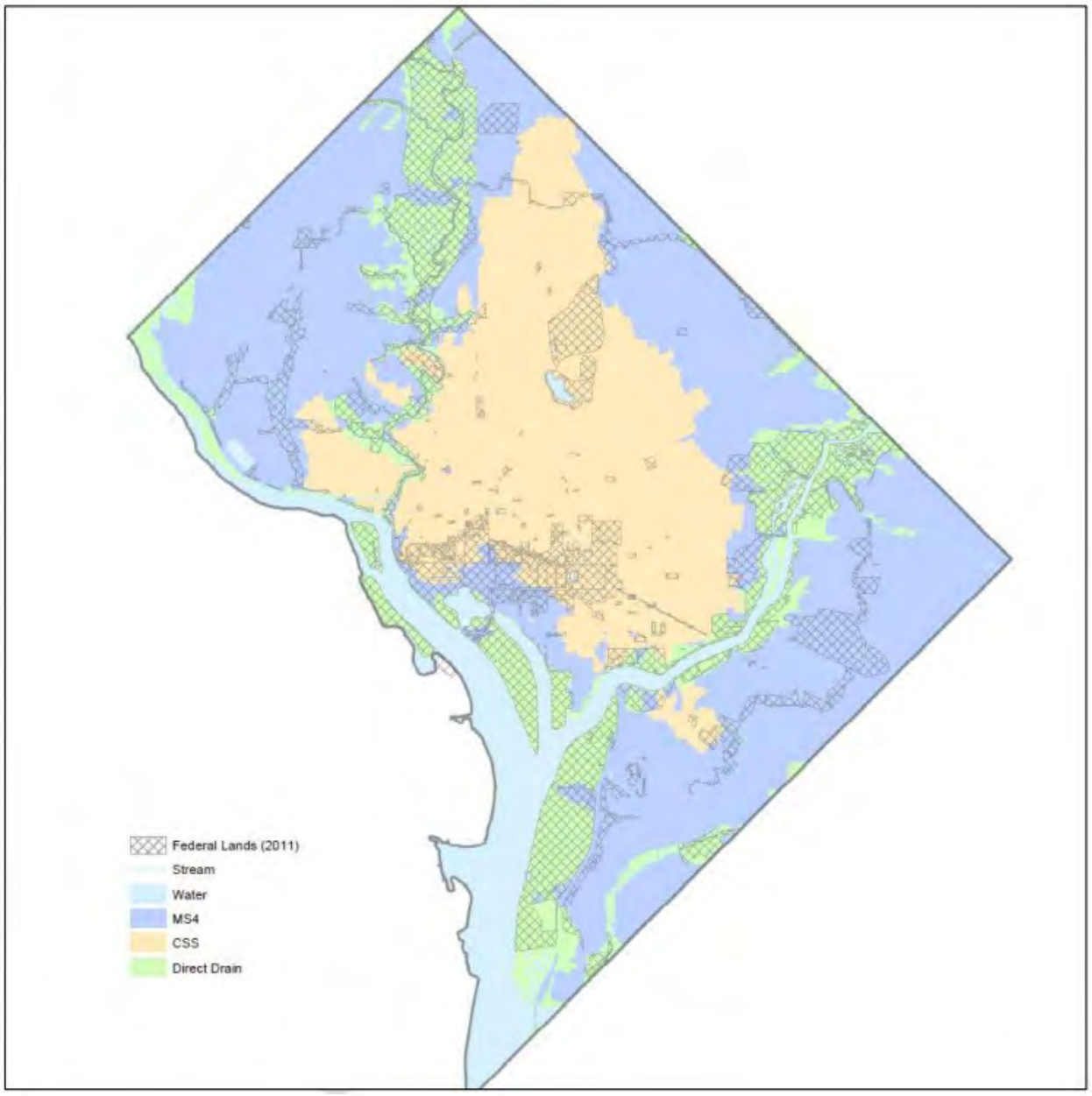


Currently, the crosshatched and yellow areas shown on this map are regulated by MS4 permits; Delaware plans to extend permit coverage to the dark green urban areas in the future. The remaining light blue and light green areas are unregulated.

Source: *Delaware's Chesapeake Bay Watershed Implementation Plan*, *Phase III,* Department of Natural Resources and Environmental Control, August 2019, 17, https://dnrec.alpha.delaware.gov/watershed-stewardship/nps/chesapeake/phase-iii/.

a Not all states' WIPs include graphical portrayals of MS4 permit coverage. For this reason, graphics are not available for Pennsylvania, Virginia, or West Virginia.

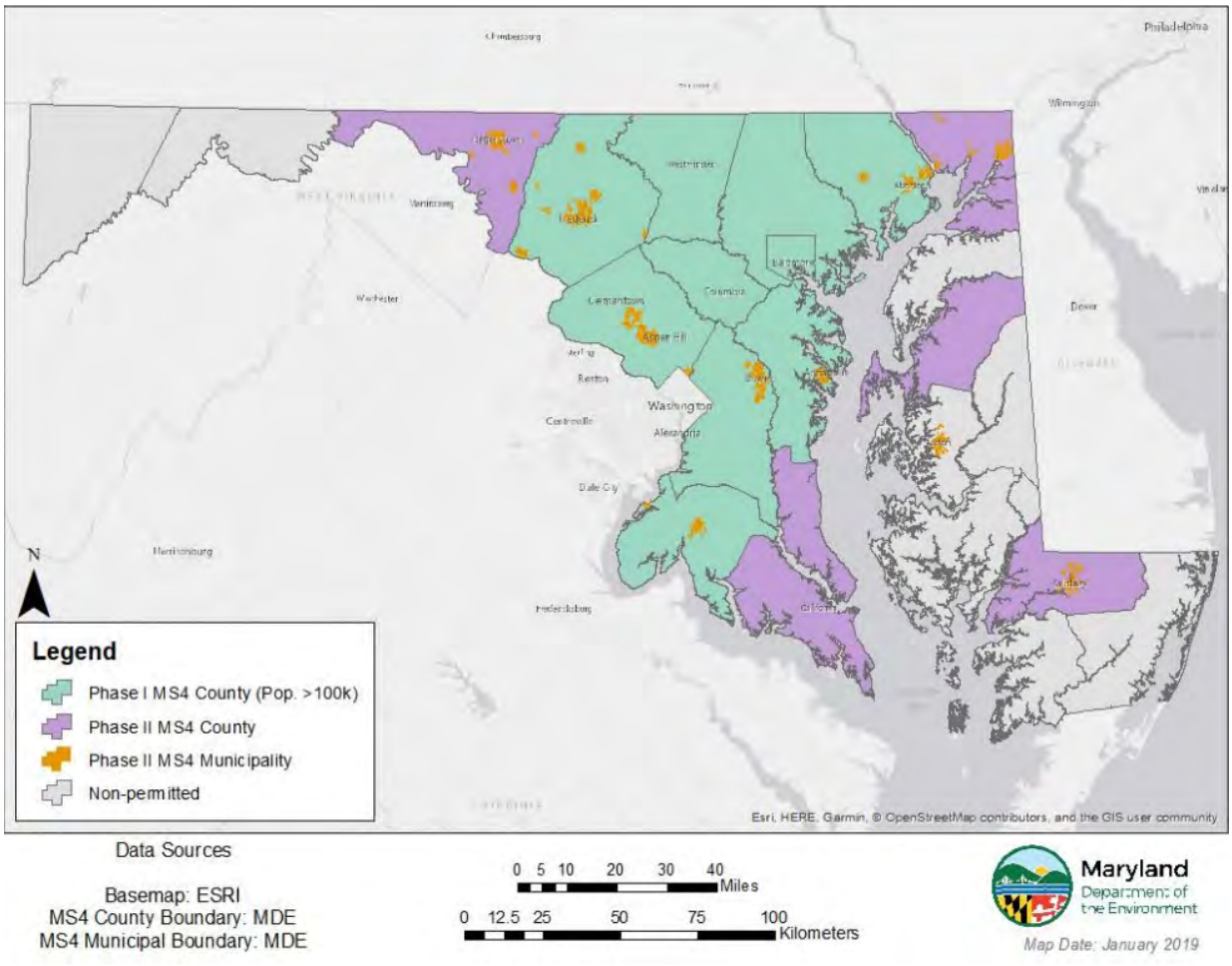
FIGURE 2: DRAINAGE AREAS WITHIN THE DISTRICT OF COLUMBIA



The dark blue area of the map represents the portion of the District where runoff drains into the MS4. In the yellow area, runoff drains into the combined sewer system (meaning that this stormwater is treated at the District's wastewater treatment plant prior to discharge). The green areas represent the portion of the District where runoff drains directly into waterways without entering any municipal sewer pipes first.

Source: *Watershed Implementation Plans—Chesapeake Bay*, District of Columbia Department of Energy & Environment, August 23, 2019, 23, https://doee.dc.gov/service/watershed-implementation-plans-chesapeake-bay.

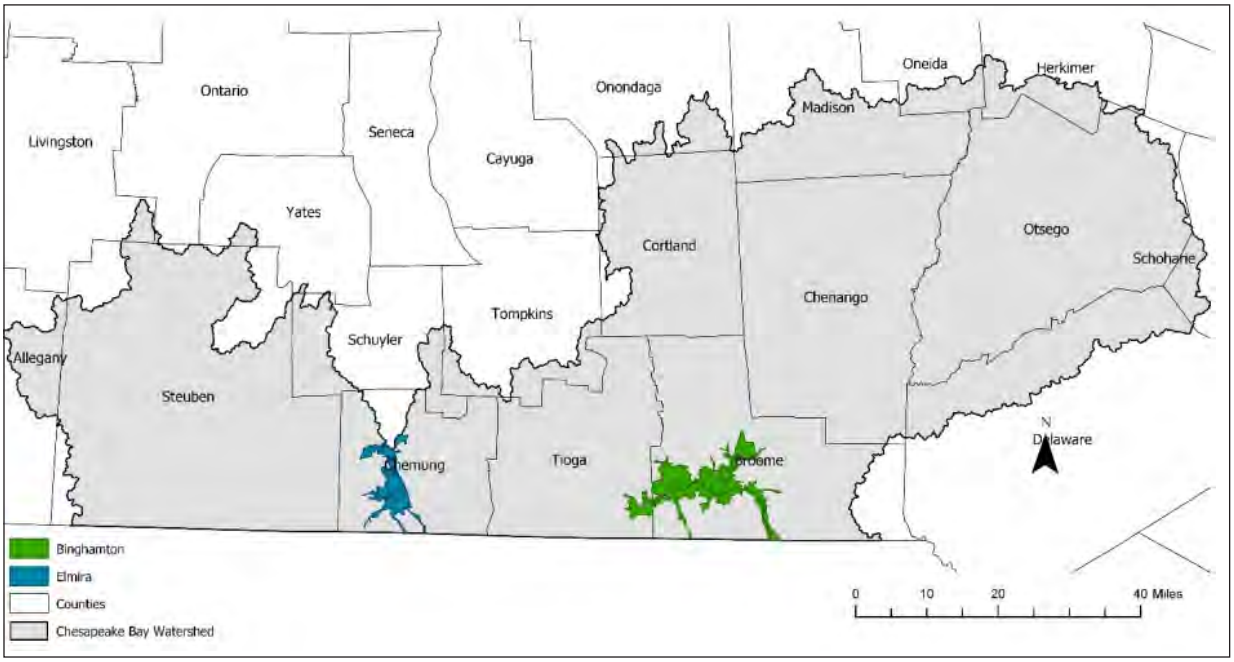
FIGURE 3: MS4-PERMITTED AREAS WITHIN THE STATE OF MARYLAND



All map areas colored green, purple, and orange are regulated by permit. The gray areas are unregulated.

Source: Maryland Department of the Environment, *Maryland's Phase III Watershed Implementation Plan to Restore Chesapeake Bay by 2025*, August 2019, B-34, https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/Phase3WIP.aspx.

FIGURE 4: CHESAPEAKE BAY MS4 AREAS IN NEW YORK STATE



There are only two urbanized areas within the New York State's portion of the Chesapeake Bay watershed that are regulated by MS4 permit, represented by the green and blue areas on the map. All of the gray areas are unregulated.

Source: New York State Department of Environmental Conservation, *Amended Final Phase III Watershed Implementation Plan: New York Chemung and Susquehanna River Basins*, November 2020, 102, https://www.dec.ny.gov/lands/112126.html.

ENDNOTES

1 U.S. Environmental Protection Agency (hereinafter EPA), Region III, *Urban Stormwater Approach for the Mid-Atlantic Region and the Chesapeake Bay Watershed*, July 2010, 1, https://www.epa.gov/sites/production/files/2015-07/documents/ms4guider3final07_29_10.pdf.

2 Chesapeake Bay Foundation, *Land and the Chesapeake Bay*, 2000, 4-5, https://www.cbf.org/document-library/cbf-publications-brochures-articles/Land_Chesapeakefb68.pdf.

3 EPA, Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment, December 29, 2010, ES-3, https://www.epa.gov/sites/production/files/2014-12/documents/bay_tmdl_executive_summary_final_12.29.10_final_1.pdf.

4 National Research Council, *Urban Stormwater Management in the United States*, 2009, https://www.nap.edu/catalog/12465/urban-stormwater-management-in-the-united-states.

5 Christopher J. Walsh et al., "The Urban Stream Syndrome: Current Knowledge and the Search for a Cure," *Journal of the North American Benthological Society* 24, no. 3 (September 2005): 706-723, https://www.researchgate.net/publication/228642919_The_Urban_Stream_Syndrome_Current_Knowledge_and_the_Search_For_A_Cure.

6 Environment Maryland, *Watermen Blues: Economic, Cultural and Community Impacts of Poor Water Quality in the Chesapeake Bay*, September 2009, https://environmentmaryland.org/sites/environment/files/reports/Watermen-Blues---Environment-Maryland.pdf.

7 Chesapeake Bay Foundation, *Bad Water 2009: The Impact on Human Health in the Chesapeake Bay Region*, July 2009, https://www.cbf.org/document-library/cbf-reports/57298_final008c.pdf.

8 Chesapeake Bay Foundation, *The Economic Argument for Cleaning Up the Chesapeake Bay and Its Rivers*, May 2012, 13, https://www.cbf.org/document-library/cbf-reports/2012-Economic-Report3788.pdf.

9 National Academies of Sciences, Engineering, and Medicine, *Framing the Challenge of Urban Flooding in the United States*, 2019, https://www.nap.edu/catalog/25381/framing-the-challenge-of-urban-flooding-in-the-united-states.

10 EPA, "Chesapeake Bay Total Maximum Daily Load (TMDL)," https://www.epa.gov/chesapeake-bay-tmdl (accessed February 26, 2021).

11 Chesapeake Bay Foundation, "Economic Benefits of Cleaning up the Chesapeake," 2014, https://www.cbf.org/news-media/features-publications/reports/economic-benefits-of-cleaning-up-the-chesapeake-bay/.

12 National Academy of Sciences, *Report in Brief: Urban Stormwater Management in the United States*, 2008, https://www3.epa.gov/npdes/pubs/nrc_stormwaterreport_fs.pdf.

13 Ibid.

14 Chesapeake Bay Program, "Stormwater Runoff," https://www.chesapeakebay.net/issues/stormwater_runoff, (accessed February 26, 2021).

15 Chesapeake Bay Program, "Chesapeake Assessment Scenario Tool," https://cast.chesapeakebay.net/ (data downloaded February 19, 2021).CAST is discussed in more detail in sections IV and V of this paper.

16 33 U.S.C. §§ 1311(a), 1342.

17 The exception to this rule is in the four jurisdictions that are not delegated authority to implement the Clean Water Act permitting program: Massachusetts, New Hampshire, New Mexico, and the District of Columbia. In these jurisdictions, the EPA Regional Office issues the permits.

18 33 U.S.C. § 1342(p)(3)(B)(iii). This standard is often referred to as the maximum extent practicable, or MEP, standard. The MEP standard is used to develop individualized permit conditions for large MS4 permits. In the context of permits for small MS4s, the EPA has interpreted the MEP standard to require six standardized "minimum control measures" as a baseline level of effort to minimize stormwater pollution. The six minimum control measures are: (1) public education and outreach, (2) public involvement/participation, (3) illicit discharge detection and elimination, (4) construction site stormwater runoff control, (5) post-construction stormwater management in new development and redevelopment, and (6) pollution prevention/good housekeeping for municipal operations. 44 C.F.R. §122.34(b).

19 33 U.S.C. § 1311(b)(1)(C).

20 Chesapeake Bay Program, "Chesapeake Assessment Scenario Tool." Between 2009 and 2019, the annual nitrogen loadings from stormwater discharged from areas regulated under MS4 permits into the Chesapeake Bay increased by approximately 450,000 pounds. CAST is discussed in more detail in sections IV and V of this paper.

21 33 U.S.C. § 1342(p)(2).

22 40 C.F.R. §§ 122.26, 122.32.

23 33 U.S.C. § 1342(p)(2).

24 *Maryland Department of the Environment v. County Commissioners of Carroll County*, 465 Md. 169 (2019). The court agreed with two counties challenging their permits that MS4 permits only regulate discharges *from* a storm sewer system; however, the court also held that a jurisdiction-wide requirement (such as a requirement to manage runoff from 20 percent of a county's impervious surface area) does not violate this restriction if it is essentially a "surrogate or proxy" for pollutant load reductions designed to attain total maximum daily loads, and if it does not actually require the permittee to implement stormwater controls in areas not served by an MS4 system.

25 9 Va. Admin. Code § 25-890-40.I.E.5.a ("The permittee shall address post-construction stormwater runoff *that enters the MS4*"[emphasis added]).

26 National Association of Clean Water Agencies, *MS4 Stormwater Permitting Guide*, March 2018, 9, https://www.nacwa.org/docs/default-source/news-publications/White-Papers/2018-03-07permittingguide.pdf.

27 Ibid., 10.

28 Loudoun County, Virginia, *Phase II Chesapeake Bay TMDL Action Plan*, November 2019, Appendix A, https://www.loudoun.gov/DocumentCenter/View/157709/Loudoun-Phase-II-Bay-TMDL-Action-Plan_DEQ-Submittal_11-1-2019.

29 Arlington, Virginia, *Arlington County Chesapeake Bay TMDL Action Plan*, September 2015, Appendix A: Arlington County MS4 Service Area Delineation Methodology, https://projects.arlingtonva.us/wp-content/uploads/sites/31/2015/05/Chesapeake-Bay-TMDL-Action-Plan-Appendix-A-MS4-Service-Area.pdf.

30 Chesapeake Bay Program, "Chesapeake Assessment Scenario Tool." The Chesapeake Bay Program is the regional partnership that directs and conducts the restoration of the Chesapeake Bay; its members include various state, federal, academic, and environmental organizations. CAST is a web-based nitrogen, phosphorus, and sediment load estimator tool based on the Chesapeake Bay Program Phase 6 Watershed Model, which is a state-of-the-art model calibrated to real-world monitoring data across the watershed. It provides information about pollutant loadings from all major categories of sources, including MS4 and non-MS4 (unregulated) urban stormwater sources.

31 Delaware Department of Natural Resources and Environmental Control (hereinafter Delaware DNREC), *Delaware's Chesapeake Bay Watershed Implementation Plan: Phase 3*, August 2019, 16, http://www.dnrec.delaware.gov/swc/district/Pages/Chesapeake-Bay-WIP-Phase-III.aspx.

32 District of Columbia Department of Energy and the Environment, *District of Columbia's Phase III Watershed Implementation Plan for the Chesapeake Bay*, August 2019, 49, https://doee.dc.gov/service/watershed-implementation-plans-chesapeake-bay.

33 State of Maryland, *Maryland's Phase III Watershed Implementation Plan to Restore Chesapeake Bay by 2025*, August 2019, B-37, https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/Phase3WIP.aspx.

34 New York State Department of Environmental Conservation (hereinafter New York DEC), *Final Phase III Watershed Implementation Plan: New York Chemung and Susquehanna River Basins*, August 2019, 102, https://www.dec.ny.gov/lands/112126.html.

35 Pennsylvania Department of Environmental Protection (hereinafter Pennsylvania DEP), *Pennsylvania Phase 3 Chesapeake Bay Watershed Implementation Plan*, August 2019, 16, http://files.dep.state.pa.us/Water/ChesapeakeBayOffice/WIPIII/FinalPlan/PA_Phase_3_WIP_Final.pdf.

36 Virginia Department of Environmental Quality (hereinafter Virginia DEQ), *Chesapeake Bay TMDL Phase III Watershed Implementation Plan*, August 2019, 83, https://www.deq.virginia.gov/home/showpublisheddocument?id=4481.

37 West Virginia's Chesapeake Bay Program, *West Virginia's Phase 3 Watershed Implementation Plan for the Chesapeake Bay Total Maximum Daily Load*, August 2019, 24, http://www.wvca.us/bay/files/bay_documents/1298_WV_WIP3_final_082319.pdf.

38 Ibid. Data were obtained from the "Public Reports" tool on the CAST website—specifically, a "Loads Report" for each state's area within the Bay watershed at the "Major Source—Fed vs. Non-fed" level, showing pollutant loadings in 2019 ("2019 Progress").

39 Chesapeake Bay Program, "Chesapeake Assessment Scenario Tool." CAST indicates that, as of 2019, there were 3,282,848 acres of unregulated developed land in the Bay watershed and 2,195,882 acres of regulated developed land. The loading totals displayed in Table 2 therefore indicate a loading rate of 7.42 pounds of nitrogen per unregulated acre and 7.29 pounds of nitrogen per regulated acre. Note that these loading rates account for stormwater controls that have been put into place, and as the requirements contained in MS4 permits around the watershed are implemented and additional stormwater controls are installed, the loading rate from regulated developed land should gradually decrease over time. Absent a comprehensive strategy to reduce pollution from unregulated areas, unregulated acre loading rates would not be expected to decrease, but rather to hold steady or increase as land development continues.

40 Chesapeake Bay Program, "Chesapeake Assessment Scenario Tool." According to CAST, between 2009 and 2019, developed acres in the regulated category grew at a greater rate (9.5 percent) than developed acres in the unregulated category (6.2 percent).

41 It should be noted that BMP verification, a data quality issue, can impact these trends. If stormwater management practices are not sufficiently verified, then the pollution reductions they achieve are not counted in the model.

42 Chesapeake Bay Program, "Chesapeake Assessment Scenario Tool." Data were obtained from the "Public Reports" tool on the CAST website—specifically, a "Loads Report" for each state's area within the Bay watershed at the "Major Source—Fed vs. Non-fed" level, showing pollutant loadings in 2009 ("2009 Progress") and 2019 ("2019 Progress"). CAST loading estimates account for both land development, which increases pollution, and implementation of stormwater controls, which reduces pollution.

43 EPA, "Midpoint Assessment of the Chesapeake Bay Total Maximum Daily Load," 2018, 4, https://www.epa.gov/sites/production/files/2018-07/documents/factsheet-epa-midpoint-assessment-chesapeake-bay-tmdl.pdf.

44 EPA, "EPA Evaluation of Virginia's 2016–2017 and 2018–2019 Milestones," July 27, 2018, 4, https://www.epa.gov/sites/production/files/2018-07/documents/final-evaluation-va-2016-2017-and-2018-2019-milestones.pdf. EPA, "Evaluation of Virginia's 2018–2019 and 2020–2021 Milestones," July 29, 2020, 8, https://www.epa.gov/sites/production/files/2020-07/documents/pa_2018_2019_2020_2021_final_milestone_evaluation.pdf.

45 For example, several municipalities in Pennsylvania have recently begun openly flouting and challenging their legal requirements to comply with new state stormwater mandates intended to help attain Chesapeake Bay TMDL reduction goals. These municipalities are regulated by MS4 permits, but similar reactions could be expected if new obligations are imposed on unregulated communities, where funding and technical challenges are even greater. See Ad Crable, "Small PA Communities Say No to Stormwater Mandate," *Chesapeake Bay Journal*, January 15, 2020, https://www.bayjournal.com/news/local_government/small-pa-communities-say-no-to-stormwater-mandate/article_b6550ea6-413a-11ea-84b2-eb3b11d7e7be.html.

46 National Research Council, *Urban Stormwater Management*, 119 (describing the best-case, "ideal world" stormwater management scenario as one in which "future land-use development would be controlled to prevent increases in stormwater discharges from predevelopment conditions").

47 This table does not include performance standards requiring the temporary detention of runoff for flood control purposes. These standards are typically inadequate to prevent pollution impacts from stormwater and in many cases actually make downstream flooding worse.

48 7 Del. Admin. C. § 5101-5.2.

49 7 Del. Admin. C. § 5101-5.6.2.

50 7 Del. Admin. C. § 5101-1.4.2.

51 D.C. Mun. Regs. Title 5, §§ 21-520.3, 520.4.

52 Ibid.

53 D.C. Mun. Regs. Title 5, § 21-599 (defining major land-disturbing activity).

54 COMAR 26.17.02.06(A)(2). Maryland Department of the Environment, *Maryland Stormwater Design Manual*, 2000, revised 2009, chapters 2, 5, https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Pages/stormwater_design.aspx.

55 COMAR 26.17.02.02(B)(29), 26.17.02.05(D)(1).

56 COMAR 26.17.02.05.B(2).

57 New York DEC, *New York State Stormwater Management Design Manual*, January 2015, section 4.3, https://www.dec.ny.gov/chemical/29072.html.

58 Ibid., section 9.2.

59 New York State SPDES General Permit for Stormwater Discharges from Construction Activity, Permit No. GP-0-15-002, Appendix B, Table II, 2015.

60 Pennsylvania DEP, *Pennsylvania Stormwater BMP Manual*, December 2006, 3.3.3-3.3.4, http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=4673.

61 Ibid., 3.3.3.

62 Pennsylvania NPDES Permit PAG-02, General Permit for Discharges of Stormwater Associated with Construction Activities, 2019.

63 9 Va. Admin. Code § 25-870-63.A.1.

64 9 Va. Admin. Code § 25-870-63.A.2.

65 Va. Code § 62.1-44.15:28.A.5.

66 Because the District is almost entirely built out, most development activity is redevelopment. See District of Columbia Department of Energy and the Environment, *Consolidated Total Maximum Daily Load (TMDL) Implementation Plan Report*, August 2016, 69, https://dcstormwaterplan.org/wp-content/uploads/0_TMDL_IP_080316_Draft_updated.pdf.

67 Ibid., 76.

68 Md. Code, Natural Resources § 8-1808.10.

69 Maximilian Merrill, "Riparian Buffers: The Lack of Buffer Protection Policies and Recommendations to Expand Protection," *Journal of Environmental Law and Litigation* 31, no. 1 (2015): 65-86, section V, https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/19860/Merrill.pdf.

70 33 U.S.C. § 1342(p)(2)(B). 40 C.F.R. §§ 122.26(b)(14)(x), (b)(15)(i).

71 7 Del. Admin. C. § 5101-1.4.2.

72 33 U.S.C. § 1342(p)(2)(B); 40 C.F.R. §§ 122.26(a)(1)(ii), (b)(14)(i)-(xi).

73 40 C.F.R. § 122.26(b)(14).

74 EPA, Chesapeake Bay Total Maximum Daily Load (TMDL), 2010, section 4, 4-25, https://www.epa.gov/sites/production/files/2014-12/documents/cbay_final_tmdl_section_4_final_0.pdf.

75 National Research Council, *Urban Stormwater Management*, 32, 36-37.

76 Ibid., 101-102.

77 Rena Steinzor et al., *Toxic Runoff From Maryland Industry: Inadequate Stormwater Discharge Protections Threaten Marylanders' Health and the Environment*, Center for Progressive Reform and Environmental Integrity Project, November 2017, https://www.environmentalintegrity.org/wp-content/uploads/2017/02/Industrial-Stormwater.pdf.

78 National Research Council, *Urban Stormwater Management*, 82.

79 A bill proposed in the Pennsylvania legislature would address fertilizer pollution, resulting in an estimated reduction of 105,000 pounds per year of nitrogen and 4,000 pounds per year of phosphorus. Pennsylvania DEP, *Pennsylvania Phase 3 Chesapeake Bay Watershed Implementation Plan*, 8, 88. In May 2020, the bill, SB915, passed the State Senate and now awaits action in the State House of Representatives.

80 Delaware DNREC, *Delaware's Chesapeake Bay Watershed Implementation Plan: Phase 3*, 33 (explaining that existing legal requirements for nutrient management plans are currently not enforced). Virginia DEQ, *Chesapeake Bay TMDL Phase III*, 73 (discussing plans to strengthen program enforcement in the future, including by commencing audits submitted by contractor-applicators).

81 Tim Wheeler, "Lawn Fertilizer Limits Take Effect, but Effectiveness Questioned," *Baltimore Sun*, October 1, 2013, https://www.baltimoresun.com/news/environment/bs-xpm-2013-10-01-bal-bmg-lawn-fertilizing-limits-take-effect-20130930-story.html.

82 Virginia DEQ, *Authorization of FY 2019 SLAF Project Funding List*, February 26, 2019, https://www.deq.virginia.gov/home/showpublisheddocument?id=4423.

83 Virginia DEQ, *Chesapeake Bay TMDL Phase III,* 74.

84 Delaware DNREC, *Delaware's Chesapeake Bay Watershed Implementation Plan: Phase 3*, 29.

85 District of Columbia Department of Energy and the Environment, *District of Columbia's Phase III Watershed Implementation Plan,* 87.

86 State of Maryland, *Maryland's Phase III Watershed Implementation Plan,* B-38.

87 Pennsylvania DEP, *Pennsylvania Phase 3 Chesapeake Bay Watershed Implementation Plan*, 47-48.

88 Virginia DEQ, *Chesapeake Bay TMDL Phase III,* 74.

89 See generally Rebecca Hammer, *Making It Rain: Effective Stormwater Fees Can Create Jobs, Build Infrastructure, and Drive Investment in Local Communities*, NRDC, April 2018, https://www.nrdc.org/sites/default/files/stormwater-fees-ib.pdf.

90 Black & Veatch Management Consulting, *2018 Stormwater Utility Survey*, 2018, 42, https://www.bv.com/sites/default/files/2019-10/18%20Stormwater%20Utility%20Survey%20Report%20WEB_0.pdf.

91 Gabrielle Gonzalez, Allison Mosley, and Kurt Stephenson, *An Analysis of Stormwater Utility Incentive Programs in the Chesapeake Bay*, Center for Watershed Protection, December 2016, https://owl.cwp.org/mdocs-posts/an-analysis-of-stormwater-utility-incentive-programs-in-the-chesapeake-bay/ ("Stormwater fee credit programs appear to offer minor financial incentives for private landowners to retrofit existing lands with conventional stormwater control practices. Although the researchers were unable to obtain comprehensive data on landowner participation rates for fee credit programs, the collected evidence confirms these findings. Of the 15 stormwater utilities providing some quantitative data on participation rates, approximately 80% of the utilities report fewer than 50 fee credit applications per year. Typically, the number of accounts receiving a credit are less than a very small fraction (<2%) of all properties").

92 West Virginia's Chesapeake Bay Program, *West Virginia's Phase 3 Watershed Implementation Plan*, 34.

93 New York State Department of Environmental Conservation, *Final Phase III Watershed Implementation Plan*, 122-23.

94 Chesapeake Bay Program, Scientific and Technical Advisory Committee, *Re-plumbing the Chesapeake Watershed: Improving Roadside Ditch Management to Meet TMDL Water Quality Goals*, STAC Workshop Report, March 2016, http://www.chesapeake.org/pubs/349_Boomer2016.pdf.

95 Dennis King and Patrick Hagan, "Stormwater Treatment in Maryland: Planning-Level County Cost Estimates," University of Maryland Center for Environmental Science, presentation at WIP Phase II Workshop, Salisbury, Maryland, September 2011, https://www.mwcog.org/asset.aspx?id=committee-documents/a11fwftz20111108150815.pdf ("Costs [of stormwater management] increase from rural to suburban to urban to ultra-urban landscape contexts").

96 40 C.F.R. § 122.32(a). While the state has significant discretion in adopting the criteria, the EPA's regulations recommend "a balanced consideration of the following designation criteria on a watershed or other local basis: discharge to sensitive waters, high growth or growth potential, high population density, contiguity to an urbanized area, significant contributor of pollutants to waters of the United States, and ineffective protection of water quality by other programs." 40 C.F.R. § 123.35(b)(1)(ii).

97 40 C.F.R. § 123.35(b)(2).

98 Minnesota Pollution Control Agency, "Stormwater Program Rulemaking," https://www.pca.state.mn.us/water/stormwater-program-rulemaking (accessed February 26, 2021).

99 40 C.F.R. § 123.35(d).

100 The EPA's regulations anticipate that waivers are not necessarily permanent. 40 C.F.R. § 122.35(b) (The state permitting agency's MS4 designation process "must include the authority to designate a small MS4 waived under paragraph (d) of this section if circumstances change").

101 33 U.S.C. § 1342(p)(2)(E). Courts have held that such a determination must be made formally and explicitly in writing; agency statements or findings about stormwater pollution sources that are made in other contexts, such as in TMDL documents, should not be considered "implicit" designations for purposes of RDA. *Conservation Law Foundation v. Pruitt*, 881 F.3d 24, 32 (1st Cir. 2018) ("[RDA] designations are formal documents containing independent analyses by the EPA and, unlike . . . TMDL approval documents, identify with particularity the dischargers or categories thereof that are required to secure permits. . . . This practice aligns with EPA's position here that section 122.26 requires a 'separate, express determination' by the agency").

102 40 C.F.R. § 122.26(a)(9)(i)(C)-(D). The regulations also authorize designations of discharges for which controls are needed based on TMDL waste load allocations.

103 40 C.F.R. § 122.26(a)(9)(ii) (specifying two different processes for seeking permit coverage, one for "operators of small MS4s designated pursuant to . . . this section" and another for "operators of non-municipal sources designated pursuant to . . . this section").

104 EPA, "Long Creek Residual Designation," 2009, https://www.epa.gov/npdes-permits/long-creek-residual-designation. "Vermont Department of Environmental Conservation, "Residual Designation Authority (RDA)," September 30, 2009, https://dec.vermont.gov/watershed/stormwater/permit-information-applications-fees/rda. EPA, "Petition to Designate Sources in Los Alamos County, New Mexico," 2019, https://www.epa.gov/npdes/petition-designate-sources-los-alamos-county-new-mexico.

105 EPA, "EPA's Evaluation of New York's 2018–2019 and 2020–2021 Milestones," July 29, 2020, 2, https://www.epa.gov/sites/production/files/2020-07/documents/ny_2018_2019_2020_2021_final_milestone_evaluation.pdf.

106 40 C.F.R. § 122.26(f)(2).

107 *Los Angeles Waterkeeper v. Pruitt*, 320 F.Supp.3d 1115, 1121-22 (C.D. Cal. 2018).

108 Ibid., 1,122 (stating that consideration of other regulatory programs is "a factor divorced from the text of the statute").

109 *Blue Water Baltimore v. Wheeler*, 2019 WL 1317087 at *5 (D. Md. Mar. 22, 2019).

110 33 U.S.C. § 1370.

111 New Jersey Admin. Code § 7:14A-25.3(a) ("All municipalities are assigned either to Tier A or to Tier B as follows . . ."). Also see New Jersey Department of Environmental Protection, Municipal Tier Assignments 2009, https://www.nj.gov/dep/dwq/images/mun-tierA-assignments1.jpg (map indicating the Tier A/Tier B status of all New Jersey jurisdictions) (accessed February 26, 2021).

112 Md. Exec. Order No. 01.01.1996.03. 4 Pa. Admin. Code § 1.371(5). Va. Code Ann. § 62.1-44.15(3a), (10). W. Va. Code § 22-1-3a.

113 Wesley R. Horner, "A Scientific Foundation for Shaping Riparian Buffer Protection Regulations," Pennsylvania Land Trust Association, 2014, https://conservationtools.org/guides/132-a-scientific-foundation-for-shaping-riparian-buffer-protection-regulations.

114 Pennsylvania DEP, "Act 167," https://www.dep.pa.gov/Business/Water/CleanWater/StormwaterMgmt/Pages/Act-167.aspx (accessed February 26, 2021).

115 American Society of Civil Engineers, "Stormwater: 2010 Report Card for Pennsylvania's Infrastructure," 2010, http://www.pareportcard.org/PDFs/Stormwater%20Final%20-%20NATL.pdf ("While this was promising and forward-thinking for 1978, these Act 167 plans never were fully funded or enforced by the Pennsylvania DEP. There are 357 designated watersheds in Pennsylvania and for many of them, Act 167 plans were prepared; however, many have not been updated since their original execution. The municipalities that did incorporate Act 167 plans into their municipal regulations experienced uneven regulatory enforcement").

116 For example, see Va. Code Ann. § 62.1-44.15:33(A) ("Localities that are VSMP authorities are authorized to adopt more stringent stormwater management ordinances than those necessary to ensure compliance with the Board's minimum regulations, provided that the more stringent ordinances are based upon factual findings of local or regional comprehensive watershed management studies or findings developed through the implementation of a MS4 permit or a locally adopted watershed management study and are determined by the locality to be necessary to prevent any further degradation to water resources, to address TMDL requirements, to protect exceptional state waters, or to address specific existing water pollution including nutrient and sediment loadings, stream channel erosion, depleted groundwater resources, or excessive localized flooding within the watershed and that prior to adopting more stringent ordinances a public hearing is held after giving due notice").

117 For example, see Va. Code § 62.1-44.15:33.

118 For example, West Virginia has no statewide stormwater requirements that apply in unregulated areas, but several non-MS4 jurisdictions within the Bay watershed have voluntarily adopted stormwater control requirements for development. West Virginia's Chesapeake Bay Program, *West Virginia's Phase 3 Watershed Implementation Plan*, 28.

119 Wetlands Watch, "Non-MS4 Stormwater Management," http://wetlandswatch.org/nonms4-stormwater-management (accessed February 26, 2021).

120 State of Maryland, *Maryland's Phase III Watershed Implementation Plan*, B-37, B-38.

121 See Abel Russ, *Pollution Trading in the Chesapeake Bay: Threat to Bay Cleanup Progress*, Environmental Integrity Project, August 19, 2019, 1, https://environmentalintegrity.org/wp-content/uploads/2019/08/Pollution-Trading-in-the-Chesapeake-Bay.pdf ("The Bay states sometimes suggest that pollution trading will reduce pollution loads. It will not. Even in a best-case scenario, pollution trading will have no net effect on pollution loads").

122 Ibid., 5.

123 See Virginia DEQ, *Chesapeake Bay TMDL Phase III,* 74 (indicating that the state plans to ramp up outreach and education to unregulated communities about the availability of SLAF funding).

124 New York State, "Governor Cuomo Proposes New Environmental Justice Provisions for State's Water Infrastructure Loan Programs," press release, August 11, 2020, https://www.governor.ny.gov/news/governor-cuomo-proposes-new-environmental-justice-provisions-states-water-infrastructure-loan.

125 Water Environment Federation, "Five Types of Green Infrastructure Incentive Programs," January 10, 2013, https://stormwater.wef.org/2013/01/five-types-of-green-infrastructure-incentive-programs/.

126 Montgomery County Department of Environmental Protection, "RainScapes Rewards Rebates," 2020, https://www.montgomerycountymd.gov/water/rainscapes/rebates.html.

127 See Alisa Valderrama, "Eliminating Tax Hurdles for Homeowners to Invest in Water Efficiency and Green Infrastructure," NRDC, Expert Blog, February 25, 2016, https://www.nrdc.org/experts/alisa-valderrama/eliminating-tax-hurdles-homeowners-invest-water-efficiency-and-green.

128 For more information, see the issue brief on structuring and implementing stormwater fees prepared by NRDC for the Choose Clean Water Coalition. Hammer, *Making It Rain*.

129 See Mark Hiller, "Frustration Storm Over Stormwater Fee," PAhomepage.com, January 3, 2019, https://www.pahomepage.com/news/frustration-storm-over-stormwater-fee/.

130 Russ McIntosh and Adrienne Vicari, *Determining if a Stormwater Utility is Right for Your Community*, Herbert, Roland, & Grubic, Inc., 2018, http://www.hrg-inc.com/wp-content/uploads/2018/02/Guide_Is-a-Stormwater-Utility-Right-For-You.pdf.

131 EPA, *Managing Wet Weather With Green Infrastructure: Municipal Handbook—Incentive Mechanisms*, June 2009, https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_incentives.pdf.

132 See State of Maryland, *Maryland's Phase III Watershed Implementation Plan*, B-40 (describing a circuit rider program implemented on the Eastern Shore of Maryland).

133 EPA, *Tools, Strategies and Lessons Learned from EPA Green Infrastructure Technical Assistance Projects*, December 2015, https://www.epa.gov/sites/production/files/2016-01/documents/gi_tech_asst_summary_508final010515_3.pdf.

134 Chesapeake Stormwater Network, https://chesapeakestormwater.net/.

135 Municipal Online Stormwater Training Center, https://arch.umd.edu/most-center.

136 Center for Watershed Protection, https://www.cwp.org/.

137 The Chesapeake Bay Program has investigated dozens of stormwater practices using an "expert panel" approach and has developed information on how and when it is most effective to deploy particular practices, as well as how much pollution reduction may be expected from each. Chesapeake Bay Program, "BMP Expert Panels," https://www.chesapeakebay.net/who/group/bmp_expert_panels (accessed February 26, 2021).

138 Nell Green Nylen and Michael Kiparsky, *Accelerating Cost-Effective Green Stormwater Infrastructure: Learning From Local Implementation*, Wheeler Institute for Water Law & Policy, Berkeley Law Center for Law, Energy & the Environment, February 2015, https://www.law.berkeley.edu/files/CLEE/GSI_Report_Full_2015-02-25.pdf.

139 Jennifer R. Fetter, "Stormwater Basics," Penn State Extension, last updated March 22, 2018, https://extension.psu.edu/stormwater-basics.

140 Northern Middlesex Council of Governments and Merrimack River Watershed Council, *Developing an Effective Stormwater Education and Outreach Program for Your Community*, June 2014, https://www.urbanwaterslearningnetwork.org/wp-content/uploads/2016/04/Manual-Stormwater-Education-and-Outreach_2014.pdf (accessed February 26, 2021).