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Green Infrastructure for Chesapeake Stormwater Management

Legal Tools for Climate Resilient Siting

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Contents

I. CHESAPEAKE WATERSHED AND CLIMATE CHANGE

The Chesapeake Bay watershed extends through six states and the District of Columbia and is home to almost 18 million people—10 million of whom live along or near the coastline. The 64,000-square mile watershed stretches over 11,684 miles of shoreline and encompasses 150 major rivers and streams.[1]

The Chesapeake is also distinctly susceptible to the impacts of climate change—particularly to increasing flooding and more intense rainstorms. The Northeast Atlantic shares with Louisiana the highest relative sea level rise projection in the United States, at 0.3 to 0.5 meters (one to 1.65 feet) higher than the global mean sea level rise projected for 2100.[2] The Hampton Roads region of Virginia is particularly vulnerable to sea level rise,[3] while Maryland, with 16 of its 23 counties situated within the coastal zone,[4] is expected to witness a relative sea level rise of at least 3.7 feet.[5]

One of the greatest impacts of climate change, both in the near- and long-term, will be on stormwater management. Urban areas located in the Chesapeake watershed face hazards posed by rising sea levels, severe storm surges, and more extreme weather events,[6] all of which contribute to increased localized flooding during rain events. This, in turn, heightens the risk of stormwater facility failure, resulting in pollutants entering water bodies unimpeded.

From a local governance perspective, climate change presents a problem of logistics and infrastructure, requiring one of either two solutions: managed retreat—strategically relocating people and assets away

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[1] *Facts & Figures*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/discover/bay101/facts (last visited June 9, 2017).

[2] NAT'L OCEANIC & ATMOSPHERIC ADMIN., TECHNICAL REP. NOS CO-OPS 083, GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE U. S. vii, 9 (2017) [hereinafter NOAA Sea Level Rise], *available at* https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf.

[3] *See* Howard Botts, Aarti Desai, Wei Du, Thomas Jeffery, & Zach Lindfors, *2017 Storm Surge Report*, CORELOGIC, June 2017, *available at* http://www.corelogic.com/about-us/researchtrends/storm-surge-report.aspx?WT.mc_id=pbw_170530_iRNG1#, *see* Howard Botts, Wei Du, Thomas Jeffery, & Zach Lindfors, *2016 Storm Surge Report*, CORELOGIC, June 2016, *available at* http://corelogic.maps.arcgis.com/apps/MapJournal/index.html?appid=0cd57ed426974442ac928615931803cd, *see* R. J. Nicholls, S. Hanson, C. Herweijer, N. Patmore, S. Hallegatte, J. Corfee-Morlot, Jean Chateau, & Robert Muir Wood, *OECD Environment Working Papers No. 1: Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes*, OECD, 2007. While the Hampton Roads region is noted as being particularly at risk, the degree and overall ranking of this risk can vary. The often cited claim that this region is second only to New Orleans in risk from sea level rise is not documented. Email from Rob Thieler, Dir., Woods Hole Coastal and Marine Sci. Ctr., to Ethan Blumenthal (June 28, 2017, 5:35 PM EST) (on file with author); Email from Tal Ezer, Professor of Ocean, Earth & Atmospheric Sci., Old Dominion Univ, to Ethan Blumenthal (June 29, 2017, 10:00 AM EST) (on file with author); Email from Benjamin Strauss, Vice Pres. for Sea Level and Climate Impacts, Climate Central, to Ethan Blumenthal (July 5, 2017, 3:18 PM EST) (on file with author).

[4] *Md.'s Coastal Zone*, MD. DEP'T NAT. RES., http://dnr.maryland.gov/ccs/Pages/md-coastal-zone.aspx (last visited June 9, 2017).

[5] MD. CLIMATE CHANGE COMM'N, SCI. AND TECH. WORKING GRP., UPDATING MARYLAND'S SEA-LEVEL RISE PROJECTIONS 15 (2013), *available at* http://www.mdsg.umd.edu/sites/default/files/files/Sea-Level_Rise_Projections_Final.pdf.

[6] The Intergovernmental Panel on Climate Change (IPCC) defines "climate extremes" (also known as "extreme weather" or "climate events") as: "The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable." *See* IPCC, *2012: Glossary of terms*, *in* MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION 557 (Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley eds., 2012), *available at* https://www.ipcc.ch/pdf/special-reports/srex/SREX-Annex_Glossary pdf. Examples of extreme events include heat waves, droughts, tornadoes, and hurricanes. *See Extreme Events*, NAT'L CTRS. FOR ENVTL. INFO., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://www.ncdc.noaa.gov/climate-information/extreme-event (last visited June 9, 2017).

from vulnerable areas[7]—or creative adaptation. Yet—and despite numerous emerging efforts among government, academic, and institutional actors to recognize and adapt to climate change—incorporation of climate change impacts into stormwater management planning and implementation of related capital projects has been limited at best. Perhaps most perplexing is that, in a region maintaining a reputation as a pioneer in green infrastructure,[8] few localities have considered how to site and utilize green infrastructure practices more strategically for stormwater management in a changing climate.

This paper focuses on green infrastructure as a solution, and aims to serve as a tool that will enable local governments in Maryland and Virginia to site green infrastructure stormwater management and infiltration projects in locations that maximize the resilience of these projects to projected climate change impacts, while also increasing community capacity to handle projected changes in stormwater resulting from climate change. These two states are home to almost 70 percent of the Chesapeake watershed's population.[9] The paper examines the potential legal obstacles to Maryland and Virginia's state and local governments which may consider spearheading innovation in this area, and explores opportunities to establish binding siting guidelines. We review the most promising pathways within the existing legal framework, and recommend specific actions that legislative and regulatory bodies can take to modify the current stormwater management regime so as to more easily incorporate pragmatic consideration of climate change impacts.

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[7] *See* Miyuki Hino, Christopher B. Field & Katharine J. Mach, *Managed Retreat as a Response to Natural Hazard Risk*, 7 NATURE CLIMATE CHANGE 364, 364 (2017), *available at* http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3252.html.

[8] *See infra* app. B. Green Infrastructure is an environment-oriented method of managing stormwater runoff. *What is Green Infrastructure?*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/what-green-infrastructure (last visited June 20, 2017).

[9] *Population Growth*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/issues/issue/population_growth#inline (last visited June 9, 2017).

II. GREEN INFRASTRUCTURE & LOCAL STORMWATER MANAGEMENT

A. Introduction to Green Infrastructure

Developed areas are a main source of water pollution because of the high quantity of runoff produced by impermeable surfaces such as asphalt and concrete. These surfaces prevent water from being absorbed into the ground and naturally filtered.[10] Unmanaged stormwater can cause erosion, more localized flooding, and greater amounts of pollutants entering into waterways, as stormwater—rain or snowmelt flowing over these hard surfaces—collects pollutants on its way to the storm sewer system.[11]

The conventional strategy for managing urban stormwater is through "grey infrastructure" practices, such as gutters, pipes, and basins, which are designed to efficiently convey stormwater to local water bodies.[12] In a Municipal Separate Storm Sewer System ("MS4"), the stormwater is conveyed through dedicated storm sewers and discharged to waterways without treatment.[13] In a Combined Sewer System ("CSS"), stormwater is collected and conveyed together with wastewater from homes and businesses via combined sewer mains to a sewage treatment plant. Storm events can result in the sewer system and treatment plant exceeding their capacity, ultimately causing sewer overflows and discharges of untreated co-mingled stormwater and wastewater into the environment.[14]

Many localities are turning to "green infrastructure" practices: conserving or mimicking green spaces and natural processes to retain and infiltrate stormwater where it is generated. The goal is to prevent runoff from entering MS4s or CSSs, or slowing the rate of introduction into these systems. Small-scale green infrastructure practices include porous surfaces, rainwater capture, or vegetation. Large-scale practices include creation of interconnected networks of green space, vegetated infiltration basins, grass swales, and wetland restoration. The benefits have been extensively studied, and include reduced stormwater volume, pollution prevention, and groundwater replenishment.[15]

Chesapeake Bay communities pioneered the use of green infrastructure practices to manage stormwater. For example, Prince George's County, Maryland has been credited with initiating small-

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[10] *See Nonpoint Source: Urban Areas*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/nps/nonpoint-source-urban-areas (last visited June 9, 2017).

[11] Storm sewer systems are generally regulated as generators of "point source pollution" which may be traced to single points of origin. However, much stormwater runoff—prior to entering the storm sewer system—is considered to be *non*point pollution. "Nonpoint pollution" is pollution resulting from many diffuse sources, such as precipitation, agricultural runoff, or seepage, which is difficult to trace back to its individual sources. *See What is Nonpoint Source?*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/nps/what-nonpoint-source (last visited June 9, 2017).

[12] *See Benefits of Green Infrastructure*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/benefits-green-infrastructure (last visited June 20, 2017).

[13] *See National Pollutant Discharge Elimination System: Stormwater Discharges from Municipal Sources*, U.S. ENVTL. PROT. ADMIN., https://www.epa.gov/npdes/stormwater-discharges-municipal-sources (last visited June 20, 2017).

[14] *See Combined Sewer Overflows (CSOs)*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/npdes/combined-sewer-overflows-csos (last visited June 20, 2017).

[15] *What is Green Infrastructure?*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/what-green-infrastructure (last visited June 20, 2017).

scale low-impact development/environmental site design techniques as an alternative to traditional stormwater practices.[16] The County later enacted a comprehensive Complete Streets Ordinance, requiring incorporation of green infrastructure practices into many public-right-of-way projects.[17] Other localities, such as Norfolk, Virginia, initiated neighborhood-level practices;[18] while regional organizations, like the Hampton Roads Planning District Commission, developed comprehensive Green Infrastructure Plans as a planning tool to achieve multiple benefits—including stormwater management, recreation, protection of drinking water supplies, and habitat restoration.[19]

B. Key Terms

Clarification is required when using the term "green infrastructure." The term has two common, but distinct uses. The older and broader usage may be best stated as: "An interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations."[20] This paper focuses on the narrower usage, which describes neighborhood- or site-level practices, techniques, and engineered structures for *managing stormwater*, and that mimic natural hydrological systems and are designed to be environmentally friendly.

The narrower version is often synonymous with "environmental site design," "low-impact development," and "non-structural best management practices." Specific examples include: permeable pavement, reinforced turf, disconnection of impervious surfaces, direction of sheetflow to conservation areas, rainwater harvesting, submerged gravel wetlands, landscape infiltration and berms, dry wells, micro-bioretention, rain gardens, green roofs, bio-swales, and enhanced filters.[21]

This paper specifically references terminology derived from legal authorities in the Chesapeake watershed states of Maryland and Virginia, which provide the geographic focus of this analysis. The definitions below are provided to assist in understanding the terms used in this paper. They draw from

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[16] *See* OFFICE OF POLICY DEV. & RESEARCH, U.S. DEP'T OF HOUS. & URBAN DEV., THE PRACTICE OF LOW IMPACT DEVELOPMENT 29 (2003), *available at* https://www.huduser.gov/publications/pdf/practlowimpctdevel.pdf.

[17] *See* PRINCE GEORGE'S COUNTY, MD., CODE §§ 23-102, 23-615; *see also* Prince George's County, Md., Complete and Green Streets Policy, Ordinance CB-83-2012 (2012), *available at* http://www.anacostia.net/Archives/AWSC/documents/CB_83_2012_Dr_3 pdf.

[18] *See* CITY OF NORFOLK PUBLIC WORKS, FEE REDUCTION PROGRAM: WAYS YOU CAN REDUCE YOUR STORMWATER FEE (2016), *available at* http://www.norfolk.gov/DocumentCenter/View/28851, *see also Retain Your Rain*, CITY OF NORFOLK, http://www.norfolk.gov/index.aspx?nid=3700 (last visited June 20, 2017).

[19] *See* HAMPTON ROADS PLANNING DIST. COMM'N, A GREEN INFRASTRUCTURE PLAN FOR THE HAMPTON ROADS REGION (2010), *available at* http://www.hrpdcva.gov/departments/planning/green-infrastructure-plan-for-hampton-roads-region.

[20] MARK A. BENEDICT & EDWARD T. MCMAHON, THE CONSERVATION FUND, GREEN INFRASTRUCTURE: SMART CONSERVATION FOR THE 21ST CENTURY 5 (2006), *available at* http://www.sactree.org/assets/files/greenprint/toolkit/b/greenInfrastructure pdf.

[21] *See also* the definition provided by the U.S. Environmental Protection Agency, and adopted by Maryland's Department of the Environment: "Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits….Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems that mimic nature soak up and store water." Examples cited include: downspout disconnection, rainwater harvesting, rain gardens, planter boxes, bioswales, permeable pavements, green parking, green roofs, urban tree canopy, and land conservation. *What is Green Infrastructure?*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/what-green-infrastructure (last visited June 20, 2017).

federal, state, and local statutes, from regulations, and from documents such as design manuals, model ordinances, and policy statements. In the Chesapeake Bay states, two terms applied similarly when discussing green infrastructure are: *Best Management Practices* and *Environmental Site Design*.

Best Management Practices (BMPs), as referenced in the Virginia Stormwater Management Program regulations, means "schedules of activities, prohibitions of practices, maintenance procedures, and other management practices, including both structural and *nonstructural* practices, to prevent or reduce the pollution of surface waters and groundwater systems."[22]

Environmental Site Design (ESD), as utilized in the Maryland Stormwater Management Act, "means using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources."[23]

ESD is, functionally, a subset of BMPs; specifically, nonstructural BMPs. This paper will use "ESD" in referring to all site-based green infrastructure practices implemented for stormwater management. Occasionally, the discussion will quote Virginia state code or regulations referencing BMPs generally, or non-structural BMPs, but the focus of this paper is on this subset. While ESD, by itself, does not constitute a climate resilient practice, it can be used as a resiliency tool, such as by increasing the overall capacity or amount of green practices on the ground, which would allow or offset additional or higher order storms.

Maximum extent practicable (MEP) is another key term, used both in federal and state documents in reference to stormwater management.[24] This legal term generally describes the extent to which private developers, or government agencies when regulating development activities, must implement stormwater control strategies to protect water quality. It may also *specifically* mean to what extent these parties must implement green infrastructure as the primary method for managing stormwater. According to the Maryland stormwater regulations, "[t]he MEP standard is met when channel stability and 100 percent of the average annual predevelopment groundwater recharge are maintained, nonpoint source pollution is minimized, and structural stormwater management practices are used only if determined to be absolutely necessary."[25] Virginia's stormwater regulations define MEP as a

[22] 9 VA. ADMIN. CODE § 25-870-10 (2017) (emphasis added).
[23] *See* MD. CODE ANN., ENVIR. § 4-201.1(B) (LexisNexis 2017). According to this statute and the Maryland Stormwater Design Manual, ESD practices include: (1) Optimizing conservation of natural features (e.g., drainage patterns, soil, vegetation); (2) minimizing impervious surfaces (e.g., pavement, concrete channels, roofs); (3) slowing down runoff to maintain discharge timing and to increase infiltration and evapotranspiration; and (4) using other nonstructural practices or innovative technologies approved by the Department of the Environment. *Id*.; *see generally* MD. DEP'T OF THE ENV'T, MARYLAND STORMWATER DESIGN MANUAL Chap. 5 (2009) [hereinafter Design Manual], *available at* http://mde.maryland.gov/programs/water/StormwaterManagementProgram/Pages/stormwater_design.aspx.
[24] "Permits for discharges from municipal storm sewers…shall require controls to reduce the discharge of pollutants to the *maximum extent practicable*, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." *See* 33 U.S.C. § 1342(p)(3)(B) (2017) (listing permit requirements for municipal stormwater discharges)(emphasis added).
[25] MD. CODE REGS. 26.17.02.06(A)(2) (2017)

technology-based standard, achieved, in part, "by selecting and implementing effective structural and nonstructural BMPs and rejecting ineffective BMPs…an iterative standard, which evolves over time as urban runoff management knowledge increases."[26]

Common types of small-scale green infrastructure practices

- **Rain gardens** (a.k.a. bioretention, bioinfiltration)—Shallow, vegetation basins that collect and absorb runoff. *Planter boxes* are urban rain gardens, suitable for sites with limited spaces, and have vertical walls and either open or closed bottoms.
- **Bioswales**—Vegetated, mulched, or xeriscaped channels that slow, infiltrate, and filter stormwater. Ideal locations include along streets and parking lots.
- **Permeable pavements**—Constructed of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice infiltrates, treats, and /or stores rainwater where it falls, and is suited for parking lots and low-traffic transportation corridors.
- **Green Streets**—Integrates multiple green infrastructure elements into street or alley design.
- **Green roofs**—Covered with vegetation that infiltrates rainfall and evapotranspirates stored water, green roofs are particularly cost-effective in dense urban areas.

What is Green Infrastructure?, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/what-green-infrastructure (last visited June 9, 2017).

C. Incorporating climate change impacts into local green infrastructure siting and design criteria

Today, a plethora of data assists communities in understanding the projected impacts of climate change. These data can help localities identify and prioritize green infrastructure sites, so that the desired long-term sustainability of projects, calculated against predicted environmental conditions, can be built into processes for the selection and design of specific stormwater facilities. In short, communities that account for storm surge, sea level rise, and increased intensity and occurrence of extreme weather events, can better target where to locate new ESD stormwater facilities, determine how to size them, and project what maintenance and monitoring activities will be needed.

Maryland and Virginia communities should be able to prescribe where ESDs can best be applied, given changing climatic conditions using data sources, including those identified in Appendix A, and the resources of state agencies and universities. In addressing climate change while promoting green infrastructure, Public Works, Engineering, and Planning officials must determine the best sites to locate specific stormwater practices in order to:

(1) Most effectively control anticipated climate change impacts to water quantity and quality (i.e. increased localized flooding due to greater precipitation, sea level rise, and storm surge)

[26] 9 VA. ADMIN. CODE § 25-870-10 (2017).

(2) Ensure the long-term sustainability of the stormwater facilities themselves. For example, ESDs placed in areas where stormwater runoff volume and quality are expected to change over time must continue to function adequately under conditions of frequent inundation and increased salinity.

Designing site-based criteria for small-scale green infrastructure practices: matching stormwater facilities to climate change conditions

Climate change poses a serious risk to local governments' ability to manage stormwater. Extreme weather events, greater precipitation, and sea level rise threaten to overwhelm existing infrastructure. At the same time, many officials are considering updating their stormwater systems with green infrastructure, which offers multiple ecological and community benefits. This contrasts with traditional grey infrastructure—conventional piped drainage and water treatment systems.

Officials should consider the following when developing standards for siting green infrastructure practices—particularly when these practices are specifically intended to better control increased stormwater runoff over time, due to climate change:

- **Watershed vs. parcel-based standards.** Taking a watershed approach permits local governments to delineate specific zones, or areas, based on predicted climate change impacts. For example, certain areas are anticipated to be completely inundated, while scientists predict less drastic increases in annual flooding in other areas. Similarly, different regions may be predicted to experience varying rainfall characteristics, such as in storm duration, intensity, and location of peak intensity. Engineers can prescribe certain green infrastructure practices—based on type, size, and capacity—for each area. Developers responsible for implementing ESDs would be required or encouraged to select among the practices prescribed for the area in which their parcel is located.
- **Prioritization.** Officials can develop a process for choosing and prioritizing among the best project sites within the watershed. This starts with an assessment of landscape characteristics, jurisdictional attributes, water quality *and* quantity control needs—based on current data and predicted climate change impacts—infiltration capacity, total and percent impervious area, and site sustainability.[27] Then capital expenditures on public works and designation of sites for managing stormwater from private development activities can be effectively sited for long term sustainability.
- **Capacity.** ESDs have different capacities to manage stormwater; some are better suited to control and filter significant amounts of runoff. Engineers can modify ESD design to account for changing amounts of runoff and salinity concentration over time, as sea levels rise and the locality experiences greater amounts of precipitation.
- **Lifecycle design.** Officials may plan for a "managed retreat" strategy in neighborhoods anticipated to be inundated after a period of time. In the short-term, less-expensive green infrastructure practices, designed for a limited lifespan of up to a few decades, may be more appropriate for these areas.
- **Maintenance.** Climate change impacts may impact how, and how easily, green infrastructure practices are maintained. Some ESDs may require more frequent maintenance due to managing greater amounts of runoff as the effects of climate change increase in severity.
- **Neighborhood characteristics and community input.** Green infrastructure can enhance communities by improving water and air quality, adding habitat and wildlife, increasing walkability, and promoting neighborhood beauty. Residents benefit from "green jobs," improved health, more recreation space, and

[27] *See, e.g.*, U.S. ENVTL. PROT. AGENCY, GREEN INFRASTRUCTURE AND CLIMATE CHANGE: COLLABORATING TO IMPROVE COMMUNITY RESILIENCY 7 (2016), *available at* https://www.epa.gov/sites/production/files/2016-08/documents/gi_climate_charrettes_final_508_2 pdf.

higher property values. Officials should select the types of green infrastructure practices which maximize these benefits. Examples include rain gardens, planter boxes, "green streets," and urban trees. Cities can also encourage residents, through financial incentives, education, and outreach, to voluntarily install ESDs—such as green roofs and rainwater harvesting—on their own properties.

Additional resources:

- *Performance of Green Infrastructure*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/performance-green-infrastructure (last visited June 9, 2017).
- *Green Infrastructure for Climate Resiliency*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/green-infrastructure/green-infrastructure-climate-resiliency (last visited June 9, 2017).
- Hua-peng Quin, Zhuo-xi Li, and Guangtao Fu, *The effects of low impact development on urban flooding under different rainfall characteristics*, 129 J. of Envt'l Mngmnt. 577, 577-85 (2013), *available at* http://www.sciencedirect.com/science/article/pii/S0301479713005495.

III. STORMWATER MANAGEMENT IN VIRGINIA AND MARYLAND

The current legal framework for stormwater management in Virginia and Maryland provides the initial basis for analysis. Adoption of climate-resilient ESD practices and requirements is subject to this framework unless additional legislation is adopted.

A. Federal Framework

The federal National Pollutant Discharge Elimination System (NPDES), authorized under the Clean Water Act (CWA), addresses water pollution by regulating point sources that discharge pollutants to the waters of the United States. The NPDES stormwater program regulates stormwater discharges from municipal separate storm sewer systems (MS4s),[28] as well as stormwater discharges from construction and industrial activities.[29] Operation of an MS4 is conditioned on operators obtaining an NPDES permit, and developing and implementing a stormwater management program. Local governments usually are the MS4 permittees. States establish NPDES permitting programs in accordance with federal requirements, and oversee compliance with MS4 permits. MS4 permits require implementing controls to reduce pollution discharge to the "maximum extent practicable" (MEP).[30]

Most localities in Maryland and Virginia operate MS4s, as opposed to municipal combined storm and sanitary sewer systems (CSSs), which are found chiefly in the older cities in the region. These combined systems are also subject to NPDES permit requirements. CSSs which experience Combined Sewer Overflows (CSOs) are required to develop a long-term control plan to reduce and eventually eliminate the discharge of untreated pollutants from the system during wet weather events.[31]

State-mandated stormwater management plans are helpful in driving source reduction within these long-term control plans.

B. Chesapeake Regional Programs

Maryland and Virginia's stormwater programs and water quality protection activities are affected by several regional programs that affect their legal commitments, accountability, and funding opportunities.

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[28] MS4 operators are distinguished between Phase I MS4s—localities with populations of 100,000 or more, which are required to obtain NPDES permits—and Phase II MS4s. Phase II MS4s are small MS4s in urbanized areas and other, designated non-urban MS4s, which must also obtain NPDES permit coverage. *See National Pollutant Discharge Elimination System: Stormwater Discharges from Municipal Sources*, U.S. ENVTL. PROT. ADMIN. https://www.epa.gov/npdes/stormwater-discharges-municipal-sources (last visited June 20, 2017).

[29] *See Stormwater Discharges from Construction Activities*, U.S. ENVTL. PROT. ADMIN. https://www.epa.gov/npdes/stormwater-discharges-construction-activities (last visited June 28, 2017); *see Stormwater Discharges from Industrial Activities*, U.S. ENVTL. PROT. ADMIN. https://www.epa.gov/npdes/stormwater-discharges-industrial-activities (last visited June 28, 2017).

[30] 33 U.S.C. § 1342(p)(3)(B)(iii).

[31] *See* Combined Sewer Overflow (CSO) Control Policy, 59 Fed. Reg. 18,688 (Apr. 19, 1994).

Chesapeake Bay Watershed Agreement. This multi-state federal-state agreement guides conservation and restoration of the estuary and its watershed. The most recent version was signed June 16, 2014, and contains 10 goals aimed at advancing watershed restoration. Goals include promoting species and habitat protection, ensuring water quality, addressing climate change, advancing land conservation, and engaging public participation.[32]

Chesapeake Bay Total Maximum Daily Load (TMDL). Established by the U.S. Environmental Protection Agency on December 29, 2010, the TMDL identifies the necessary pollution reductions from major sources of nitrogen, phosphorus, and sediment and sets pollution limits necessary to meet water quality standards. Accountability is ensured by state-specific short-term goals, the Chesapeake Bay Programmatic Milestones, and the Chesapeake Bay Watershed Implementation Plans (WIPs).[33]

Stormwater management efforts are intended to advance compliance with the TMDL as well as the goals of the Chesapeake Bay Watershed Agreement.

C. Virginia Framework

Virginia's Department of Environmental Quality (DEQ) administers the state's NPDES stormwater program under the Virginia Pollutant Discharge Elimination System (VPDES) Permit Program. MS4 permits focus primarily on improving water quality and require operators to implement an MS4 Program Plan, which must comply with the Virginia Stormwater Management Act (VSMA).[34]

The VSMA and its associated regulations in the Virginia Administrative Code[35] regulate, permit, and control stormwater runoff in the Commonwealth. The Virginia *Stormwater Management Handbook*, *Stormwater Management Model Ordinance*, and *BMP Standards and Specifications* provide technical guidance.[36]

Virginia's stormwater management regime continues to undergo revision. Prior to 2012, stormwater was regulated separately from soil erosion and sediment control. However, Virginia House Bill 1065/Senate Bill 407, enacted in 2012, integrated elements of stormwater management, erosion and

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[32] *Chesapeake Bay Watershed Agreement*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/chesapeakebaywatershedagreement/page (last visited June 12, 2017).
[33] *Chesapeake Bay Total Maximum Daily Loads*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/chesapeake-bay-tmdl (last visited June 12, 2017).
[34] VA. CODE ANN. §§ 62.1-44.15:24—62.1-44.15:50 (2017); *Municipal Separate Storm Sewer System (MS4) Permits*, VA. DEP'T OF ENVTL. QUALITY, http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/MS4Permits.aspx (last visited June 21, 2017).
[35] 9 VA. ADMIN. CODE §§ 25-870-10—25-870-830 (2017).
[36] *See* VA. DEP'T OF ENVTL. QUALITY, VIRGINIA STORMWATER MANAGEMENT HANDBOOK (DRAFT 2d ed. 2013) [hereinafter Virginia Stormwater Management Handbook], *available at* http://www.deq.virginia.gov/fileshare/wps/2013_SWM_Handbook/, *see* VA. DEP'T OF CONSERVATION & RECREATION, STORMWATER MANAGEMENT MODEL ORDINANCE (2012) [hereinafter Model Ordinance]; *see* VA. DEP'T OF ENVTL. QUALITY, 2013 BMP STANDARDS & SPECIFICATIONS (DRAFT 2013), *available at* http://www.deq.virginia.gov/fileshare/wps/2013_DRAFT_BMP_Specs/.

sediment control, and provisions of the Virginia Chesapeake Bay Preservation Act.[37] The 2012 law required localities to adopt a Virginia Stormwater Management Program (VSMP) as of July, 2014,[38] and all localities would continue to administer the Virginia Erosion and Sediment Control Program (VESCP).[39] The goal was to integrate these programs with one another, along with flood management, at the local level.

House Bill 1173/Senate Bill 423 was enacted in 2014.[40] It recognized the concerns of a number of small localities in Virginia's Tidewater region. One concern involved lack of local resources to adequately manage stormwater runoff from land disturbing activities between 2,500 sq. ft. and 1 acre in size located in a designated Chesapeake Bay Preservation Area (this challenge is unique to Tidewater localities: outside of such Areas, stormwater management plans do not apply to land-disturbing activities occurring on properties less than one acre, and erosion and sediment control regulations do not apply to land-disturbing activities that disturb less than 10,000 sq. ft.).[41] The bill addressed these concerns by permitting localities that do not operate an MS4, to opt-out of administering a VSMP. DEQ then would establish a VSMP for any locality that neither establishes its own program nor operates a MS4.[42]

House Bill 1250/Senate Bill 673, enacted in 2016, further refines this framework. Under HB 1250, all localities operating an MS4 system (all Phase I and II MS4s) must adopt and administer a consolidated

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[37] *See* 2012 Va. HB 1065.

[38] HB 1065 required a VSMP be administered in each locality. While towns not operating an MS4 could opt out of developing and administering a VSMP, these towns would then be subject to the VSMP of the county in which they were located. *See id.* at §10.1-603.3(A-B) ("Any locality, excluding towns, unless such town operates a regulated MS4, shall be required to adopt a VSMP for land-disturbing activities consistent with the provisions of this article according to a schedule set by the Board…Any town lying within a county, which has adopted a VSMP in accordance with subsection A, may adopt its own program or shall become subject to the county program").

[39] *See id* at § 10.1-561.

[40] *See* 2014 Va. HB 1173.

[41] Virginia's sediment control statutes requires VESCP authority approval of an erosion and sediment control plan for land-disturbing activities, with certain exceptions including "[d]isturbance of a land area of less than 10,000 square feet in size or less than 2,500 square feet in an area designated as a Chesapeake Bay Preservation Area pursuant to the Chesapeake Bay Preservation Act…." VA. CODE ANN. § 62.1-44.15:55(F)(1) (2017). Under HB 1065, the VSMA required VSMP authority approval to conduct any land-disturbing activity, with exemptions including "[l]and-disturbing activities that disturb less than one acre of land area except for land-disturbing activity exceeding an area of 2,500 square feet in all areas of the jurisdictions designated as subject to the Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20 et seq.) adopted pursuant to the Chesapeake Bay Preservation Act…" 2012 Va. HB 1065, § 10.1-603.8(C)(4); *see also* 2014 Va. HB 1173, § 62.1-44.15:34 (maintaining the same language). The current version of the VSMA requires a VESMP permit to conduct any land-disturbing activity that "disturbs one acre or more of land," or "For a land-disturbing activity occurring in an area designated as a Chesapeake Bay Preservation Area subject to the Chesapeake Bay Preservation Act…Soil erosion control and water quantity and water quality criteria shall apply to any land-disturbing activity that disturbs 2,500 square feet or more of land…." VA. CODE ANN. § 62.1-44.15:34(E)(1)-(3).

[42] *See* 2014 Va. HB 1173, § 62.1-44.15:27(A) ("Any locality that operates a regulated MS4 or that notifies the Department of its decision to participate in the establishment of a VSMP shall be required to adopt a VSMP for land-disturbing activities consistent with the provisions of this article according to a schedule set by the Department.…The Department shall operate a VSMP on behalf of any locality that does not operate a regulated MS4 and that does not notify the Department, according to a schedule set by the Department, of its decision to participate in the establishment of a VSMP. A locality that decides not to establish a VSMP shall still comply with the requirements set forth in this article and attendant regulations as required to satisfy the stormwater flow rate capacity and velocity requirements set forth in the Erosion and Sediment Control Law….")

Virginia Erosion and Stormwater Management Program (VESMP).[43] The State Water Control Board approves VESMPs, which are thereafter subject to a five-year review. [44]

Each locality which does not operate an MS4, and which previously opted to have DEQ administer a VSMP for it pursuant to HB 1173, may select one of three options: (1) adopt its own VESMP; (2) adopt its own VESMP, with DEQ technical support; or (3) continue to administer its current Virginia Erosion and Sediment Control Program (VESCP), while the State Water Control Board administers a VSMP on its behalf.[45]

The VESMP framework becomes effective in July 2018 pursuant to House Bill 1774, which was adopted by the Virginia General Assembly in 2017.[46] The bill also establishes a work group to review and consider easier-to-administer alternative methods of stormwater management which rural Tidewater localities could implement while maintaining control over water quality and quantity. The work group is scheduled to meet summer 2017, and report its results to the Governor and legislature by January 1, 2018.[47]

D. Maryland Framework

Maryland's stormwater statutes and regulations require local governments to establish stormwater management programs (SWMPs), under which they issue permits for new development.[48] The Water Management Administration, within the Maryland Department of the Environment (MDE), implements and supervises the stormwater management program. The Water Management Administration determines whether local stormwater management plans are acceptable under its regulations, and subjects them to a triennial review.[49] Under Maryland law, proposed new developments must draft stormwater management plans, and apply ESD to the MEP as the preferred method for controlling runoff.[50] The requirements apply to both public and private development and stormwater facilities,[51]

[43] *See* Virginia Erosion and Stormwater Management Act, 2016 Va. SB 673 (requiring any locality operating a MS4 permit or VSMP to adopt a VESMP regulating any land-disturbing activity disturbing 10,000 or more square feet generally, or 2,500 or more square feet if located in a Chesapeake Bay Preservation Area). Rather than developing a new model ordinance, DEQ will issue a conversion chart, converting the existing state stormwater management code provisions to the updated versions.

[44] *Id*. at 62.1-44.15(19). For a map of current VSMP authorities, *see* VA. DEP'T OF ENVT. QUALITY, LOCAL VSMP AUTHORITIES (2016), *available at* http://www.deq.virginia.gov/Portals/0/DEQ/Water/StormwaterManagement/VSMP_Map_V2 pdf.

[45] The Commonwealth will administer the retained category of "VSMP" authority—*not* "VESMP"—for these localities, and will manage only the quality and quantity of stormwater runoff resulting from development that disturbs one acre or more of land. *See* VA. CODE ANN. § 62.1-44.15:27 (2017).

[46] *See* 2016 Va. HB 1774.

[47] The new VESMP program has not yet taken effect, with the legislature this year delaying implementation until July 2018. *See* 2016 Va. HB 1774 (delaying, from July 1, 2017, to July 1, 2018, the effective date of new stormwater laws enacted during the 2016 Session of the General Assembly—the tenth enactments of Chapters 68 and 758 of the Acts of Assembly of 2016).

[48] MD. CODE ANN., ENVIR. § 4-202 (LexisNexis 2017). A 2012 law mandated the state's 10 largest jurisdictions create a Maryland Stormwater Fee by July 1, 2013. In 2015, the legislature changed the law to give those localities the option to fund stormwater programs through a dedicated fee or by other means. MD. CODE ANN., ENVIR. § 4-202.1 (LexisNexis 2017).

[49] MD. CODE ANN., ENVIR. § 4-206 (LexisNexis 2017); MD. CODE REGS. 26.17.02.03(C) (2017). Any proposed amendments to local stormwater management ordinances are also subject to Administration review and approval. MD. CODE REGS. 26.17.02.04(A) (2017).

[50] MD. CODE ANN., ENVIR. § 4-203(b)(5)(ii)(3)(A)(2017).

although localities have the discretion to impose upon *themselves* more stringent criteria—presumably including incorporating climate change considerations into siting ESD programs.[52] However, more stringent criteria would not apply to private developers without MDE's approval.[53]

Maryland MS4 permits focus primarily on water quality. Permittees are required to maintain a stormwater management program under the stormwater management statutes, and implement the techniques, practices, and methods specified in the state *Stormwater Design Manual*.[54] MS4 permittees must, as part of reducing discharge of pollutants to the MEP, provide a detailed restoration plan, based on an impervious surface area assessment. By the end of the five-year permit term, the permittees must implement restoration efforts for 20 percent of their impervious surface area. Equivalent acres of impervious surfaces restored—via techniques such as new retrofits—are based upon the treatment of the Water Quality Volume (WQ_v) criteria and associated list of practices defined in the *Stormwater Design Manual*.[55] This is in order to meet stormwater wasteload allocations (WLAs) included in the EPA-approved Total Maximum Daily Loads (TMDLs).[56]

State and local watershed implementation plans (WIPs) address the Chesapeake Bay TMDL and require Maryland local jurisdictions to restore some percentage of untreated impervious area.[57]

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[51] MD. CODE ANN., ENVIR. § 4-204(a) (2015).
[52] MD. CODE ANN., ENVIR. § 4-203(b)(5)(i) (2015).
[53] *See* MD. CODE ANN., ENVIR. § 4-203(b)(9)(i) (2015); MD. CODE REGS. 26.17.02.03(A)(2) (2017).
[54] *See, e.g.*, MD. DEP'T OF THE ENV'T, 11-DP-3314 MD0068284, NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM: MUNICIPAL SEPARATE STORMWATER SEWER SYSTEM DISCHARGE PERMIT (2014).
[55] MD. DEP'T OF THE ENV'T, ACCOUNTING FOR STORMWATER WASTELOAD ALLOCATIONS AND IMPERVIOUS ACRES TREATED: GUIDANCE FOR NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM STORMWATER PERMITS (2014) [hereinafter Md. NPDES Guidance].
[56] "A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality." *See* Clean Water Act § 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs), U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/tmdl (last visited June 12, 2017).
[57] Md. NPDES Guidance, *supra* note 55.

IV. CURRENT DEVELOPMENTS IN ESD SITING & DESIGN TO PROMOTE CLIMATE RESILIENCY

The prevailing approach toward green infrastructure in Maryland and Virginia treats it chiefly as a local stormwater management technique focused on improving water quality. In these states, climate adaptation and resiliency are addressed outside of the stormwater management framework.

Climate adaptation is viewed instead as a flood management and hazard mitigation effort, with a focus on safety and liability. Conversation only recently began on the subject of developing climate change-based siting and design criteria for ESDs and for green infrastructure in its broader application. Efforts to develop guidelines are underway, but few—if any—actual ESD projects using siting criteria have been implemented.

Chesapeake Bay watershed communities are aware of hazards posed by rising sea levels and changing precipitation patterns. State and local governments, along with regional academic and nonprofit institutions, have or will soon issue climate adaptation and resiliency plans. While these plans often identify stormwater management as an essential component, siting and design guidelines—when they exist—are vague, and largely are not specific to ESDs.

- The **Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA)** initiated conversations about incorporating climate change into stormwater management plans. In 2016, the EPA and NOAA issued a report focusing on tools and methods for incorporating climate change into stormwater/land use management plans, drawing from a series of 2013 workshops held in the Chesapeake Bay and Great Lakes regions. The EPA and NOAA identify, from data compiled from the discussions, four main topic areas on challenges and solutions: incorporating climate change into planning, building local capacity, identifying community green infrastructure costs and benefits, and implementation within current governance structures.[58]

- The **Center for Watershed Prevention** made an important contribution to discussion of practical approaches with its 2011 *Linking Stormwater and Climate Change: Retooling for Adaptation*. The authors center on upgrading stormwater facility design—particularly ESDs—to accommodate climate change impacts. This technical paper notes critical changes likely needed for many stormwater mainstays, such as determining the appropriate "design storm," due to the likelihood of significant increases in winter precipitation and a shift to storms which are less frequent, but of greater intensity.[59]

[58] *See* NAT'L CTR. FOR ENVTL. ASSESSMENT, NAT'L OCEANIC & ATMOSPHERIC ADMIN., EPA/600/R-15/087F, STORMWATER MANAGEMENT IN RESPONSE TO CLIMATE CHANGE IMPACTS: LESSONS FROM THE CHESAPEAKE BAY AND GREAT LAKES REGIONS (2016).

[59] Dave J. Hirschman, Deb S. Caraco & Sadie R. Drescher, *Linking Stormwater and Climate Change: Retooling for Adaptation*, 2 WATERSHED SCI. BULL. 11, 14 (2011). The authors advocate focusing on designing for climate uncertainty, and on broad design

- The **American Society of Civil Engineers' Environment & Water Resources Institute (ASCE-EWRI)** is exploring revisions to established stormwater management concepts in the face of "nonstationary hydrologic extreme events." Such events include extreme precipitation, floods, droughts, and sea level rise. ASCE-EWRI is questioning the current practice of designing hydraulic structures on the assumption that extreme hydraulic events are stationary.[60] Continuing this practice is a growing concern, because of the effect of various factors such as human intervention in river basins, low frequency climatic variability, and climate change due to increased greenhouse gasses in the atmosphere.[61] In addition to considering methods for making better predictions of extreme events, ASCE-EWRI has undertaken efforts to update the Curve Number Hydrology Method chapters in the National Engineering Handbook, in conjunction with the Natural Resources Conservation Service.[62] This methodology is widely used to determine the relationship between rainfall and the estimated runoff.

- The **Chesapeake Bay Program's Climate Resiliency Working Group** is taking leadership on this issue and is developing a two-day workshop, entitled Monitoring and Assessing Impacts of Changes in Weather Patterns and Extreme Events on BMP Siting and Design, to take place in autumn 2017. One focus of the workshop is on compiling siting and design guidelines to reduce the future impact of changing climactic conditions (including sea level rise, coastal storms, increased temperatures, and extreme events) on urban stormwater, agriculture, and stream restoration BMPs.[63]

No locality in Maryland is programmatically incorporating climate change resiliency considerations when siting ESDs/non-structural BMPs for stormwater management. A number of localities have prepared climate resiliency and adaptation plans, such as Baltimore's Disaster Preparedness and Planning Project.[64] Others have conducted climate impact studies, such as Queen Anne's County.[65] But integration of climate adaptation with ESD lies ahead.

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principles and approaches that: "(1) enhance storage and treatment in natural areas; (2) use small-scale storage and treatment; and (3) provide conveyances that allow for a margin of safety for flood conveyance and water treatment." *Id.* at 14.

[60] "Standard practice in planning and design for flood and drought protection, and in siting and dimensioning water projects, typically involves the assumption of a stable and stationary climate. The stationarity assumption requires that the mean and variance of climatic conditions do not change over time." J.C. Knox & Z.W. Kundzewicz, *Extreme hydrological events, palaeo-information and climate change*, 42 HYDROLOGICAL SCI. J. 765, 768 (1997).

[61] Email from Brian Parsons, Dir., Am. Soc'y of Civ. Eng'rs' Env't & Water Resources Inst., to author (Mar. 29, 2017, 02:49 PM EST) (on file with author); Telephone Interview with Brian Parsons, Dir., Am. Soc'y of Civ. Eng'rs' Env't & Water Resources Inst. (Mar. 27, 2017).

[62] The Curve Number (CN) method is utilized to compute total storm runoff based on total rainfall.

[63] ZOË JOHNSON & SUSAN JULIUS, CLIMATE RESILIENCY WORKING GRP., CHESAPEAKE BAY PROGRAM, PROPOSAL FOR RESPONSIVE STAC WORKSHOP ON: MONITORING AND ASSESSING IMPACTS OF CHANGES IN WEATHER PATTERNS AND EXTREME EVENTS ON BMP SITING AND DESIGN (2017), *available at* http://www.chesapeake.org/stac/presentations/264_Proposal%204_FINAL_Monitoring%20and%20Assessing%20Impacts%20of%20Changes%20in%20Weather%20Patterns%20and%20Extreme%20Events%20on%20BMP%20Siting%20and%20Design pdf.

[64] *See, e.g.*, CITY OF BALTIMORE, DISASTER PREPAREDNESS AND PLANNING PROJECT ("DP3"): A COMBINED ALL HAZARDS MITIGATION AND CLIMATE ADAPTATION PLAN (2013), *available at* http://www.baltimoresustainability.org/plans/disaster-preparedness-plan/. The DP3 does make recommendations pertaining to ESD in stormwater management. Specifically, one recommendation, under Infrastructure goals, is to alter transportation systems in flood-prone areas in order to effectively manage

Similarly, no locality in Virginia has systematically incorporated climate change resiliency considerations when *siting* ESDs/non-structural BMPs, although Norfolk has undertaken some activities leading in that direction. Virginia Beach meanwhile is updating the design storms upon which to base future BMP design, a key climate change consideration.[66] A number of Virginia local governments have completed or initiated a climate resiliency plan.

A few cities--Norfolk, Newport News, and Hampton--have consulted with Dutch experts ("Dutch Dialogues") to incorporate a new "living with water" approach into stormwater management.[67]

SNAPSHOT: Virginia Beach

With a population of approximately 450,000 residents, Virginia Beach is taking a proactive approach, using climate change impact projections in order to ensure the cost-effectiveness of future stormwater management projects. The city recently engaged a consultant to conduct a study on recurrent flooding and sea level rise. The first study will encompass precipitation, sea level changes and tidal impacts, and address both water quantity and quality. Significantly, the city will update the design storm, upon which stormwater design criteria are based. The city anticipates the design storm for 1-, 10- and 100-year/24 hour storm events will likely show Virginia Beach is experiencing increased rainfall. The updated design storm will inform an amendment to the city's public works specifications, which will be proposed to the City Council.[68] While Virginia's Administrative code requires design storms utilize the rainfall precipitation frequency data recommended by NOAA Atlas 14, the city may be able to use its updated data to supplement the older standard, viewed as a regulatory floor rather than as a ceiling.[69]

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stormwater, including encouraging Green Streets in flood prone and other areas, as well as installing permeable pavement in non-critical areas. *See id.* at 180-81.

[65] QUEEN ANNE'S CTY. DEP'T OF PUB. WORKS, SEA LEVEL RISE AND COASTAL VULNERABILITY ASSESSMENT AND IMPLEMENTATION PLAN (2016), *available at* http://www.qac.org/DocumentCenter/View/5456.

[66] Telephone Interview with Greg Johnson, Stormwater Technical Services Engineer, City of Virginia Beach Department of Public Works (Mar. 14, 2017). *See also* Greg Johnson, *The Trident Approach to Stormwater Management*, HAMPTON ROADS WATER SYMPOSIUM (Sept. 20, 2016), *available at* http://www.hrpdcva.gov/uploads/docs/06_Trident%20Approach%20to%20SW%20Mgmt_G%20Johnson%20VB pdf.

[67] Cities across the United States participate in these "Dutch Dialogues" workshops, which integrate local expertise with the Netherlands' multi-century experience in stormwater and flood management in order to yield new innovations in managing local water challenges. *See, e.g.*, *Life at Sea Level*, DUTCH DIALOGUES VA., http://www.lifeatsealevel.org/ (last visited June 12, 2017); *see also* Michael Kimmelman, *The Dutch Have Solutions to Rising Seas. The World Is Watching*, N.Y. TIMES, June 15, 2017, *available at* https://www.nytimes.com/interactive/2017/06/15/world/europe/climate-change-rotterdam.html?emc=edit_th_20170616&nl=todaysheadlines&nlid=66441156&_r=0.

[68] Telephone Interview with Greg Johnson, Stormwater Technical Services Engineer, City of Virginia Beach Department of Public Works (Mar. 14, 2017).

[69] *See* 9 VA. ADMIN. CODE 25-870-66 (2017) ("Nothing in this section shall prohibit a locality's VSMP authority from establishing a more stringent standard in accordance with § 62.1-44.15:33 of the Code of Virginia"); *see* 9 VA. ADMIN. CODE 25-870-72(A) ("*Unless otherwise specified*, the prescribed design storms are the one-year, two-year, and 10-year 24-hour storms using the site-specific rainfall precipitation frequency data recommended by the U.S. National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Partial duration time series shall be used for the precipitation data" (emphasis added)); *see also* 9 VA. ADMIN. CODE 25-870-72(C) ("The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) synthetic 24-hour rainfall distribution and models, including, but not limited to TR-55 and TR-20; hydrologic and hydraulic methods developed by the U.S. Army Corps of Engineers; or *other standard hydrologic and hydraulic methods*, shall be used to conduct the analyses described in this part") (emphasis added).

SNAPSHOT: Norfolk

Norfolk is home to nearly 250,000 residents, and the site of the world's largest naval station, which serves as headquarters of the Atlantic fleet. Norfolk is situated in the state's Tidewater region and is uniquely vulnerable to climate change-exacerbated flooding. This is due to a combination of low elevation and ongoing subsidence, and a projected sea level rise twice that of the global average.[70] Norfolk has engaged in adaptation and resiliency planning since at least 2007. The city is taking a Dutch-influenced "living with water" approach, which combines traditional flood-prevention intervention (barriers) and nature-based approaches (sponges), with at least one action plan estimated at a $1 billion implementation cost.[71] The Rockefeller Foundation named Norfolk a pilot municipality for the organization's 100 Resilient Cities initiative in fall 2013, and the next year the city required all new structures be built "three feet above the predicted level that water will rise in a flood"[72]—one of the strictest standards in the state. Yet implementation is only beginning, and is limited to small-scale, parcel-based neighborhood-level projects. Norfolk will receive a portion of a $120 million U.S. Department of Housing and Urban Development's National Disaster Resiliency Competition (NDRC) grant, which was awarded to the state in 2016. Some of this funding will be expended upon green infrastructure, although most is anticipated to fund traditional grey infrastructure projects.[73] There is currently no citywide policy on green infrastructure, and stormwater projects are planned on a project-by-project basis.

[70] The global mean sea level is projected to rise between 0.3 and 2.5 meters (one to 8.2 feet) by 2100. NOAA Sea Level Rise, *supra* note 2, at 21. U.S.G.S. estimated that land subsidence accounts for more than half the relative sea-level rise in the Hampton Roads region, which experiences the highest rate of sea-level rise on the Atlantic Coast. Subsidence in this area is caused by a combination of compaction from extensive groundwater pumping and the glacial isostatic adjustment of the Earth's crust in response to glacier formation and melting. *See* JACK EGGLESTON & JASON POPE, U.S. GEOLOGICAL SURVEY, CIRCULAR 1392, LAND SUBSIDENCE AND RELATIVE SEA-LEVEL RISE IN THE SOUTHERN CHESAPEAKE BAY REGION 2, 11, 14 (2013), *available at* https://pubs.usgs.gov/circ/1392/pdf/circ1392 pdf.

[71] *About Dutch Dialogues*, DUTCH DIALOGUES VA., http://www.lifeatsealevel.org/about-dutch-dialogues/ (last visited June 21, 2017); Norfolk, Va. City Council Res. 1,609, 2 (2015), *available at* http://www.norfolk.gov/documentcenter/view/20208.

[72] CITY OF NORFOLK, VA., COASTAL RESILIENCE STRATEGY 4, 10 (2015), *available at* https://www.norfolk.gov/DocumentCenter/View/16292.

[73] *See* Press Release, U.S. Department of Housing and Urban Development, HUD Awards $1 Billion Through National Disaster Resilience Competition (Jan. 21, 2016), *available at* https://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2016/HUDNo_16-006.

V. OPPORTUNITIES TO ESTABLISH CLIMATE RESILIENCY-BASED ESD SITING GUIDELINES USING THE EXISTING LEGAL FRAMEWORK

A. Introduction

State agencies and localities in Virginia and Maryland maintain the discretion to establish and implement ESD siting guidelines applicable to their own, publicly funded stormwater facility projects. The key inquiry is whether local stormwater management entities may adopt a *binding* set of guidelines applicable to both public capital projects and to private development activities. There are multiple benefits associated with taking a mandatory and systematic approach to adopt a climate resiliency tool for green infrastructure. States may prefer establishing a uniform set of policies and processes, with sufficient flexibility to account for local variation. Local governments can reduce uncertainty and risk by ensuring future administrations follow the guidelines.

Maryland and Virginia's legislative bodies undoubtedly can establish or require the development of binding siting and design guidelines for green infrastructure via statutory amendments. However, it is important to understand how both the relevant state agencies and local governments may be empowered to adopt such measures within the *existing* legal frameworks.

The following subsections identify and analyze potential existing pathways that Virginia and Maryland state agencies, and their political subdivisions, can pursue. Using this route, administrators and local officials can to take immediate action to address climate change impacts on green infrastructure stormwater management systems.

B. Existing Legal Framework: Authority for State Agency Actions

1. Virginia

A number of existing statutory and regulatory provisions enable Virginia's State Water Control Board ("Board"), administered by the Department of Environmental Quality ("DEQ"),[74] to define ESD siting guidelines for VSMP/VESMP authorities. The power is generally rooted in the Board's authority to prescribe ESD siting guidelines for local VSMPs/VESMPs, granted under several provisions of the Virginia Stormwater Management Act.

The VSMA contains a provision granting the Board its general powers, which are in addition to more specific powers and duties elsewhere conferred by the statute. This provision includes a mandate to "permit, regulate, and control soil erosion and stormwater runoff," and permission to "otherwise act to

[74] *See* VA. DEP'T OF ENVTL. QUALITY, STATE WATER CONTROL BOARD OVERVIEW, *available at* http://www.deq.virginia.gov/Portals/0/DEQ/LawsAndRegulations/CitizenBoards/WaterBoard/StateWaterControlBoardOverview pdf (last visited June 28, 2017) (providing overview of Board function, responsibilities, and member composition).

protect the *quality* and *quantity* of state waters from the potential harm of unmanaged stormwater."[75] A straightforward textual reading would treat this as a general grant of power over stormwater management, within which siting guidelines for ESDs could readily fit. Such guidelines must undertake to help control stormwater runoff and protect water quality and quantity from flooding—such as by creating greater system efficiency or better performance in the face of climate change.

The provision of the Stormwater Management Act authorizing the Board more specifically to regulate stormwater management systems also could support action to adopt ESD siting criteria. This authority is expansive, and authorizes "regulations that establish requirements for the effective control of soil erosion, sediment deposition, and *stormwater*…that shall be met in any VESMP to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources, and *that specify minimum technical criteria*…."[76] The term "technical criteria" arguably encompasses siting criteria—particularly those based on sound assessments and climate modeling accepted by the scientific community.

This section of Virginia's stormwater statute also enumerates 18 specific tasks the regulations must accomplish. None of these expressly discusses climate change or how to site stormwater facilities; nevertheless, the Board can promulgate regulations that go beyond these 18 categories, as long as they (1) fall within the Board's scope of authority, and (2) the entire body of regulations, as a whole, meets the objectives set out in the list.[77]

The Board also maintains sufficient authority to develop siting criteria even under a narrower reading that requires that its regulations fit within one or more category.

For example, the fourteenth objective explicitly requires the Board to adopt regulations to "[e]ncourage low-impact development designs, regional and watershed approaches, and nonstructural means for controlling stormwater."[78] The goal of fostering adoption of ESDs implies Board authority also to establish related standards and criteria to be met in selecting and installing these facilities. Siting criteria ensuring more effective stormwater management in the face of climate change can reassure localities of the wisdom of adopting ESDs in appropriate locations over traditional grey infrastructure stormwater facilities.

The eighteenth objective is to "[p]rovide for the evaluation and potential inclusion of emerging or innovative stormwater control technologies that may prove effective in reducing nonpoint source pollution."[79] This encompasses new methodologies for siting ESDs.

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[75] VA. CODE ANN. § 62.1-44.15:25 (2017) (emphasis added).
[76] VA. CODE ANN. § 62.1-44.15:28 (2017) (emphasis added).
[77] *See id.*
[78] VA. CODE ANN. § 62.1-44.15:28(14) (2017).
[79] VA. CODE ANN. § 62.1-44.15:28(18) (2017). Note that "technologies" can refer to methods; not simply to devices themselves. *See Technology*, MERRIAM-WEBSTER DICTIONARY (2017), *available at* https://www.merriam-webster.com/dictionary/technology (defining "Technology" as: (a) "the practical application of knowledge especially in a particular area;" (b) "a capability given by

The third objective is for Board regulations to "[b]e based upon relevant physical and development information concerning the watershed[]…including data related to land use, soils, [and] *hydrology*."[80] "Hydrology" is defined as "a science dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere."[81] Studies of climate change include current and predicted adjustments to the hydrological cycle, such as changes in precipitation, average sea level, and flooding. It is therefore appropriate for the Board to develop regulations based on this scientific data, in order to better protect public welfare and the environment.

The Department could also incorporate ESD siting guidelines into the model ordinance it must provide localities to assist them in establishing a VESMP.[82] DEQ drafted a model ordinance under the earlier version of Virginia's stormwater code.[83] Rather than developing a new model ordinance, DEQ is currently planning to issue a conversion chart, converting the existing state stormwater management code provisions to the updated versions. But it could adopt additional model provisions to advance climate resilience objectives.

Content of the model ordinance is limited only to consistency with the statute and its associated regulations. Although the current model ordinance does not contain any siting criteria, no statutory or regulatory provision excludes or prohibits siting guidelines.[84] The model ordinance is not legally binding. Model ordinances in Virginia are considered "guidance documents."[85] They are not promulgated under the Virginia Administrative Process Act, § 2.2-4000 et seq., and, whereas regulations have the force of law and bind regulated entities, guidance documents do not.[86]

As noted in the previous chapter, the Board itself may operate as a VSMP authority, when certain localities opt out of adopting their own VESMPs,[87] or when a state or federal agency is the entity conducting land-disturbing activities.[88] The Board, in this situation, may establish siting guidelines directly.

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the practical application of knowledge;" and (c) "a manner of accomplishing a task especially using technical processes, methods, or knowledge").

[80] VA. CODE ANN. § 62.1-44.15:28(3) (2017) (emphasis added).

[81] *See Hydrology*, MERRIAM-WEBSTER DICTIONARY (2017), *available at* https://www.merriam-webster.com/dictionary/hydrology.

[82] VA. CODE ANN. § 62.1-44.15:27(F) (2017).

[83] *See* Model Ordinance, *supra* note 37.

[84] *See id*.

[85] Guidance documents are defined as "any document developed by a state agency or staff that provides information or guidance of general applicability to the staff or public to interpret or implement statutes or the agency's rules or regulations." VA. CODE ANN. § 2.2-4101 (2017).

[86] *See also Guidance Documents*, VIRGINIA REGULATORY TOWN HALL, https://townhall.virginia.gov/um/guidancedocuments.cfm (last visited June 13, 2017). The Model Ordinance itself contains a disclaimer that it "does not carry the force of law," and, under Section IV, a clarification that a locality is not required to adopt the particular ordinance. Model Ordinance, *supra* note 37, at IV.

[87] *See* Virginia Erosion and Stormwater Management Act, 2016 Va. SB 673.

[88] VA. CODE ANN. §§ 62.1-44.15:24, 62.1-44.15:27.1 (2017).

It is also worth noting that Virginia's Flood Protection and Dam Safety laws require the Department of Conservation and Recreation (DCR) to develop a flood protection plan for the entire Commonwealth.[89] This plan, among other requirements, must contain "[s]trategies to prevent or mitigate flood damage."[90] This broadly-worded language, which focuses on preventing future threats of flooding, easily encompasses climate change impacts. Such strategies could include conducting studies to project future flood threats and establishing siting criteria for stormwater facilities (including ESDs) based on those projections, either through zoning or stormwater management regulations.

2. Maryland

Several existing provisions offer the state opportunities to require that both state agencies and localities incorporate ESD siting criteria into the process of planning and constructing stormwater infrastructure facilities.

Powers over state stormwater management related to climate change resiliency

A number of statutory measures, executive actions, and agency guidelines in Maryland are oriented toward avoiding or adapting to the adverse impacts of climate change. These offer avenues for state agencies to prescribe ESD siting criteria for many state—and potentially state-funded local—public stormwater infrastructure projects.

Former Governor Martin O'Malley, in 2012, issued an executive order directing climate change considerations to be incorporated into state capital projects. The Climate Change and CoastSmart Construction Executive Order prescribed that all state structures, as well as other *infrastructure* improvements, be planned and constructed to avoid or minimize future flood damage.[91] The executive order instructed state agencies, in proposing new or reconstructed state capital projects, to consider the risk of coastal flooding and sea level rise, and stated they should *site and design* State-funded structures to avoid or minimize associated impacts.[92]

The directive also directed the Critical Area Commission for the Chesapeake and Atlantic Coastal Bays to adopt regulations, applicable to state agency actions resulting in development on state-owned lands, for extreme weather-related impacts.[93] The Commission adopted the climate change provisions in 2014. These provisions require state agencies to demonstrate how proposals for developments on state-owned land both consider sea level rise impacts and incorporate climate resilient practices.[94] The

[89] VA. CODE ANN. § 10.1-602(1)(d) (2017).
[90] VA. CODE ANN. § 10.1-602 (2017).
[91] Exec. Order No. 01.01.2012.29 (2012).
[92] *Id*.
[93] *Id*. at E.
[94] *See* MD. CODE REGS. 27.02.01.01, 27.02.05.03 (2017). "Climate resilient practice" is defined in the regulations as "a management measure that, in the context of sea level rise, increasing tidal inundation, increasing average temperatures, precipitation changes, and coastal and riverine flooding: (a) Guides and informs decisions regarding the siting, design, construction, or reconstruction of a development project; and (b) Enables a natural system to absorb disturbance and adapt while

regulations apply only to state agencies, and not to local government projects, even when they occur on state-owned lands.[95]

In 2014, House Bill 615, the Coast Smart Council Act, established the Maryland Coast Smart Council in the Department of Natural Resources. The bill directed the Coast Smart Council to adopt siting and design criteria.[96] The Council's Coast Smart Construction Program, detailing siting and design criteria and implementation procedures, was approved on June 26, 2015.[97] The program is directed to "structures," whose definition under the bill—also incorporated into Maryland's Finance and Procurement code—is generally limited to buildings, and does not specifically include utilities or infrastructure such as stormwater systems.[98] Yet a broader reading suggests that on-site stormwater management facilities constructed *as part of* a capital project, must also comply with those criteria. "Coast Smart" itself encompasses siting techniques that "avoid[] or minimize[] future impacts associated with coastal flooding and sea level rise."[99] The Coast Smart Construction Program applies to all state agencies that "design and build facilities or prepare programs and budgets for the design and construction of facilities," and is regularly reviewed by the Council.[100]

In 2015, Senate Bill 258, the Maryland Commission on Climate Change Act, directed state agencies to identify and recommend specific policy planning, regulatory, and fiscal programs that would address greenhouse gas reduction efforts or address climate change.[101] Consideration was specifically to be given to sea level rise, flooding, and increased precipitation.[102] MDE has not yet initiated this process for its stormwater management program, and there are no current plans to do so. However, opportunity remains to encourage the state to prioritize commencing this effort and, in so doing, to urge MDE to incorporate ESD siting criteria into applicable planning and policy documents, and in updating regulatory provisions—for both state and local stormwater facilities.

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undergoing change, so as to retain essentially the same identity, structure, and function." MD. CODE REGS. 27.02.01.01(7-2) (2017).

[95] *See* MD. CODE REGS. 27.02.05.03 (2017). Additionally, the executive order directed the Department of Natural Resources and the Commission on Climate Change to propose Climate Change and "Coast Smart" construction guidelines. The siting and design guidelines, issued in a January 2014 report, encompass infrastructure improvements in the coastal zone, including drainage systems. See ADAPTATION RESPONSE WORKING GRP. OF THE MD. COMM'N ON CLIMATE CHANGE, MD. DEP'T OF NAT. RES., CLIMATE CHANGE AND COAST SMART CONSTRUCTION: INFRASTRUCTURE SITING AND DESIGN GUIDELINES (Zoe Johnson ed., 2014). The report suggested state agencies use the guidelines to assess non-State structure and infrastructure projects applying for state grant and loan funding. The report contains several siting guidelines. For example, the siting guidelines recommend avoiding areas likely to be inundated by sea level rise within the next 50 years, and to identify, protect, and maintain ecological areas that buffer the project. *See id.* at 7-18.

[96] H.B. 615, 2014 Reg. Sess. (MD. 2014) (codified as MD. CODE ANN., NAT. RES. §§ 3-1001—3-1004 (LexisNexis 2017); MD. CODE ANN., STATE FIN. & PROC. 3-602.3 (LexisNexis 2017)). This bill superseded the earlier guidelines and requirements of the 2012 executive order.

[97] MD. COAST SMART COUNCIL, MD. DEP'T OF NAT. RES., COAST SMART CONSTRUCTION PROGRAM 1 (2015).

[98] MD. CODE ANN., STATE FIN. & PROC. §3-602.3(b) (LexisNexis 2017).

[99] *See id*. at (a).

[100] MD. COAST SMART COUNCIL, MD. DEP'T OF NAT. RES., COAST SMART CONSTRUCTION PROGRAM 2 (2015).

[101] S.B. 258, 2015 Reg. Sess. (MD. 2015) (codified as MD. CODE ANN., ENVIR. §§ 2-1301—2-1306) (LexisNexis 2017).

[102] *Id*. at 2-1305(A).

The Department of Natural Resources' (DNR) Climate Change Policy, adopted prior to SB 258, in 2010, requires siting, designing, and constructing both facilities and infrastructure so as to avoid or minimize anticipated climate change impacts. DNR, in its policy, also charged itself with developing specific climate change siting and design criteria. While the policy applies only to DNR projects, it offers another avenue for the state to incorporate siting guidelines for ESD projects that fall within that agency's scope.[103]

In summary, Maryland state agencies have the authority to adopt ESD siting guidelines for climate resiliency when developing stormwater management facilities as part of state capital projects. Key state agencies may also be able to extend ESD siting guidelines to local projects via grant allocations. One example is DNR's Community Resiliency Grants, which assist coastal communities in addressing coastal hazards, including coastal and localized flooding, storm surge, and sea level rise. This program provides up to $100,000 to fund one of three phases: vulnerability and risk assessment, developing planning responses, and implementation of projects to reduce community vulnerability to these hazards. "Track B," or Green Infrastructure Resiliency Grants, supports communities in the use of green infrastructure practices to increase resiliency to "non-coastal" climate-related hazards, including localized flooding, more frequent and intense precipitation events, and sea level rise.[104] DNR may have the discretion to rank or condition funding eligibility for any project, which includes ESD stormwater management facilities, to incorporate siting criteria.

State powers over local stormwater management

Maryland's Department of Environmental Protection (MDE), which includes the state's Water Management Administration, maintains several options, under existing statutory and regulatory provisions, to prescribe ESD siting guidelines for localities.

The Maryland Stormwater Management Act requires MDE to promulgate regulations establishing stormwater management criteria and procedures.[105] The statute mandates specific regulatory goals. For example, MDE regulations must establish a baseline, or minimum content to be included in local stormwater management ordinances or regulations.[106] This gives the Department a broad grant of power over stormwater management facilities. Significantly, MDE regulations must "specify all stormwater management plans shall be designed to…prevent, to the maximum extent possible [MEP], an increase in nonpoint pollution…[and] implement quantity control strategies to prevent increases in the frequency and magnitude of out-of-bank flooding from large, less frequent storm events…"[107]

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[103] MD. DEP'T OF NAT. RES., BUILDING RESILIENCE TO CLIMATE CHANGE: POLICY NO. 2010:11 (2010).
[104] *See* MD. DEP'T OF NAT. RES., STATE OF MD., MARYLAND'S COMMUNITY RESILIENCY GRANTS: 2017 REQUEST FOR PROPOSALS (2017) [hereinafter Community Resiliency Grants], *available at* http://dnr.maryland.gov/ccs/coastsmart/Documents/cs_RFP pdf.
[105] MD. CODE ANN., ENVIR. §4-203 (2015).
[106] MD. CODE ANN., ENVIR. §4-203(b)(5)(i) (2015).
[107] MD. CODE ANN., ENVIR. §4-203(b)(8) (2015).

Read as authorizing MDE also to regulate specific, minimum *methods* which localities must follow to meet these objectives, these provisions empower MDE to require local stormwater management plans to incorporate ESD siting guidelines, as both a quality control and flood mitigation strategy. Specifically, ESD facilities sited and designed in consideration of predicted climate change impacts are more likely to meet the MEP standard over time, due to their capacity to handle greater quantities of water. This would improve the stormwater management system's ability to reduce overall flooding and to filter out pollution from runoff which would otherwise drain unimpeded to the greater watershed.

The regulations themselves affirm a broad grant of power, under the Act, to MDE's Water Management Administration. The general regulatory provisions define the body's wide scope of power, with the qualification that the enumerated powers are not exclusive of others.[108] Even if this expansive authority were narrowed by the statutory limits on the power delegated to MDE through the Stormwater Management Act, the listed items of delegated authority themselves imply wide latitude. The Water Management Authority is responsible for "establishing policies, procedures, standards, model ordinances, and criteria relating to stormwater management," "reviewing approving…[c]ounty…[and] [m]unicipal stormwater management ordinances," and "developing guidelines and regulations."[109] Each of these provisions grants the authority to impose requirements and ensure they are incorporated in local law. Nothing here, or in the statute itself, prevents the Water Management Authority from establishing ESD siting requirements.

The Maryland Code of Regulations pertaining to stormwater management incorporates by reference the Maryland Stormwater Design Manual, which the state last revised in 2009.[110] The minimum control requirements in the Design Manual must be contained in each county and municipal ordinance. Individual stormwater management plans must use the Design Manual's methods, practices, and techniques in implementing ESD to the MEP.[111] The current version provides guidance on BMP location, including a review of environmental factors—such as habitat quality—in narrowing the list of BMPs most suitable for each site.[112] Climate change impacts are not currently included in this guidance. The Design Manual also contains a chapter addressing ESDs specifically. However, the discussion on locating these practices focuses on site development strategies and does not address climate change impacts.[113] The Design Manual can be updated to incorporate the consideration of such impacts when selecting and developing sites for implementing ESD practices. Updates to the Design Manual must be made via the regulatory process, including posting on the Maryland Register and review of public comments.[114] This provides an opportunity to involve all pertinent stakeholders in making revisions.

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[108] MD. CODE REGS. 26.17.02.03 (2017) ("The Administration is responsible for implementing and supervising the stormwater management program which is established by the Stormwater Management Subtitle. This responsibility shall include, *but is not limited to*…" (emphasis added)).
[109] MD. CODE REGS. 26.17.02.03 (2017).
[110] MD. CODE REGS. 26.17.02.01-1(2017); *see also* Design Manual, *supra* note 23.
[111] MD. CODE REGS. 26.17.02.06(A) (2017).
[112] Design Manual, *supra* note 23, at Chap. 4.
[113] *Id.* at Chap.5, 5.9-5.10.
[114] Telephone Interview with Stew Comstock, Maryland Department of the Environment (Apr. 3, 2017).

Powers over local flood control

Maryland's laws concerning flood control and watershed management require each locality to maintain a flood management plan.[115] These plans may contain stormwater detention or retention structures.[116] MDE may provide grants for flood control and watershed management capital projects, and retains approval authority over plans which include projects for which state grants funds are requested. MDE, in conjunction with the Department of Planning, is charged with adopting regulations for administering the grant program.[117] These regulations may extend to "[s]tandards of eligibility for applicants and projects," and "[e]ngineering and economic standards and alternatives."[118] No specific limitations are placed on these provisions, indicating the state can condition grant funding for ESD projects on incorporating climate resiliency considerations.

C. Existing Legal Framework: Authority for Local Government Actions

In both states, local governments can, in their own discretion, hold their own public projects for stormwater management projects to a higher standard.[119] But a locality's self-imposed *legally binding* standard, if established under its state-mandated stormwater management program, would require state approval.[120] Local governments might also seek to establish ESD siting standards, using authorities *outside* of the stormwater management framework. Specifically, local governments could adopt such standards under their public safety, flood prevention, or zoning powers.

The following discussion reviews promising pathways local governments in Maryland and Virginia can take, without any new state authorizing legislation, to establish climate change-based ESD siting criteria, based on existing grants of authority.

1. Virginia

Virginia is a Dillon Rule state, meaning that local governments have the authority to act only in instances where they have been expressly granted such authority from the Commonwealth, or where such authority is necessarily implied by an express grant.[121] Courts must narrowly interpret delegations of power to local governments.[122]

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[115] Md. Code Ann., Envir. § 5-803 (LexisNexis 2017).
[116] *Id*. at (d)(2)(iii)
[117] *Id*. at (h).
[118] *Id*. at (h)(9).
[119] *See* MD. CODE REGS. 26.17.02.06(B) (2017); *See*, *e.g.*, 9 VA. ADMIN. CODE § 25-870-47 (2017) ("Nothing in this section shall preclude an operator from constructing to a more stringent standard at his discretion."). An "operator" may include a VESMP authority. *See* 9 VA. ADMIN. CODE § 25-870-10 (2017). Virginia's stormwater regulations also require *state* projects to comply with a local VESMP authority's technical requirements "to the largest extent practicable." 9 VA. ADMIN. CODE §§ 25-870-160(B), 25-870-170(A)(2) (2017).
[120] *See infra*, pp. 36, 37, 41.
[121] *Dillon Rule in Virginia*, FAIRFAX COUNTY, VA., http://www.fairfaxcounty.gov/government/about/dillon-rule.htm (last visited June 14, 2017).
[122] *See* 13B MICHIE'S JURIS. MUN. CORP. § 25, at ft. 366.

Examination of whether local government action is permitted under the Dillon Rule requires a two-step analysis. The first step asks: Did the statute grant the locality authority to act? Local governments may exercise only those powers: a) the state *expressly* grants to it; b) necessarily and fairly *implied* from that grant; or c) *indispensable* to the existence of the unit of local government.[123] The second step queries: Did the locality properly *exercise* the authority? Granted authority is properly executed when either: a) the enabling authority provides *specific direction* for how to execute the power and the locality follows that direction, or b) if the enabling authority does not provide specific direction and the localities' actions are considered *within reason*.[124]

Dillon's Rule likely does not bar Virginia local governments from adopting strategies to mitigate climate change-driven impacts in the context of stormwater management. This is due to the relatively broad powers, granted by the Commonwealth, which authorize localities to protect public welfare, develop flood management programs, and make land use decisions. The Virginia Coastal Policy Center at the William and Mary Law School published a detailed analysis of relevant statutory grants of power to local governments. The report determined both that the Dillon Rule is not a barrier to Virginia counties adopting climate adaptation strategies, and that localities can manage threats of flooding predicted to result from sea level rise through existing ordinances and general zoning authority.[125]

Zoning

Virginia localities can leverage their general zoning authority to incorporate climate change impacts into establishing criteria for where different ESD practices may be located, as well as for applicable design standards.

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[123] 1 John F. Dillon, *Commentaries on The Law of Municipal Corporations* § 237 (89) at 448-49 (5th. ed. 1911) ("It is a general and undisputed proposition of law that *a municipal corporation possesses and can exercise the following powers, and no others*: First, those granted in *express words;* second, those *necessarily or fairly implied* in or *incident* to the powers expressly granted; third, those *essential* to the declared objects and purposes of the corporation, —not simply convenient, but indispensable" (emphasis in original)); *see also* 13B MICHIE'S JURIS. MUN. CORP. § 25 (2016) ("A municipal corporation possesses and can exercise the following powers, and no others. First, those granted in express words by general statutes or charters; second, those necessarily or fairly implied in or incident to the powers expressly so granted; third, those essential to the declared objects and purposes of the corporation, not simply convenient, but indispensable."); *id.* at § 26 (describing the Dillon Rule of strict construction, which controls the powers of local governing bodies).

[124] Dillon, *supra* note 124, at § 239 (91), 453 ("The rule of strict construction does not apply to the *mode adopted* by the municipality *to carry into effect powers expressly or plainly granted*, where the mode is not limited or prescribed by the legislature, and it is left to the discretion of the municipal authorities. In such a case the usual test of validity of the act of a municipal body is, Whether it is reasonable? And there is no presumption against the municipal action in such cases." (emphasis in original)); *see also* Michie's Juris., *supra* note 123, at § 25. ("Virginia courts recognize the 'reasonable selection of method' rule, which permits local governing bodies to exercise discretionary authority when a statutory grant of power has been expressly made but is silent upon the mode or manner of its execution.").

[125] The report lists adaptation measures and cites to specific sections of the state code and local ordinances that either expressly or implicitly grant local governments the authority to implement certain adaptation tools. Notably, this includes §10.1-658(A), which announced the state's interest in flood control. The authors interpret this provision as speaking directly to the power of localities to create flood management programs. The cited tool is drainage pipes, but this arguably could include stormwater nonstructural BMPs/ESDs. Lauren Gill, *The Dillon Rule and Sea Level Rise: An Analysis of the Impact of the Dillon Rule on Potential Adaptation Measures the City of Poquoson May Implement*, VA. COASTAL POL'Y CLINIC, WM. & MARY L. SCH., Spring 2013, at 5-6, *available at* http://scholarship.law.wm.edu/vcpclinic/8/.

The Virginia state code delegates to local governments a broad scope of power over land use decisions, including zoning. Zoning broadly refers to the power to divide an area into separate districts, and then regulate or restrict certain land uses by each classified district. Virginia's key enabling statute authorizes localities to "classify the territory under its jurisdiction or any substantial portion thereof into districts…" and, in each district to "regulate, restrict, permit, prohibit, and determine" a variety of uses, including "the use of land, buildings, structures and other premises for agricultural, business, industrial, residential, flood plain and other specific uses," and the "size, height, area, bulk, *location*, erection, construction, reconstruction, alteration, repair, maintenance, razing, or removal of *structures*."[126] A Dillon Rule analysis here is straightforward: within each zone, localities may determine the use and location of land and structures, and there is no specific direction on method. So long as the method of execution is reasonable, the action is permitted.[127]

A key question is whether stormwater facilities qualify as "structures." This term is not defined in the code, but in relying on the straightforward dictionary definition—"something that is constructed"[128]—stormwater facilities would qualify. This would be true even for ESD facilities, as these must be engineered and constructed. This interpretation is supported elsewhere in state law, which includes, as one of the purposes of zoning ordinances, facilitating adequate flood protection, and provides that zoning ordinances may also include "reasonable provisions…to protect surface water and ground water."[129] Notably, a state code provision addressing the general powers of local governments, declares that "[a]ny locality may construct a dam, levee, seawall *or other structure or device*, or perform dredging operations…the purpose of which is to prevent the tidal erosion, flooding or inundation of such locality."[130] Arguably, a "device" is essentially a subcategory of "structure,"[131] and the terms here are used to refer to flood-mitigation structures and devices—both of which logically include stormwater

[126] VA. CODE ANN. § 15.2-2280 (2017) (emphasis added). A prospective question arises whether stormwater facilities, including ESDs, remain within a localities' jurisdiction and subject to local zoning authority once they are permanently inundated by rising sea levels and flooding, and therefore are sited on submerged lands. The Commonwealth has jurisdiction over tidal, navigable waters, and the submerged lands underlying navigable water, including the Chesapeake estuary. *Jennings v. Board of Supervisors of Northumberland County*, 281 Va. 511, 515, 708 S.E.2d 841, 843 (2011). *Jennings* addresses this question, at least insofar as an ESD "extends" from the waterfront and, arguably, constitutes an extension of a larger stormwater system facility. In *Jennings*, a landowner with riparian rights challenged the county's zoning authority over additions to his commercial marina. The proposed mooring slips and piers would lie beyond the mean low-water mark of a tidal, navigable waterway. The court agreed that while the Virginia Marine Resources Commission (VMRC) had jurisdiction over the bottomland seaward of the mean low-water mark, its regulatory authority was concurrent with the county's, because VA. CODE ANN § 15.2-3105 clarifies: "The boundary of every locality bordering on the Chesapeake Bay, including its tidal tributaries (the Elizabeth River, among others), or the Atlantic Ocean shall embrace all wharves, piers, docks and other structures, except bridges and tunnels that have been or may hereafter be erected along the waterfront of such locality, and extending into the Chesapeake Bay, including its tidal tributaries (the Elizabeth River, among others), or the Atlantic Ocean." *Id.*

[127] This is otherwise known as the "reasonable selection of method rule." *See* Dillon *supra* note 124, at § 239 (91), 453. For a helpful and in-depth discussion of zoning law in Virginia, *see* GREG KAMPTNER., ALBEMARLE CTY. ATTORNEY'S OFFICE, THE ALBEMARLE COUNTY LAND USE LAW HANDBOOK 4-1 (2016). Kamptner explains that, under a Dillon Rule analysis, VA. CODE ANN § 15.2-2280 authorizes a locality to zone and regulate the territory in its jurisdiction, but does not delineate *how* the locality is purported to implement the broad powers granted. The choice of implementation by the locality will be upheld as long as the method selected is reasonable. *Id.*

[128] *See Structure*, MERRIAM-WEBSTER DICTIONARY (2017), *available at* https://www.merriam-webster.com/dictionary/structure.

[129] VA. CODE ANN § 15.2-2283 (2017).

[130] VA. CODE. ANN. § 15.2-970 (2017) (emphasis added).

[131] *See Device*, MERRIAM-WEBSTER DICTIONARY (2017) (defining "device" to include "a piece of equipment or a mechanism designed to serve a special purpose or perform a special function"—which must, necessarily, be "constructed"), *available at* https://www.merriam-webster.com/dictionary/device.

facilities.[132] The Virginia Stormwater Management Act's requirements for VSMPs (VESMPs under the VSMA effective July 2018) include "[p]rovisions for long-term responsibility for and maintenance of stormwater management control *devices* and other techniques specified to manage the quality and quantity of runoff."[133] Likewise, the related stormwater regulation refers to "the provision of long-term responsibility for and maintenance of stormwater management *facilities* and other techniques specified to manage the quality and quantity of runoff,"[134] with "stormwater management facility" itself defined as "a control measure that controls stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow."[135] Both "device" and "facility," here in Virginia law used interchangeably, plausibly fall under the general definition of "structure."[136]

Virginia localities could administer climate change-impact based siting criteria for ESDs using overlay districts to define areas where these are needed or where specific types of ESDs are desirable. An overlay district is a zoning district which establishes a set of requirements on top of an underlying "base" zoning district.[137] The rationale for the use of overlay districts is that these areas are distinguished by a set of common characteristics or features making it desirable to have extra regulation beyond that of the underlying district. Localities could create climate resiliency, watershed, or stormwater management overlay zones, with the area and shape of each zone or subzone determined by predicted sea level rise and storm intensity. Specific ESDs (and design criteria for each type of permitted ESD, accounting for characteristics such as the ability to filter a minimum amount of stormwater over a certain period of time) would be permitted, and others prohibited in separate sub-zones/zones. This could include creating sub-zones comprising areas projected to be inundated in the very near future, and where no or only short-term ESDs may be installed.[138]

Municipalities may prefer prescribing ESD siting standards for areas forecast to be severely affected by climate change-driven floods and precipitation, while taking a softer approach in areas predicted to be less drastically affected. Incentive zoning provides one method to do this.[139] Incentive zoning means "the use of bonuses in the form of increased project density *or other benefits* to a developer in return

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[132] This statutory interpretation is supported by the textual canons of construction, *ejusdem generis (*"of the same kinds, class, or nature") and *noscitur a sociis* ("a word is known by the company it keeps").
[133] VA. CODE. ANN. § 62.1-44.15:27(G)(5) (2017) (emphasis added).
[134] 9 VA. ADMIN. CODE § 25-870-112 (2017) (emphasis added).
[135] 9 VA. ADMIN. CODE § 25-870-10 (2017).
[136] *See Facility*, MERRIAM-WEBSTER DICTIONARY (2017) (defining "facility" to include "something that is built, installed, or established to serve a particular purpose"—which also can be "constructed"), *available at* https://www.merriam-webster.com/dictionary/facility.
[137] Norfolk, Va. Code of Ordinances § 11-0 (2017) ("An Overlay District is intended to provide supplemental regulations or standards pertaining to specific geographic features or land uses, wherever these are located, in addition to 'base' or underlying Zoning District regulations applicable within a designated area").
[138] Localities may conduct their own calculations of projected sea level rise—for example, through hiring qualified and expert consultants—and these calculations may incorporate data from other studies, conducted at the regional, national, or global level. Several tools and techniques to model sea level rise exist, including the Sea Level Rise Inundation Tool, developed by the Center for Coastal Resources Management (CCRM) at the Virginia Institute of Marine Science (VIMS). *See Comprehensive Coastal Management Portal*, CTR. FOR COASTAL RES. MGMT., VA. INST. OF MARINE SCI., http://ccrm.vims.edu/ccrmp/index.html (last visited June 29, 2017).
[139] Incentive zoning is authorized via VA. CODE ANN. § 15.2-2286(A)(10) (2017).

for the developer providing certain features, design elements, uses, services, or amenities desired by the locality, including *but not limited to*, site design incorporating principles of new urbanism and traditional neighborhood development, environmentally sustainable and energy-efficient building design, affordable housing creation and preservation, and historical preservation, as part of the development."[140] This definition is sufficiently expansive to include ESD siting guidelines. Localities could develop incentives to encourage private developers to adhere to those guidelines in siting ESDs as part of their stormwater management plans.

There are two important legal questions localities may consider before using their expressly designated zoning authority to assign areas where designated types of ESDs are approved or prohibited.

The first pertains to whether such use meets the Dillon Rule "reasonable selection of method" requirement. Localities can demonstrate the reasonableness of relying upon a prediction of future flooding rather than on historic data alone. Virginia's land use code does not explicitly require zoning ordinances, for purposes of flood prevention, to be based only on past and current states of affairs to the exclusion of considering future conditions. Indeed, the provision of the land use code declaring the legislature's intent in delegating the zoning powers to localities explicitly states its goal of planning for future events: "This chapter is intended to encourage localities to improve the public health, safety, convenience, and welfare of their citizens and to *plan for the future* development of communities to the end that transportation systems be carefully planned; that new community centers be developed with adequate highway, utility, health, educational, and recreational facilities…that residential areas be provided with healthy surroundings for family life; that agricultural and forestal land be preserved…."[141]

Further, localities in the Hampton Roads Planning District Commission are specifically required to incorporate "strategies to combat *projected* sea-level rise and recurrent flooding" into reviews of their comprehensive plans.[142] This illustrates two points. First, the legislature recognizes climate change as a threat to public safety sufficient to not only accept, but explicitly mandate preparation for emerging risk. Second, making local policy on the basis of future predictions is considered a reasonable exercise of local land use and planning authority within the context of the Commonwealth's statutory land-use framework.

Establishing ESD siting criteria based on emerging risk also harmonizes with Virginia's statutory provision laying out the purposes of zoning ordinances. Among those purposes are to "provide for adequate light, air, convenience of access, and safety from fire, *flood*, impounding structure failure, crime and other dangers," and "to facilitate the provision of adequate police and fire protection, disaster evacuation, civil defense, transportation, *water, sewerage, flood protection*, schools, parks, forests, playgrounds, recreational facilities, airports and other public requirements."[143] An adequate flood protection regime,

[140] VA. CODE ANN. § 15.2-2201 (2017) (emphasis added).
[141] VA. CODE ANN. § 15.2-2200 (2017) (emphasis added).
[142] VA. CODE ANN. § 15.2-2223.3 (2017) (emphasis added).
[143] VA. CODE ANN. § 15.2-2283 (2017) (emphasis added).

in the context of scientifically valid studies indicating the probable effects of the climate change on a region, logically will incorporate standards and criteria based on those predictions.

The second consideration involves the extent to which localities risk exposure to regulatory takings claims by affected private landowners. Such risk might arise by changing zoning in a manner that limits developers' selection of ESD facilities to an approved menu of options such that developable area is significantly reduced or rendered impossible.

The Fifth Amendment of the U.S. Constitution, as applied to the states and to local jurisdictions through the Fourteenth Amendment, provides that government agencies may "take" property for a public purpose only if the agency offers "just compensation" for the value of the property taken.[144] The courts have recognized that this guarantee encompasses more than an actual physical invasion of property and extends to what is termed "regulatory takings." The jurisprudence surrounding regulatory takings is premised on the assertion that some economic injuries caused by public action should be compensated by the government.[145] "[I]f regulation goes too far, it will be recognized as a taking."[146]

Generally, under federal takings law, government regulation of land uses to accomplish public purposes will not constitute a taking, taking into account the character of the governmental action, the economic impact of the action, and the degree of interference with the property owner's reasonable "distinct investment-backed expectations," especially where the owner is left with some economic value in the property.[147] It is highly likely that ESD siting criteria have the character of preventing public harm, given the goal is to more efficiently mitigate risks of flooding and prevent pollution of the waters. It is also *un*likely that such criteria will deny a property owner of all "economically viable use" of her land. Thus, even if a property owner faces higher costs related to developing her land in a manner consistent with siting criteria—for example, the selection of available ESDs may be more expensive than those not permitted in that zoning district, or a proposed development plan must be modified, at greater expense, to permit incorporation of those ESDs—it is unlikely to eliminate all possibility of economic return on the property.[148]

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[144] U.S. CONST. amend. V. The Fifth Amendment applies to the states via the Fourteenth Amendment. *See Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 122 (1978) (citing *Chicago B. & Q. R. Co. v. Chicago*, 166 U.S. 226, 239 (1897)).

[145] *Penn Cent. Transp. Co.*, *supra* note 145, at 124 ("when interference arises from some public program adjusting the benefits and burdens of economic life to promote the public good").

[146] *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1014 (1992) (citing *Pennsylvania Coal Co. v. Mahon*, 260 U.S. 393, 415 (1922)).

[147] *See Penn Cent. Transp. Co.*, *supra* note 145 (holding that application of New York City's Landmarks Preservation Law to Grand Central Terminal, which prevented a proposed use of the property's air rights to develop a 50-story office building, does not effect a taking, because the restrictions are substantially related to promoting the general welfare, economic value of the property remains, and the limitations do not destroy the property owner's distinct investment-backed expectations). Indeed, the court labeled zoning laws as "the classic example." *Id.* at 125.

[148] *See Penn Cent. Transp. Co.*, *supra* note 145, at 130-31 ("'Taking' jurisprudence does not divide a single parcel into discrete segments and attempt to determine whether rights in a particular segment have been entirely abrogated…this Court focuses rather on both on the character of the action and on the nature and extent of the interference with rights in the parcel as a whole").

Virginia's regulatory takings law accords with the federal rule. Virginia's constitution states: "No private property shall be damaged or taken for public use without just compensation to the owner thereof."[149] Similar to federal court analysis, the Commonwealth's courts review (1) the economic impact of the regulation on the claimant; (2) the extent to which the regulation interferes with distinct investment-backed expectations; and (3) the character of the government action.[150] Virginia courts take a somewhat broader view than their federal counterpart, because the property owner need not be deprived of *all* viable economic use when the property is damaged. Property use is damaged "when an appurtenant right connected with the property is directly and specially affected by a use and that use inflicts a direct and special injury on the property which diminishes its value."[151] But ESD siting criteria do not "damage" property, and are intended to enhance the safety of both property and life against risk of flooding.[152] And mere diminution in value is not sufficient basis for a takings claim. Local governments should be free to proceed without fear of risking a regulatory takings judgment.

VSMA Opportunities for Local Governments: More Stringent Criteria and Comprehensive Stormwater Management Plans

The Commonwealth expressly grants Virginia local governments the power to establish and operate a stormwater management system.[153] Step two of the Dillon Rule analysis asks whether regulating where stormwater facilities may be located—specifically, based on climate change impacts on sea level rise and precipitation—is a proper execution of that authority. The Commonwealth provides specific direction on

[149] VA. CONST. art. I, § 11.
[150] 4C MICHIE'S JURIS. CONST. LAW § 81.
[151] *Collett v. City of Norfolk*, 85 Va. Cir. 258, 258 (Va. Cir. Ct. 2012) (citing *Supervisors of Prince William County v. Omni Homes, Inc.*, 253 Va. 59, 72 (1997)).
[152] Interestingly, a locality could find itself defending against a takings claim for *in*action. The claim is one for "inverse condemnation," a taking which occurs when "governmental action adversely affects the landowner's ability to exercise a right connected to the property." *Kitchen v. City of Newport News*, 275 Va. 378, 386 (Va. Sup. Ct. 2008) (citing *Prince William County v. Omni Homes*, 253 Va. 59, 72 (1997)). A common example involves government action *damaging* property. *Id.* This is premised on the idea that a property owner can sue on an implied contract that she will be compensated for property—taken or damaged for public use—in the same amount she would have been paid had the property been condemned via eminent domain. *AGCS Marine Ins. Co. v. Arlington Cty.*, 2017 Va. LEXIS 91* (Va. 2017). Virginia courts have held that government failure to act, when it has a duty to do so, can give rise to compensable damaging under the Virginia constitution's takings clause. *Livingston v. Va. DOT*, 284 Va. 140, 161 (Sup. Ct. Va. 2012) (holding "a property owner may be entitled to compensation under Article I, Section 11 of the Constitution of Virginia if the government's operation of a public improvement damages his property". The court found that the Virginia Department of Transportation's failure to maintain a channel—one of plaintiff residents' several alleged causes of flood damage—could support an inverse condemnation claim). However, a government's inaction, or failure to act, must be *purposeful. AGCS Marine Ins. Co. v. Arlington Cty.*, 2017 Va. LEXIS 91* (Va. 2017) (involving a case where insurers filed an inverse condemnation suit against Arlington County, alleging that a sewer backup resulting in property damage constituted a taking or damaging of private property for public use. The court found the constitutional provision is limited to purposeful acts and failures, and noted prior cases (including *Livingston*) involved governmental authorities using private property as flooding sites to handle expected stormwater overflows). Furthermore, damage resulting from flooding is caused by the "public use" if the "government was *in control of the instrumentality* that was designed to deal with the source of the flooding, storm water." *Collett*, *supra* note 152.
[153] The state code declares: "Any locality may (i) acquire or otherwise obtain control of or (ii) establish, maintain, operate, extend and enlarge: waterworks, sewerage, gas works (natural or manufactured), electric plants, public mass transportation systems, *stormwater management systems* and other public utilities…." VA. CODE ANN. § 15.2-2109(A) (2017) (emphasis added). Given this statutory provision provides no specific direction, localities could argue that such regulatory measures are reasonable, because they are important to the efficient and effective operation of a stormwater management system in a changing climate. The counter to this argument is that the VSMA provides the specific direction. Therefore, the "reasonable selection of method" rule is inapplicable, and the focus falls on interpreting the provisions of the VSMA and its associated regulations.

how to execute this power, via the Stormwater Management Act and its regulations, MS4 permits, guidance documents such as the Virginia Stormwater Management Handbook, and other measures. However, none of those necessarily limit, conflict with, or otherwise preempt local government discretion in this particular application of its power.[154]

Indeed, there are two main avenues permitting localities, acting as VSMP/VESMP authorities, to incorporate climate change impacts into establishing binding guidelines for siting and designing ESDs. The first is adopting siting requirements under existing statutory provisions authorizing localities to adopt more stringent stormwater management ordinances.[155] The second is developing a comprehensive stormwater management plan and incorporating siting regulations into that plan.

More stringent criteria

Virginia's Stormwater Management Act permits VESMP authorities to adopt stormwater management ordinances more stringent than those necessary to ensure compliance with the State Water Control Board's regulations. This establishes the state stormwater statutory and regulatory provisions as a floor—rather than a ceiling—which localities can go beyond in regulating stormwater in their own jurisdictions.[156]

This permission is contingent on the locality taking certain steps. First, the locality must make factual findings, and determine the more stringent requirements are necessary to meet one of several enumerated goals—which include protecting water quality and preventing excessive localized flooding. Second, the locality must hold a public hearing after giving notice—which can presumably be met by adopting the ordinance at a regular, open meeting of the city council or county commission. Third, the locality must submit a letter report, justifying its action, to DEQ.[157]

Siting criteria impose upon localities and private developers additional—and arguably more stringent—standards against which to make decisions such as selecting ESD facilities and determining where to locate them. The VSMA forbids localities from prohibiting, conditioning, or limiting the use of any state-approved BMP (including ESDs) unless the limitations are based on site-specific concerns; such determinations are appealable.[158] However, localities can justify "site-specific concerns" by referencing

[154] Related to the above discussion of zoning is whether the VSMA permits localities to issue ordinances, under that statute's grant of local authority, addressing *potential* flooding conditions. No language explicitly limits local authority to address current flooding conditions only. Indeed, the goal is to attain predevelopment levels of runoff. *See*, *e.g.*, VA. CODE ANN. § 62.1-44.15:28 (2017) (providing that Board regulations must "require that VESMPs maintain after-development runoff rate of flow and characteristics that replicate, as nearly as practicable, the existing predevelopment runoff characteristics and site hydrology, or improve upon the contributing share of the existing predevelopment runoff characteristics and site hydrology if stream channel erosion or localized flooding is an existing predevelopment condition"). The reasonable selection of method rule may in fact *require* localities to take into account climate change-driven sea level rise and increased precipitation in order to effectively meet this goal.

[155] VA. CODE ANN. § 62.1-44.15:33 (2017).

[156] *Id.*

[157] *Id.*

[158] Similarly, authority to preclude or limit geographically the use of an approved BMP is subject to further state review upon the request of an affected landowner. *See id.* at C. Requiring defined categories of ESDs to be implemented in certain geographic regions arguably does not fall under the terms "preclude" or "limit," unless they otherwise prevent use of an approved category.

scientific predictions about rising sea levels, more intense storm events, and finding that certain types of BMPs will be rendered ineffective when located in areas determined to be vulnerable (e.g., leading to excessive flooding and/or water quality impairment). In contrast, other types of BMPs may be particularly well-suited to address stormwater runoff in vulnerable locations. The State Water Control Board ultimately retains the power to approve or void a locality's more stringent regulations and replace them with the state minimum standards.[159]

Comprehensive stormwater management plans

Comprehensive stormwater management plans ("CSWM plans") provide a reliable vehicle for adopting ESD siting criteria to address climate resilience as part of a watershed-level BMP strategy.

Virginia's stormwater regulations permit VESMP/VSMP[160] authorities to develop CSWM plans, subject to DEQ approval, as an alternative method for meeting the state's water quality and/or quantity objectives.[161] Localities must demonstrate that the results of implementing the plan will be at least as good as, if not better than those that would be achieved from straightforward implementation of the regulations on a site-by-site basis.[162]

Siting and climate based-guidelines for BMPs—which include ESDs—may be incorporated into CSWM plans, and in fact are envisioned in the Virginia Stormwater Management Handbook,[163] particularly in conjunction with the provisions permitting localities to adopt more stringent criteria.[164] The Handbook

[159] *See id.*

[160] The regulations have not yet been updated to refer to both VSMPs and V*E*SMPs, since the VESMA will not take effect until July 1, 2018.

[161] 9 VA. ADMIN. CODE § 25-870-92 (2017). As of publication, DEQ staff are aware of at least four CSWM plans that pre-date the VSMP and noted that they could easily be modified to meet the needs of the program. These include: (1) Chesterfield County (experiencing delayed implementation, due to difficulties obtaining federal permits to implement regional BMPs); (2) Henrico County (inactive due to not conforming with stormwater regulations, which were adopted in May 2011 and required local compliance by July 2014; noting some CSWM plans dated from before promulgation of 9 VA. ADMIN. CODE § 25-870-92); (3) Hanover County (also inactive, due to inconsistency between the computations and BMPs contained in the existing plan and those permitted under the revised regulations; the plan was not updated to comply with the new regulations); and (4) City of Williamsburg (updated as of July 2014, and in effect). DEQ is currently reviewing two proposed CSWM Plans from the City of Virginia Beach and Spotsylvania, but has not approved any as of yet. Fairfax County retains a CSWM plan, dating from before promulgation of the regulation or enactment of the underlying statute. Telephone Interview with Ben Leach, Manager of the Office of Stormwater Mgmt., Dep't of Envtl. Quality (Mar. 24, 2017); Telephone Interview with Joan Salvati, Local Gov't Assistance Programs Manager, Water Planning Div., Dep't of Envtl. Quality (May 17, 2017); Telephone Interview with Scott Flanigan, Stormwater Permit Manager, Envtl. Eng'g—Watershed Mgmt., Chesterfield Co. (May 24, 2017); Telephone Interview with Keith White, Stream Assessment/Watershed Mgmt. Program, Henrico Co. (May 17, 2017); Telephone Interview with Michael J. Dieter, Eng'g Manager, Dep't of Pub. Works, Hanover Co. (May 18, 2017); E-mail from Michael J. Dieter, Eng'g Manager, Dep't of Public Works, Hanover Co. (May 18, 2017, 03:25 PM EST) (on file with author); E-mail from Aaron B. Small, City Eng'r, City of Williamsburg (May 19, 2017, 01:04 PM EST) (on file with author); Emails from Ben Leach, Manager of the Office of Stormwater Mgmt., Dep't of Envtl. Quality (June 27, 2017, 5:07 PM EST and June 28, 2017, 2:36 PM EST).

[162] *See* 9 VA. ADMIN. CODE § 25-870-92 (2017).

[163] Virginia Stormwater Management Handbook, *supra* note 37, at 5-B-4—5-B-5. The handbook was most recently updated in 2013, and is considered a guidance document. *See supra* note 86.

[164] *See* Virginia Stormwater Management Handbook, *supra* note 37, at 5-B-26 ("In general, the watershed- or receiving water-based criteria will be more specific and detailed than the State-established BMP design specifications. For example, the local stormwater guidance criteria may be more prescriptive with respect to local precipitation amounts for various design storms,

assumes, throughout its discussion of preparing an effective CSWM plan, that strategic siting and siting criteria for BMPs is an integral element of taking the watershed approach to stormwater management. The Handbook notes that different portions of watersheds require different types of stormwater controls. One reason taking a watershed-wide approach is particularly effective relates to how it permits the siting of a variety of on-site and regional facilities in locations where the greatest respective benefits are achieved. In fact, this approach results in greater use of nonstructural measures, including both large-scale green infrastructure and small-scale ESDs.[165] An effective CSWM plan should base criteria, for selecting and locating stormwater source controls and treatment practices, on watershed-specific factors. Important elements to identify include points where hydraulic structures or watercourses are inadequate under existing or anticipated future conditions.[166] Even more specifically, the Handbook states that ensuring the stormwater drainage system performs safely and effectively means accounting for extreme storms, adding "[c]onsequently, communities need to ensure that their stormwater infrastructure can prevent increased flooding caused by development (*and possibly exacerbated [by] future climate change*)."[167]

Related to the above discussion, CSWM plans incorporate broader powers held by localities, including flood assessment, land use planning, and zoning. The Handbook envisions the CSWM plan acting as an overlay district, one which specifies which ESD techniques are most applicable in individual sub-watersheds to meet the plan's goals and objectives.[168] Virginia's stormwater management regulations, in defining CSWM plans, note they "may be integrated with *other land use plans or regulations*."[169]

Comprehensive options afford a valid option for localities administering a VESMP once the updated VESMA goes into effect. Nevertheless, DEQ ultimately retains the power to approve or void the locality's VESMP, including CSWM plans it deems inconsistent with the VSMA and regulations[170]

Floodplain management authority

Virginia's Flood Protection and Dam Safety laws generally are less focused on local authority. They chiefly affect the roles and responsibilities of state-level entities, and the making of loans and grants.

2. Maryland

Maryland is neither a strictly Home Rule nor Dillon Rule state.[171] Home Rule generally means the state's political subdivisions—its counties and municipalities—are authorized to legislate on almost all local

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runoff reduction and BMP sizing requirements, outline a preferred sequence for BMPs, *and indicate where BMPs should (or should not) be located* in the watershed." (emphasis added)).

[165] *Id.* at 5-6.

[166] *Id.* at 5-B-11.

[167] *Id.* at 5-B-29 (emphasis added).

[168] *Id.* at 5-B-30.

[169] 9 VA. ADMIN. CODE § 25-870-10 (2017) (emphasis added).

[170] VA. CODE ANN. § 62.1-44.15:27(H) (2017).

[171] The Dillon Rule is discussed above in greater detail in regard to Virginia. To reiterate briefly, a "Dillon Rule state" refers to states in which localities are limited to exercising the powers expressly granted to them by the state. *See supra* note 124.

matters, without seeking permission from the state; the usual exception involves preemption by or conflict with state law. Of Maryland's 23 counties, six are Commissioner Counties, 11 are Charter Counties, with the power to legislate on almost all local matters, and six are Code Home Rule Counties, possessing home-rule powers and authorized to enact legislation in the areas of the "express powers" of the charter counties.[172] Maryland applies Home Rule to all of its 157 incorporated cities.[173]

General powers to promote public welfare and control stormwater management

Maryland's Local Government code expressly grants municipalities and most counties substantial powers over public safety, zoning, flood mitigation, and stormwater system management. The scope of this delegated authority arguably permits these localities to establish ESD siting criteria.

For example, the state grants municipalities express law making powers to "protect and preserve the municipality's rights, property, and privileges" and "secure persons and property from danger and destruction."[174] This may extend to issuing ESD siting guidelines, which ultimately better protect residents and property from flooding and water pollution, as sea levels rise and precipitation patterns shift. Similarly, Charter counties are authorized to legislate so as to maintain "the peace, good government, health, and welfare of the county."[175]

Statutory provisions explicitly grant localities power over stormwater management. Charter and Code counties are authorized to enact local laws providing not only for creating a storm drainage district and initiating related capital projects, but also, specifically, to regulate storm drainage facilities.[176]

Zoning

State law grants localities extensive authority over land use within their jurisdictions. Local governments are explicitly authorized to regulate "the location and use of buildings, signs, structures, and land."[177] This grant of power is limited only by its broad purpose of promoting the community's health, safety, and general welfare.[178] Construing stormwater management facilities, including ESDs, as "structures," indicates localities are empowered to regulate where these facilities may be located. While "structure" is not explicitly defined in the land use context,[179] there is a strong argument in favor of including stormwater facilities. Tellingly, Maryland's flood management statute explicitly refers to stormwater

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[172] *See Code Home Rule vs. Commissioner vs. Charter*, 2015 NEWLY ELECTED OFFICIALS ORIENTATION (Md. Ass'n of Counties, Annapolis, Md.), *available at* http://www.mdcounties.org/DocumentCenter/Home/View/39.
[173] *Home Rule in Maryland*, MD. MUN. LEAGUE, http://www.mdmunicipal.org/index.aspx?NID=414 (last visited June 15, 2017).
[174] MD. CODE ANN., LOCAL GOV'T. § 5-202 (LexisNexis 2017).
[175] MD. CODE ANN., LOCAL GOV'T. § 10-206(a)(2) (LexisNexis 2017).
[176] MD. CODE ANN., LOCAL GOV'T. § 10-321 (LexisNexis 2017).
[177] MD. CODE ANN., LAND USE § 4-102(6) (LexisNexis 2017) (emphasis added).
[178] *See id.*
[179] *See also* E-mail from Paul Cucuzzella, Principal Counsel, Md. Dep't of Planning (Apr. 5, 2017, 2:43 PM EST) (on file with author).

facilities as "structures."[180] This interpretation extends to most small-scale ESDs which—despite mimicking natural processes—are ultimately human-designed and constructed.[181] Alternately, the location of stormwater facilities would fall under the regulation of land generally.

Similar to Virginia, localities possess extensive zoning authority.[182] State law requires zoning regulations to serve one of a number of listed purposes. Among these are to "promote health, public safety, and general welfare," "promote the conservation of natural resources," and "prevent environmental pollution."[183] Unrestricted flooding threatens the public safety in terms of human injury, property damage, and pollution. Effectively-designed and -located ESDs perform better as flood-prevention measures to reduce runoff and filter water, preserving water quality and protecting the watershed. This suggests local governments may leverage this authority to define separate climate resiliency, watershed, or stormwater management zones. The area and shape of each zone or subzone could be determined by predicted sea level rise and storm intensity and flooding projections.

Analysis of regulatory takings statutory and case law in Maryland comports with the discussion on the same issue pertaining to Virginia. Maryland's constitution states: "The General Assembly shall enact no Law authorizing private property to be taken for public use without just compensation, as agreed upon between the parties, or awarded by a jury, being first paid or tendered to the party entitled to such compensation."[184] Maryland state code similarly limits condemnation proceedings to a public use objective, and mandates just compensation.[185] To determine regulatory takings, Maryland courts will look to three factors: "(1) the economic impact of the regulation on the claimant, (2) the extent to which regulation has interfered with distinct investment-backed expectations, and (3) the character of the governmental action."[186] ESD siting criteria should pose similarly little risk of inviting regulatory takings claims.

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[180] MD. CODE ANN., ENVIR. § 5-803(d)(2) (LexisNexis 2017) ("[Flood] [m]anagement techniques may include…Stormwater detention or retention *structures*." (emphasis added)). Note also that Maryland's stormwater regulations clarify that terms not defined there or in the relevant statutes will have "the meaning attributed by common use," suggesting the dictionary definition of "structure" is appropriate. *See* MD. CODE REGS. 26.17.02.02(A) (2017).

[181] "Structure" is separately defined in other sections of Maryland's state code. For example, the Transportation code defines "structure" as "any object constructed or placed on or above the ground, including any building, fence, derrick, haystack, pole, wire, tower, or smokestack." MD. CODE ANN., TRANSP. §5–101(m) (LexisNexis 2017). MD. CODE ANN., STATE FIN & PROC. §3-602.3 (LexisNexis 2017), has a much more limited definition.

[182] MD. CODE ANN., LAND USE § 4-201 (LexisNexis 2017) ("A legislative body may divide the local jurisdiction into districts and zones of any number, shape, and area that the legislative body considers best suited to carry out the purposes of this division… zoning regulations shall be uniform for each class or kind of development throughout each district or zone; but zoning regulations in one district or zone may differ from those in other districts or zones").

[183] *See* MD. CODE ANN., LAND USE § 4-202 (LexisNexis 2017).

[184] MD. CONST. art. III, § 40.

[185] MD. CODE ANN., REAL PROP. § 12-101 (LexisNexis 2017).

[186] *Muskin v. State Dep't of Assessments & Taxation*, 422 Md. 544, 566 (Ct. App. MD 2011) (citing *Neifert v. Dep't of the Env't*, 395 Md. 486, 517 (2006)). Similar to Virginia, plaintiffs may state a claim for inverse condemnation by pleading governmental inaction "in the face of an affirmative duty to act." *Litz v. Md. Dep't of the Env't*, 446 Md. 254, 267 (Md. Ct. App. 2016) (alleging state's failure to address pollution and sewage from private property owners' septic fields resulted in run-off which contaminated plaintiff's recreational campground property). In *Litz*, the court held "an inverse condemnation claim is pleaded adequately when a plaintiff alleges a taking caused by a government entity's or entities' failure to act, in the face of an affirmative duty to act." *Id*.

Stormwater management authority

Maryland's Stormwater Management Act states that MDE regulations shall "[m]ake allowance for the difference in hydrologic characteristics and stormwater management needs of different parts of the State."[187] This acknowledges that stormwater management strategies are region-specific, and implies certain flexibility for local stormwater management programs to include ESD siting guidelines when useful for addressing climate-driven changes to local hydrological conditions and precipitation patterns. Furthermore, MDE regulations specify only the "*minimum* content of the local ordinances,"[188] implying that state regulations establish a floor rather than a ceiling on local regulatory authority over stormwater management and ESDs. The stormwater regulations, in describing the minimum county and municipal control requirements, state that "an approving agency may require more than the minimum control requirements specified…if hydrological or typographic conditions warrant or if flooding, stream channel erosion, or water quality problems exist downstream…"[189]

However, any locally-promulgated ESD siting guidelines remain subject to MDE approval. MDE reviews localities' stormwater management programs on a triennial basis, and stormwater management ordinances must be approved by the Water Management Administration.[190] Localities wishing to develop and legislatively enact binding guidelines, as part of their stormwater management program, must submit any proposed amendments for review and approval.[191]

Floodplain management authority

Maryland's Flood Control and Watershed Management laws require subdivisions with designated priority watersheds to prepare and implement a flood management plan.[192] Flood management techniques may include stormwater detention or retention structures and "other practical methods."[193]

The regulations establishing criteria for flood management plans note these plans are intended "to guide activities in a watershed so that flood hazards are minimized" and to attain a set of goals, including the specific objective of the "prevention of *future* flood hazards," and with a broad supporting aim to include "[a]ny rules, regulations, or ordinances necessary for implementation and hazard

[187] MD. CODE ANN., ENVIR. §4-203(b)(2) (LexisNexis 2017).
[188] MD. CODE ANN., ENVIR. §4-203(b)(5) (LexisNexis 2017); *see also* MD. CODE REGS. 26.17.02.01(B) (2017) ("This chapter specifies the minimum content of county and municipal ordinances").
[189] MD. CODE REGS. 26.17.02.06(A)(4) (2017).
[190] MD. CODE REGS. 26.17.02.03(B)-(C) (2017) ("A variation of requirements by a county or municipality on a specific watershed may not be valid unless approved by the Administration…. at least once every 3 years after that, the Administration shall inspect and review the stormwater management programs of the counties and municipalities… To be found acceptable, a stormwater management program shall have [a]n Administration-approved stormwater management ordinance in effect").
[191] MD. CODE REGS. 26.17.02.04 (2017); *see also* MD. CODE REGS. 26.17.02.03(B) (2017) ("The stormwater management programs which are adopted by the counties and municipalities shall include stormwater management criteria consistent with the standards, procedures, and regulations of the Administration. *A variation of requirements by a county or municipality on a specific watershed may not be valid unless approved by the Administration*" (emphasis added)).
[192] Notably, Maryland's Stormwater Management Act requires localities to adopt and implement a stormwater management program, *consistent with* any flood management plan. MD. CODE ANN., ENVIR. §4-202 (LexisNexis 2017).
[193] MD. CODE ANN., ENVIR. § 5-803 (d)(2)(iii), (ix) (LexisNexis 2017).

mitigation."[194] This anticipatory language permits localities to develop, as a flood control technique incorporated into flood management plans, ESD siting criteria based on the predicted impacts of climate change on the watershed.

Further support is found in Maryland's regulations pertaining to the required contents of flood management plans, which mandate that such plans include "[a] description of potential flood damages" and "[t]he selected projects and techniques necessary to mitigate flood damages."[195] In practice, municipalities, when updating their floodplain ordinance, may adopt more stringent standards, even if not specific to climate change.[196]

[194] MD. CODE REGS. 26.17.05.04 (2017) (emphasis added).
[195] *Id.* at (7)(a), (7)(c).
[196] *See, e.g.*, QUEEN ANNE'S CTY. CODE § 14:3-12(B) (2014) (defining "Flood Protection Elevation" as "The base flood elevation plus two feet of freeboard," rather than using the one-foot minimum).

VI. POTENTIAL CHANGES IN LEGAL AUTHORITY

The previous chapter describes many opportunities for integrating climate resiliency siting considerations into ESD decisions using existing legal authority. Localities can adopt their preferred ESD policies within the limits of existing grants of authority and the current stormwater management structure. In both Virginia and Maryland, use of the zoning power appears the most promising pathway for localities to establish ESD siting guidelines.

- Zoning power is broad in scope and, through establishing overlay zones based on predicted climate change impacts, localities can comprehensively address stormwater management as part of an overall watershed management plan, and incorporate both land use and stormwater management into their climate resiliency strategies.
- Developing siting criteria within the state stormwater structure requires greater coordination with state agencies, which retain approval authority.[197] However, this strategy can provide clear guidance and greater consistency both within each state and across the Chesapeake Bay watershed.

State and local officials interested in further developing climate resilient ESD siting criteria or requirements have several additional options, requiring changes in laws and regulations:

1. State administrative and legislative authorities can adopt minor adjustments to the existing law and policy framework that would more clearly assert, and extend, state and local authority to enact climate change-based ESD siting policies.
2. Enact legislative measures that would not only provide a clear grant of *discretionary* authority, but also explicitly *mandate* state agencies or local governments to establish ESD siting guidelines addressing climate change.

A. Make minor modifications to existing state law and implementing mechanisms

Virginia's and Maryland's stormwater and flood management statutes, regulations, and guidance documents include several provisions, where minor modifications can provide state agencies or localities with clearer authority to establish climate-change based siting guidelines for ESDs.

1. Virginia

Update the Virginia Stormwater BMP Clearinghouse Website. This website is expressly cited in the Virginia regulations as providing design specifications and the pollutant removal efficiencies

[197] Alternatively, localities may justify siting criteria as a water quality measure under MS4 permit regulations—e.g., as meeting the mandate to implement ESD to the MEP in Maryland. *See, e.g.*, Md. NPDES Guidance, *supra* note 56. The argument is that greater flooding caused by climate change will cause improperly-sited ESDs to fail, resulting in decreased water quality from unfiltered runoff. One counter is that the majority of pollutants are addressed by treating the first one-inch of runoff, and ESDs are effective as long as they can treat that amount. This ignores the underlying problem needing to be addressed as one of both water quality *and* quantity.

for all approved BMPs.[198] DEQ could update BMP information on the website, to include siting and additional design criteria for each BMP.

Amend VSMA § 62.1-44.15:28 (Development of regulations). This subsection of Virginia's stormwater statute authorizes the Board to adopt regulations which VESMP authorities must follow. The legislature could modify Objectives 3, 6, and 10 in order to confirm the Board's power to prescribe statewide standards on where different types of stormwater facilities may be located, based on: (1) how climate change, and not just development activity, will affect stormwater runoff; and (2) predicted, rather than historical and current hydrological conditions.

- *Objective 3:*
  - Current language: Board regulations will "[b]e based upon relevant physical and developmental information concerning the watersheds and drainage basins of the Commonwealth, including data relating to land use, soils, hydrology, geology, size of land area being disturbed, proximate water bodies and their characteristics, transportation, and public facilities and services."[199]
  - New language: "…including data related to land use, soils, current and predicted hydrology, geology, size of land area being disturbed, proximate water bodies and their characteristics, transportation, climate change impacts, and public facilities and services."
- *Objective 6:*
  - Current language: Directs the Board to: "Establish water quality and water quantity technical criteria. These criteria shall be periodically modified as required in order to reflect current engineering methods."[200]
  - New language: "…and to reflect predicted changes in hydrological conditions, including those caused by climate change, based on scientific projections using data collected according to best practices generally accepted by the scientific community, and relying on models and methods which have undergone peer review and which are also generally accepted by the scientific community."
- *Objective 10:*
  - Current language: Directs the Board to: "Establish statewide standards for soil erosion control and stormwater management from land-disturbing activities."[201]
  - New language: "…and climate-change related impacts to site and watershed hydrology."

Amend VSMA § 62.1-44.15:29.1 (Stormwater Local Assistance Fund). This subsection of Virginia's stormwater law establishes a fund, available to provide local government with matching grants to plan, design, and implement stormwater capital projects. The statute lists

[198] *See* 9 VA. ADMIN. CODE § 25-870-65(B); *see also Virginia Stormwater BMP Clearinghouse*, VA. DEP'T OF ENVTL. QUALITY (Apr. 23, 2014), http://www.vwrrc.vt.edu/swc/.
[199] VA. CODE ANN. § 62.1-44.15:28(3) (2017).
[200] *Id.* at (6).
[201] *Id.* at (10).

seven categories of project types, which are eligible to receive grant funding; use of the funds is also limited to four specific water quality goals.[202] The legislature could add a requirement that climate-related siting criteria be met for any funded project.

Amend VA Code § 15.2-970 (Construction of dams, levees, seawalls, etc.; certain proceedings prohibited). This provision is included among those granting local governments their general powers. Specifically, it permits any locality to "construct a dam, levee, seawall or other structure or device, or perform dredging operations…the purpose of which is to prevent the tidal erosion, flooding or inundation of such locality, or part thereof. The design, construction, performance, maintenance and operation of any of such works is hereby declared to be a proper governmental function for a public purpose."[203] The language grants localities extensive authority over flood protection management. A strong argument can be made that the combination of "construct" and the examples following "the purpose of which" implies a power to regulate the siting of stormwater infrastructure; the location of a stormwater facility is essential to its operation and performance. However, the legislature could state this expressly, as follows: "construct a dam, levee, seawall, stormwater facility, including both grey and green infrastructure practices, or other structure or device… The design, construction, performance, maintenance, siting, and operation of any of such works…." This statutory chapter would include clarifying definitions of "grey infrastructure" and "green infrastructure."

2. Maryland

Adopt MDE-identified program changes to implement climate adaptation policies for stormwater management. The Governor and Secretary of MDE could direct MDE to, under the 2015 Maryland Commission on Climate Change Act (Senate Bill 258), identify within its stormwater program opportunities to create or revise policy, regulatory, and fiscal programs for addressing climate change.[204] Focus should be placed on sea level rise, flooding, and increased precipitation. Any recommendations should be reviewed and pursued concurrently with the development of ESD siting criteria. Such a review would inform efforts to draft these criteria, and vice versa. This encourages a holistic process to updating the approach to stormwater management from the perspective of addressing climate change impacts.

Amend Stormwater Design Manual (Chapter 4, *Guide to BMP Selection and Location in the State of Maryland*). Chapter 4 of the Design Manual provides developers with direction on selecting the best BMP or group of practices at a new development site. The chapter also discusses which environmental and other factors to consider when actually locating each BMP.[205] MDE could modify this chapter to include a discussion of important climate change

[202] VA. CODE ANN. § 62.1-44.15:29.1 (2017).
[203] VA. CODE ANN. § 15.2-970 (2017).
[204] S.B. 258, 2015 Reg. Sess. (MD. 2015) (codified as MD. CODE ANN., ENVIR. §§ 2-1301—2-1306) (LexisNexis 2017).
[205] Design Manual, *supra* note 23, at chap. 4.

considerations to take when locating non-structural BMPs, whether on individual parcels or on a watershed-level for public stormwater management system facilities.

Improve stormwater regulatory definition § 26.17.02.02 (Definitions). This regulatory provision lists key terms and their definitions, as used in Maryland's stormwater regulations and the Stormwater Design Manual. The definition of "Stormwater management" distinguishes between *quantitative* and *qualitative* control. The former is described as "a system of vegetative and structural measures that control the increased volume and rate of surface runoff caused by *man-made changes* to the *land*."[206] The wording limits the identified causes of increased water volume and resulting flooding to *direct* human activity. This excludes climate change impacts, such as rising sea levels, increased precipitation, and more intense and frequent storm events. MDE could expand this section of the definition, by adding language that includes climate change impacts as a driver of increased surface runoff.

Amend stormwater regulatory provision § 26.17.02.06 (Minimum Control Requirements). This regulatory provision states the basic responsibilities of localities in managing stormwater. This includes requiring the standards set out in the Design Manual to be used in planning, designing, and constructing stormwater facilities.[207] Sub-provision (4) notes that localities, in their role reviewing and approving stormwater management plans, "may require more than the minimum control requirements specified…if hydrologic or topographic conditions warrant or if *flooding*, stream channel erosion, or water quality problems *exist*."[208] MDE could modify the language to account also for *predicted* hydrologic conditions, thus permitting consideration of future climate change impacts on the stormwater management system.

Amend flood management grant program regulatory provision § 26.17.05.04 (Flood Management Plans). This provision describes the required contents of flood management plans. The legislature could modify Requirements 7 and 10 as follows:

- *Requirement 7*
  - Existing language: Mandates plans include certain information "based upon the ultimate development of the watershed and flood events up to and including the 100-year flood."[209]
  - New language: "…<u>and based upon projected climate change impacts to the watershed</u>."
- *Requirement 10*
  - Existing language: States flood management plans must contain "[a]ny stormwater management requirements and techniques necessary to mitigate

[206] MD. CODE REGS. 26.17.02.02(36)(a) (2017) (emphasis added). A qualitative control measure, in contrast, refers to "a system of vegetative, structural, and other measures that reduce or eliminate pollutants that might otherwise be carried by surface runoff." *Id.* at (36)(b).
[207] MD. CODE REGS. 26.17.02.06(A)(1) (2017).
[208] *Id.* at (A)(4) (emphasis added).
[209] MD. CODE REGS. 26.17.05.04(7) (2017).

the adverse effects of *land use* changes on stream flows and flood frequency."[210]

- New language: "…and to mitigate the adverse impacts of land use and climate change on…"

B. Enact comprehensive new legislation expressly adopting or empowering localities to adopt ESD siting guidelines

The Virginia and Maryland state legislatures can directly modify the current stormwater management regime and enact a straightforward and explicit grant of power to localities to incorporate pragmatic consideration of climate change impacts into ESD siting and design.

A state may choose to make siting guidelines mandatory to enhance climate resiliency and ensure uniformity. Any such legislative enactment should include consideration of the following elements:

- Provide localities with sufficient flexibility. If the state develops uniform criteria, or establishes guidelines for localities to develop their own siting guidelines, localities will benefit from a certain amount of discretion in the methodology they use for implementation. Local stormwater management officials will have greater familiarity with hydrological conditions specific to their region.
- Update related stormwater and floodplain management statutes and regulations to allow localities to act prospectively, as long as they base policy on appropriate methodologies and studies and other sources of data to make predictions about precipitation, sea level rise, and extreme weather events. Update the design storm methodology and the data upon which they are based, and establish the use of these as a floor and not a ceiling. Give localities flexibility to use new data. Any restrictions should have as their primary aim ensuring the quality of methodology and underlying data. Currently, state and federal agencies use past conditions—such as rainfall data that is greatly outdated—to predict the future. Specific examples for flexibility and prospective analysis include developing design storms, updating flood insurance maps, and floodplain management.
- Require all planning bodies, including planning district commissions, to incorporate strategies to combat projected climate change impacts, including sea-level rise, recurrent flooding, and increased storm intensity and occurrence. For example, Virginia's planning and land use code mandates that localities, which are located in the Hampton Roads Planning District Commission, incorporate into future CSWM plan updates "strategies to combat projected relative sea-level rise and recurrent flooding."[211] The legislature could update the code to impose this

[210] *Id*. at (10) (emphasis added).

[211] VA. CODE ANN. § 15.2-2223.3 (2017). A local planning commission in Virginia is required to prepare and recommend a comprehensive plan for the physical development of the territory within its jurisdiction. *See* VA. CODE ANN. § 15.2-2223 (2017). The local planning commissions serve primarily in an advisory capacity. VA. CODE ANN. § 15.2-2210 (2017). The governing body considers, and then decides whether to adopt the commission's plan, whether in whole or in part, or to disapprove the plan.

requirement upon all coastal communities, while clarifying the local flexibility to select among and implement a variety of strategies. The provision would list tactics including, but explicitly not limited to, practices such as green infrastructure.

- Refer, in the legislation mandating ESD siting criteria based on climate change impacts, to a separate policy document which contains the more detailed siting criteria.[212] This will permit state and/or local agencies to develop comprehensive siting guidelines, continually refining with the latest data—updated on a reasonable schedule—and work with both technical experts and relevant stakeholders. The criteria can be incorporated into the existing Virginia Stormwater Management Handbook and Maryland Stormwater Design Manual. Ideally, the guidelines will take a comprehensive, watershed-based approach.

VA. CODE ANN. § 15.2-2226 (2017). If approved and adopted by the governing body, the comprehensive plan then controls the location, character, and extent of public capital projects in that jurisdiction moving forward. No other public project not already featured in an adopted plan is authorized unless submitted and approved by the commission. VA. CODE ANN. § 15.2-2232 (2017). Maryland jurisdictions are also required to enact and execute a comprehensive plan. MD. CODE ANN., LAND USE. § 3-101 (LexisNexis 2017). There are eight required elements, including water resources, and eight permissive elements, which may include (although are not limited to) flood control, natural resources, pollution control, and "*the general location and extent of public utilities*." MD. CODE ANN., LAND USE. § 3-102 (LexisNexis 2017) (emphasis added). The water resources element must identify "suitable receiving waters and land areas to meet stormwater management and wastewater treatment" MD. CODE ANN., LAND USE. § 3-106(a)(2) (LexisNexis 2017).

[212] Incorporating the policy document by reference into the statute would make the criteria legally enforceable, with updates to the document made via the regulatory process. This is similar to the Maryland Stormwater Design Manual, which the Maryland Code of Regulations incorporates by reference. *See supra* note 111. There are limited examples of siting criteria incorporated into Virginia's stormwater regulations. *See, e.g.*, 9 VA. ADMIN. CODE § 25-870-85 (2017) (requiring geological and hydrological studies in karst areas prior to constructing stormwater management impoundment facilities or structures); 9 VA. ADMIN. CODE § 25-870-95(C) (2017) (providing that BMPs selected for "land-disturbing activity" sites grandfathered into the existing VSMA must be "*located*, designed, and maintained to perform at the target pollutant removal efficiency specified…" (emphasis added)).

VII. POLICY SUGGESTIONS

Efforts are just beginning to develop siting guidelines in order to maximize the resilience of ESD facilities to projected climate change impacts. Promising work is underway, led by the Chesapeake Bay Program's Climate Resiliency Workgroup. In the near future, policymakers, engineers, hydrologists, and other key stakeholders will engage in technical research into reducing ESD vulnerability to sea level rise, coastal storms, and extreme events, while increasing ESD effectiveness in mitigating their impacts.

However, the limited work already conducted in this area, in conjunction with best practices emerging from wetland and habitat restoration projects, does yield the following, initial considerations for developing siting and design guidelines:

- Update standards for design storms to account for predicted changes in runoff.
- Target geographic areas with long-term benefits, which will be sustainable under future conditions.
- Incorporate uncertainty by planning for multiple climate scenarios. For example, model the storm surge associated with different sea level rise scenarios.
- Account for slope and elevation in assessing site vulnerability.
- Identify areas with high flow risk.
- Adjust for groundwater table.[213]
- Consider the speed at which climate impacts occur with respect to the intended design life of a proposed practice, including the rate of loss of buffer zones.
- Account for all significant impacts of sea level rise, such as inundation and saltwater intrusion.
- Consider the vulnerability of coastal segments that may be reconfigured by storm events.

[213] *See* VA. DEP'T OF ENVTL. QUALITY, APPLICATION OF THE POSTDEVELOPMENT STORMWATER MANAGEMENT TECHNICAL CRITERIA, AS ESTABLISHED IN THE VIRGINIA STORMWATER MANAGEMENT PROGRAM REGULATIONS, IN AREAS WITH A SEASONAL HIGH GROUNDWATER TABLE: HOUSE DOCUMENT NO. 15 (2016), *available at* http://leg2.state.va.us/dls/h&sdocs.nsf/By+Year/HD152016/$file/HD15.pdf (prepared pursuant to H.R.J. Res. 587, Reg. Sess. (Va. 2015)); VA. DEP'T OF ENVTL. QUALITY, APPLICATION OF THE POSTDEVELOPMENT STORMWATER MANAGEMENT TECHNICAL CRITERIA, AS ESTABLISHED IN THE VIRGINIA STORMWATER MANAGEMENT PROGRAM REGULATIONS, IN AREAS WITH A SEASONAL HIGH GROUNDWATER TABLE: HOUSE DOCUMENT NO. 2 (2015), *available at* http://leg2.state.va.us/dls/h&sdocs.nsf/By+Year/HD22016/$file/HD2 pdf (prepared pursuant to H.R.J. Res. 587, Reg. Sess. (Va. 2015)).

In formulating siting guidelines, one potential model for consideration is the Maryland Department of Natural Resources' *Building Resilience Through Habitat Restoration*. This guidance document offers techniques for incorporating climate change impacts into State habitat restoration and enhancement project planning, implementation, and project management within the Department's Chesapeake and Coastal Service (CCS). The guidelines provide an example of documenting internal procedures for conservation and restoration project implementation, and include available sources for informing project targeting, prioritization, site analysis, design, and environmental review.[214] Both habitat restoration and ESDs serve as an adaptive management strategy for addressing climate change impacts. ESD siting guidelines may parallel a number of the considerations listed in DNR's own site analysis guidelines for habitat restoration projects which enhance coastal resiliency.

[214] HABITAT RESTORATION & CONSERVATION DIV., CHESAPEAKE & COASTAL SERV., MD. DEP'T OF NAT. RES., BUILDING RESILIENCE THROUGH HABITAT RESTORATION 22-27 (2015), *available at* http://dnr2.maryland.gov/ccs/Documents/NF_CCS-HRC_Climate_2015 pdf.

VIII. CONCLUSION

Systematic incorporation of climate change impacts into stormwater management remains at an early stage in Maryland and Virginia. This includes ESD practices—an area in which Chesapeake communities have historically innovated. Yet efforts are beginning, including those of the Chesapeake Bay Program partnership, which is working to assess the state of the knowledge and compile existing ESD siting and design guidelines, tools, and resources, to assist states and localities with preparing for sea level rise and more extreme weather events, which threaten to overwhelm the region's current stormwater infrastructure.

This paper is offered as a tool for local and state officials alike, who recognize the hazards climate change pose to human life, health, and property, as well as to the Chesapeake's wildlife habitat, natural resources, and cultural heritage. State and local governments can pursue the development of strong, science-based guidelines, within the present legal and policy structure. States can work within the existing framework primarily by issuing new regulations, while localities can act either by leveraging their land use authority, or by promulgating guidelines as strictly a stormwater management solution. State officials also have the power to innovate via new legislation, and develop a uniform set of criteria that serves as a baseline standard for localities to further refine.

The Chesapeake region stands in a position to take national leadership on the issue of climate change impacts to our vulnerable coastal communities. Rather than resorting to retreat, or relying on conventional stormwater strategies already proving ineffective, the people of Maryland and Virginia have an opportunity to demonstrate their resiliency in the face of change.

IX. APPENDIX A

Climate adaptation and resilience geospatial mapping resources are available to Virginia and Maryland local governments. These can help both state agencies and local government develop siting strategies that are consistent with other objectives and requirements. A few of the key resources are as follows:

A. Virginia

The Virginia Institute of Marine Science's (VIMS) Center for Coastal Resources Management has created a data portal for local governments, which includes maps for coastal jurisdictions to aid in tidal shoreline management. The Comprehensive Coastal Resources Management Portal is tailored to each coastal locality. Included in the portal is a map viewer that can assist in siting and locating facilities.

Visit: http://ccrm.vims.edu/ccrmp/index.html

Virginia's *Coastal GEMS* provides a very user-friendly portal for geospatial information and mapping on a wide variety of issues related to coastal habitats in the Commonwealth. Coastal GEMs provides extensive information on coastal resources in Virginia in the form of detailed descriptions and interactive spatial data. Coastal GEMs utilizes the following data layers: coastal water, coastal wildlife, coastal land, conservation planning, shellfish management, coastal access, Atlantic Coast recreational use, and reference layers. Within these data layers are sub-layers that enable users to view data about the condition of various coastal resources, habitat types, and existing environmental protections. Within the Conservation Planning layer, data sets show potential wetland restoration sites, ecological core areas, and results from the Virginia Ecological Value Assessment. Coastal GEMs offers users limited ability to view the impacts of climate change, represented by sea-level rise.

Visit: http://www.coastalgems.org/

B. Maryland

Maryland makes available online a large portfolio of mapped data through *iMAP*, the state's data portal for geospatial information. It includes numerous datasets, maps, and mappers available to users inside and outside government. Environmental datasets relevant to this study include the *Maryland Coastal Atlas, Maryland GreenPrint, Maryland Critical Area Map, MERLIN Online* (Maryland's Environmental Resources and Land Information Network), and the *Maryland Bay Trust Fund Mapper/Restoration Print*.

GreenPrint offers numerous data layers, including separate layers that can be added to any interactive map to address "Climate Impacts." These climate impacts layers include: Sea-Level Rise Affecting Marshes Model (SLAMM)(with results projected for 2050 and 2100 for different wetland types), Sea Level Rise Vulnerability (LiDAR results at 0-2 ft., 2-5 ft., and 5-10 ft. of sea level rise), Wetland Adaptation Areas (High and Medium priorities added to the state's Targeted Ecological Areas for conservation of wetland migration corridors and future wetland parcels), Storm Surge Risk Areas, and Drought and Fire

Vulnerability layers. Maryland's Coastal Atlas similarly includes this information. Maryland also offers a Water Resources Registry, which allows integration of issues related to habitat, water quality, sea level rise, critical areas, and other uses, in an online, interactive mapping tool. The tool enables users to analyze site selection and impact and mitigation factors. The *Maryland Coastal Atlas* includes climate resilience and risk reduction data layers.

Visit: iMAP Portal
http://imap.maryland.gov/Pages/map-gallery.aspx
Coastal Atlas
http://dnr.maryland.gov/ccs/coastalatlas/Pages/default.aspx
Green Infrastructure Assessment—*GreenPrint*
http://dnr.maryland.gov/land/Pages/Green-Infrastructure-Mapping.aspx
Critical Area Map
http://webmaps.esrgc.org/cbca/desktop/Map
MERLIN Online (Maryland's Environmental Resources and Land Information Network)
http://dnrweb.dnr.state.md.us/MERLIN/
Chesapeake and Atlantic Coastal Bays Trust Fund:
Homepage: http://dnr2.maryland.gov/ccs/Pages/funding/trust-fund.aspx
Map: http://esrgc.org/dashboards/dnrtrustfunds/dashboard

X. APPENDIX B

While few green infrastructure stormwater management projects in Virginia and Maryland are expressly linked to climate change resilience, a number of state and local programs are undertaking otherwise innovative approaches to address runoff through ESDs, which may provide useful information and experience on siting considerations.

A. Maryland

- **Montgomery County**. In 2016, the County developed an official policy committing to the principle of incorporating green infrastructure practices into its stormwater management projects.[215]
- **Howard County**. The County was a 2016 Green Infrastructure Resiliency Grant recipient.[216] Howard County faces a unique challenge in addressing the flooding which consistently affects a significant portion of Ellicott City's historic district. The stormwater system itself bears historic status, which limits the stormwater management practices available to the city to small-scale measures. The Historic Ellicott City Flood and Green Infrastructure Assessment project will identify green infrastructure practices that could lessen the risk of flooding as well as determine the expected level of impact each practice would make.[217] Subsequent steps will include identifying funding options to assist both local government and private homeowners to implement these small-scale, customized solutions.
- **Somerset County.** The County was a 2016 Green Infrastructure Resiliency Grant recipient. Smith Island is comprised of multiple islets and is prone to regular flooding. The Smith Island Open Ditch Drainage Assessment project will locate and digitize all roadside and non-roadside ditches which contribute to runoff. The project will then categorize and prioritize the deficiencies in the system, and determine what improvements would best address the deficiencies. Solutions may include GI/ESD practices, such as rain barrels, retention gardens, and swales. Phase II is contingent on securing funding, and would implement these improvements.[218]

B. Virginia

- **Hampton.** This city, on the lower coastal plain and surrounded on three sides by water, experiences chronic flooding related to poor drainage, a very high water table, and little

[215] MONTGOMERY CTY. DEP'T OF ENVTL. PROT., NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM: MUNICIPAL SEPARATE STORM SEWER SYSTEM PERMIT—FY2016 ANNUAL REPORT, 117-18 (2017), *available at* https://www.montgomerycountymd.gov/DEP/Resources/Files/downloads/water-reports/npdes/AnnualReport-FY16-2-27-17-Final pdf. The policy is non-binding and serves as guidelines for incorporating green infrastructure into the County's restoration efforts. E-mail from Amy Butler Stevens, Manager, Watershed Planning and Monitoring, Montgomery Cty. Dep't of Envtl. Prot. (Apr. 3, 2017, 12:33 PM EST) (on file with author).

[216] *See* Community Resiliency Grants, *supra* note 105.

[217] *See Six Communities Receive Flooding and Storm Event Funding*, MD. DEP'T OF NAT. RES. (June 7, 2016), http://news.maryland.gov/dnr/2016/06/07/six-communities-receive-flooding-and-storm-event-funding/.

[218] Public Notice, County Commission for Somerset County, Maryland, Request for Proposals: Smith Island Open Ditch Drainage System Assessment (2016), *available at* http://www.somersetmd.us/bids/2016RFPSmithIslandDrainage pdf.

topographic relief. The City recently initiated a 12-18 month resilience planning project, in partnership with the Dutch Embassy and with consultants who were instrumental in the post-Hurricane Katrina resiliency planning in New Orleans.[219]

- **Richmond.** Virginia's capital is currently conducting a green alley study under a DEQ grant. The study evaluates the effectiveness and long-term operations and maintenance costs of different green infrastructure technologies. The overarching goal is meeting the need to replace the city's aging infrastructure with green solutions, while driving down long-term costs. Total lifecycle costs include savings obtained from maintenance, longevity, and nutrient reduction.[220]
- **Stafford County.** An early adopter of new water quality control measures, Stafford imposed requirements for the removal of phosphorous, the primary pollution target, which were stricter than those imposed by other Virginia counties. The county also embraced green infrastructure, offering developers incentives to implement ESD measures.[221] Stafford later required ESD to be ranked first in considering water control measures for development projects; developers needed to prove ESD impractical in order to resort to conventional (grey infrastructure) measures. Following widespread adoption of ESD, the county permitted new and innovative devices and methods to be used on a demonstration and testing basis, in order for manufacturers to gather the data needed to receive DEQ approval. Examples included an upflow device and permeable paving. In 2014, Virginia adopted new state stormwater management regulations, restricting use of ESDs either to the devices listed on the Virginia Stormwater BMP Clearinghouse Website, or those which follow a prescribed approval process.[222] Stafford County now complies with the current state regulations, without imposing stricter local requirements.[223]

[219] *Dutch Dialogues*, HAMPTON VA, http://hampton.gov/2855/Dutch-Dialogues (last visited June 16, 2017).
[220] *Green Alleys*, CITY OF RICHMOND DEP'T OF PUB. UTILITIES (July 23, 2009), http://cordpu.blogspot.com/2009/07/green-alleys.html; Telephone Interview with Grace A. LeRose, Program Manager, City of Richmond Dep't of Pub. Util. (June 6, 2017).
[221] Examples of incentives included relaxing curb/gutter and sidewalk requirements for subdivisions that employed ESD.
[222] *See* 9 VA. ADMIN. CODE § 25-870-65 (2017).
[223] E-mail from Rishi R. Baral, Senior Eng'r, Stafford Cty. Dep't of Planning and Zoning (Apr. 24, 2017, 3:31 PM EST) (on file with author) (material prepared by Robert L. Waslov).

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