Hurricane Matthew in October 2016 reminded people across Virginia of the risks posed by coastal flooding. Although Matthew’s winds had substantially weakened, heavy rainfalls in the preceding weeks left the ground saturated. With no place to go, water inundated neighborhoods and roadways.

President Obama issued emergency declarations for cities across southeastern Virginia, and the Federal Emergency Management Agency has since approved more than 2,000 applications for individual assistance.\(^1\)

Though rising flood waters often present challenges, Virginia’s coastlines are home to some of our nation’s greatest ecosystems, the largest naval station in the world, a thriving port and tourism industry, and a burgeoning aquaculture industry. The importance of protecting these assets cannot be overstated. As discussed below, Virginia has made recurrent flooding a recent focus statewide and those efforts must continue to mitigate the ongoing risks posed by flood waters.

Flooding Resilience in the Commonwealth

Flood resilience is a key issue for the current administration. In 2014, Governor McAuliffe established the Climate Change and Resiliency Update Commission by Executive Order and directed the Commission to develop actionable recommendations.\(^2\) Based upon preliminary recommendations of the commission, McAuliffe appointed Secretary of Public Safety and Homeland Security Brian Moran the chief resilience officer for the Commonwealth of Virginia.\(^3\) Moran’s office has made great strides to lead Virginia in this area.\(^4\)

As a part of the federal government’s National Disaster Resilience Competition, the commonwealth was awarded more than $120 million.\(^5\) These funds, mostly allocated to projects in the Ohio Creek Watershed area in Norfolk, will protect and enhance the economic vitality and quality of life in Virginia. The award also provides for a business accelerator, which will focus on developing water
management and resilience related economies in the commonwealth.⁶

**General Assembly**

Hampton Roads' legislators are leaders in proposing and supporting legislation to plan and implement resilience strategies across Virginia. In 2012, then Senator Ralph Northam (6th District), proposed legislation requesting the Virginia Institute of Marine Science (VIMS) “study strategies for adaptation to prevent recurrent flooding in Tidewater and Eastern Shore localities.”⁷ This report, published in January 2013, clarified the issue to many and galvanized support for flooding adaptation in coastal Virginia.

The following year, Delegate Chris Stolle (83rd District) and Senator Lynwood Lewis (6th District) led the effort to establish a joint subcommittee to recommend short-term and long-term strategies to minimize the impact of recurrent flooding and coastal storms,⁸ which was reauthorized in 2016 as the Joint Subcommittee on Coastal Flooding.⁹ Below are examples of key legislation passed by the General Assembly since 2015.

• **Incorporate Sea Level Rise and Recurrent Flooding into Comprehensive Plan.** The 2015 General Assembly passed SB 1443 (Ch. 186 of the 2015 Acts of Assembly), requiring that “[b]eginning July 1, 2015, any locality included in the Hampton Roads Planning District Commission shall incorporate into the next scheduled and all subsequent reviews of its comprehensive plan strategies to combat projected relative sea-level rise and recurrent flooding.”¹¹ As Virginia is a Dillon Rule state, this legislation is helpful to these localities because it provides express authority to incorporate such strategies.

• **Virginia Shoreline Resiliency Fund.** The 2016 General Assembly passed SB 282 (Ch. 762 of the 2016 Acts of Assembly), establishing the Virginia Shoreline Resiliency Fund (the Fund) and stating that “[l]ocalities shall use moneys from the Fund primarily for the purpose of creating a low-interest loan program to help residents and businesses that are subject to recurrent flooding as confirmed by a locality-certified floodplain manager. Moneys in the Fund may be used to mitigate future flood damage.”¹² The General Assembly has not yet appropriated money for the Fund.¹³

• **Living Shorelines Local Tax Exemption.** The 2016 Virginia General Assembly passed HB 526 (Ch. 610 of the 2016 Acts of Assembly), which provides that any living shoreline project approved by the Virginia Marine Resources Commission or the applicable local wetlands board and not prohibited by local ordinance shall qualify for full exemption from local property taxes.¹⁴

**Local Action**

Resilience, at its heart, is a community issue, and many localities have led the way in developing and implementing flood resilience strategies.

Norfolk, named in the Rockefeller Foundation’s first round of “100 Resilient Cities,”¹⁵ has fully embraced its goal to “design the coastal community of the future” through integrating a resiliency staff into city management, launching its resilience strategy,¹⁶ and charging forward on a long-term planning process it calls Vision 2100.¹⁷ Portsmouth is incorporating resilience throughout its revised comprehensive plan, and Hampton is developing a plan to “live with water,”¹⁸ which will include actionable short-term and long-term strategies. Virginia Beach received a grant from the National Oceanic and Atmospheric Administration (NOAA) Regional Coastal Resilience Grant Program to continue and expand upon its city-wide analysis of sea level rise and adaptation strategies.¹⁹ Additionally, the Hampton Roads Planning District Commission regularly convenes a Coastal Resilience Committee and associated working group to share strategies and discuss regional planning needs.

Though rising flood waters often present challenges, Virginia’s coastlines are home to some of our nation’s greatest ecosystems, the largest naval station in the world, a thriving port and tourism industry, and a burgeoning aquaculture industry.

The Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project, a two-year project convened by Old Dominion University (ODU), aimed to develop a government and community planning process by bringing together local, state, federal, and
community stakeholders. The project concluded in 2016 with more than thirty discrete recommendations that encourage integration of data, increased regional and governmental collaboration, and a watershed-based approach to resilience.20

**Utilizing University Resources**
Virginia boasts many leading institutions of higher education. ODU and William and Mary (W&M), both located in Virginia’s flooding hot spot of Hampton Roads, have formed a strong partnership and are collaborating on diverse research projects. The initiatives discussed below are designed to enhance resiliency within the commonwealth.

- **Research Center.** Last year, the General Assembly, with the support of McAuliffe, designated the Commonwealth Center for Recurrent Flooding Resiliency (CCRFR) jointly at ODU, VIMS, and the Virginia Coastal Policy Center (the Coastal Policy Center) at W&M Law School.21 The CCRFR engages the expertise, resources, and intellectual vibrancy of the three institutions in support of building resilience to rising waters. The CCRFR serves, advises, and supports Virginia by conducting interdisciplinary studies and providing training, technical and non-technical services, and policy guidance to the commonwealth and its local governments, state agencies, industries, and citizens.

  In its first year, the CCRFR is supporting research and leveraging funds to provide decision makers with actionable tools, information and research. This approach is not constrained by political borders. For example, as the City of Hampton embarks on the development of a resilience plan, CCRFR researchers from ODU, VIMS, and W&M will not only support aspects of the project but will ensure information and strategies are captured to expand upon throughout the commonwealth. The CCRFR is an essential partner to localities, especially those that do not have the ability to develop and test new resilience strategies independently.

- **Tourism Resiliency.** ODU faculty is assessing the resilience of the tourism industry at the Virginia Beach oceanfront in collaboration with Virginia Beach and local stakeholders. This will guide development of customized tools and workshops to support business continuity in the face of flooding. Working in tandem, the Coastal Policy Center is assessing policy support for resiliency to significant storm surges and flooding by analyzing the current overarching legal framework governing the tourism industry in Virginia Beach and statewide, identifying legal and policy impediments to resilient tourism, and detailing laws and policies that could be implemented to support resiliency tourism. Although this project focuses on Virginia Beach, other communities will benefit from the resulting tourism resiliency assessment and policy recommendations.

- **Working Waterfront Master Plan.** The Virginia Working Waterfront Master Plan (the Plan) was featured at the Coastal Policy Center conference on December 2, 2016. In addition to providing background and historical information, the Plan outlines the threats that working waterways face from natural forces and policies that could be enacted at all levels of government to protect working waterways in the future. After the release of the Plan and the legislative panel discussion at the Coastal Policy Center conference, legislation was introduced in the 2017 Session of the General Assembly to address some issues raised in the Plan. The General Assembly passed SB 1203 which authorizes localities to establish working waterfront development areas by ordinance.23 However, SJ 281, which requested that “the Virginia Economic Development Partnership . . . study the long-term economic viability of working waterways,” did not pass.24

- **Integrations of tide gauges and other water level gauges throughout coastal Virginia.** VIMS’s TideWatch program currently integrates data from ten tide gauges (one maintained by VIMS and nine by NOAA) in the lower Chesapeake Bay and its tributaries. TideWatch provides visualization of the predicted astronomical tides at each tide gauge location, plus the observed water level over the previous twenty-four hours and the predicted weather-related water levels over the next thirty-six hours. VIMS is updating the program software and integrating newer tide gauges across the region. Once the network of greater than twenty tide gauges and water-level sensors are integrated it will provide wide-reaching storm surge prediction
capabilities for Tidewater Virginia. VIMS is partnering with Newport News and the National Institute of Standards and Technology to install additional water-level sensors that will link to the system leveraging funds within the region.

• High resolution state-of-the-art street-level flood modeling. VIMS has developed a world-class set of numerical computer models that can predict with high resolution street-level flooding in advance of a storm. VIMS is in the process of optimizing this model throughout Hampton Roads, integrating it into CCRFR research, and consulting with local governments to optimize the modeling capabilities.

• Localized Subsidence Research. In partnership with NASA and the United States Geological Survey, ODU scientists are using synthetic aperture radar (InSAR) data from 2006 to 2011 satellite readings to determine localized rates of land subsidence, which contributes to flooding. Moving forward, ODU will have the capability to conduct ongoing monitoring of subsidence for localities and others using current satellite data.

• Economic Analysis. ODU economists are conducting a series of economic impact analyses as a follow up to the Coastal Policy Center’s “Costs of Doing Nothing” report. The first analysis will detail the existing water management and flood mitigation economy in Hampton Roads, the capacity for the region to become a national and global leader in this area, and recommendations to achieve that goal. Subsequent reports will utilize VIMS street-level modeling to analyze the impact of coastal flooding on commercial development, assist with the development of resilient building codes, and more.

• Road flooding risk in Mathews County. VIMS is utilizing LIDAR elevation data to develop digital elevation maps of roads and roadside ditch elevations throughout Mathews County. This digital map can be used in conjunction with the street-level modeling to predict flooding risk for roads throughout the county under various storm conditions.

• Resiliency data portal. VIMS is developing a data portal, “Adapt Virginia,” that will integrate a wide range of resiliency resources for the commonwealth’s agencies and local governments. The team is working closely with both the Virginia Department of Conservation and Recreation, the Coastal Policy Center, and Wetlands Watch, a Norfolk-based nonprofit, to ensure that the portal, which will launch in 2017, provides a wealth of useful resources and case studies.

• Risk communication. Utilizing output from VIMS’s street-level flood modeling, ODU scientists will develop, analyze, and then enhance flood risk communication in collaboration with local stakeholders. The researchers will use a gamified approach, including a custom text alert system, to test users’ responses and adaptation actions (for example, moving a parked car to a higher elevation in advance of flooding).

• Community Rating System Open Space Mapping. FEMA’s National Flood Insurance Program Community Ratings System (CRS) is a voluntary incentive program that encourages localities to engage in community floodplain management activities to receive discounted flood insurance premiums for residents. ODU and VIMS faculty are actively working with the Coastal Virginia CRS Workgroup to provide technical support to localities in support of CRS programs.

Conclusion
Over the past few years, a variety of stakeholders have made great strides to address flooding resiliency in Virginia, but more can be done, such as funding the Virginia Shoreline Resiliency Fund. As we look toward changing coastlines and storm patterns, Virginia must continue to support its localities, citizens, and businesses to strengthen our communities as we continue to live with rising tides and flood waters.

Endnotes:
4 Legislation introduced in the 2017 session of the General Assembly to establish a stand-alone cabinet level position to focus on coastal flooding resilience did not pass. See HB 1964, Coastal protection and flooding adaptation, Secretary for; creates position; SB 1349, Coastal protection and flooding adaptation, Secretary for; creates position, effective clause.
5 Virginia to receive more than $120.5 million from National Disaster Resilience Competition, Press Release, Governor Terry McAuliffe, (Jan. 21, 2016) http://governor.virginia.gov/newsroom/newsarticle?articleId=13972.
7 Senate Joint Resolution No. 76 (2012).
9 Virginia House Joint Resolution No. 16 (2014).
11 Virginia Code § 15.2-2223.3 (2015).

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22 Mem. Dec., supra note 19, at 36.


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18 “Live with water” and other variations of the same phrase were popularized following the release of the New Orleans Urban Water Plan and other similar initiatives that encouraged localities to develop plans for creatively incorporating flood waters into their communities and community plans instead of simply moving it off land as quickly as possible. See e.g. Waggoner and Ball Architects, “Greater New Orleans Urban Water Plan,” available http://livingwithwater.com.
22 The Plan was funded by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through a U.S. Department of Commerce, National Oceanic and Atmospheric Administration grant, under the Coastal Zone Management Act of 1972.
23 SB 1203, Working waterfront development areas; establishment (to be codified at Va. Code § 15.2-2306.1 (2017)).
24 SJ 281, Study; long-term economic viability of working water-fronts; report.

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