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Thank you Mr. Chairmen, Ranking Member McClintock, and members of the Committee for the opportunity to join you today to discuss important ways to build resilience and protect our coastal communities.

My name is Emily Steinhilber, and I am a Research Assistant Professor at Old Dominion University in Norfolk Virginia. I coordinate Old Dominion University's Commonwealth Center for Recurrent Flooding Resiliency as well as other strategic efforts to enhance coastal resilience research, education, and outreach at the University – a signature issue of current President John R. Broderick's since 2010.

I have been at Old Dominion since 2015, and before that led a small non-profit that worked to engage the business community on issues of water quality and water quantity in Hampton Roads. I am a member of the Virginia State Bar, received a JD and Master's in Environmental Law & Policy from Vermont Law School, and a BA in Economics and History from the University of Virginia. I am also a resident of Virginia Beach, and live, with my husband, and our young daughter between the Atlantic oceanfront and the Lynnhaven River, less than half a mile from where I grew up. Community resilience to flooding in Hampton Roads, Virginia is not just a professional issue for me; it is a personal issue for me as well as my colleagues living in Coastal Virginia.

Old Dominion University, located in the city of Norfolk is Virginia's entrepreneurial-minded doctoral research university with more than 24,000 students. It contributes $2.6 billion annually to the Commonwealth's economy and graduates the second largest percentage of degrees awarded in STEM-H fields among Virginia's universities. The university prides itself on its diverse and military affiliated student body as well as its commitment to excellence in coastal resilience research, outreach, and education. To the university, this excellence in the field of coastal resilience is one born out of not just expertise, but also necessity. Our main campus is located between the shores of the Elizabeth and Lafayette rivers, and much of the campus is vulnerable to flooding. We are committed to doing our part whether that is supporting our local governments with leading edge applied research, or opening our parking garages to neighbors during flooding events.

Established by the Virginia General Assembly in 2016[i], the Commonwealth Center for Recurrent Flooding Resiliency (CCRFR) engages the expertise, resources and intellectual vibrancy of Old Dominion University, William and Mary Law School's Virginia Coastal Policy Center (VCPC) and the Virginia Institute of Marine Science (VIMS) in support of building resilience to rising

waters.[ii] The CCRFR partnership serves, advises, and supports Virginia by conducting interdisciplinary studies and providing training, technical and non-technical services, and policy guidance in the area of recurrent flooding resilience to the Commonwealth and its local governments, state agencies, industries and citizens.

My statements today are based on my experience, are my own professional opinions, and do not represent the position of the University or the Commonwealth.

I thank you again for introducing the bills before us today and supporting legislation that empowers our coastal communities and economies to adapt to rising waters. Bills like these must continue to be a part of a portfolio of policy and fiscal support that weave resilience into the fabric of our communities, reaching our most vulnerable citizens. Beyond our waterfront property owners, coastal resilience must be an essential element of housing, transportation and infrastructure, and our national defense. Today, I will speak to how coastal Virginia is adapting to more water and share my opinion regarding how the bills before us add to the toolkit of resources our communities can utilize when adapting to rising seas.

With limited resources for adaptation in the face of great need, it is absolutely critical that we support programs with multiple benefits. The bills today attempt to do just that. For example, living shorelines are a prime example of a strategy that when used where appropriate enhance water quality, wellbeing of residents, and can increase flooding resiliency.

Sea Level Rise and Flooding in Coastal Virginia

Hampton roads, a region of approximately 1.7 million residents and seventeen localities is a defense community with a deep historical tradition.[iii] Located at the mouth of the Chesapeake Bay, the region's economy is based on the Port of Virginia, tourism – including both Virginia Beach's pleasure beaches as well as Colonial Williamsburg and Jamestown – and of course the military. Beyond Naval Station Norfolk, the largest naval station in the world, the region supports 18 military installations including 2 joint bases.[iv]

With the high quality of life and economic opportunities realized from living and working in Tidewater, Virginia there are also perils of life at sea level. In addition to hurricanes and nor'easters, the region faces some of the highest rates of relative sea level rise in the eastern United States, and even the world. Moreover, we are already seeing more nuisance flooding, higher rates of precipitation, and 'rain bombs' with more predicted in the future. These storms overwhelm our stormwater systems, saturate our low coastal lands, and inundate the region. In Norfolk Virginia, the National Oceanic and Atmospheric Administration (NOAA) tide gauge situated on Norfolk Naval Station has *measured* over 18 inches of sea level rise since the station began gathering data in 1927.[v] These impacts are being felt by homeowners and businesses alike.

While global sea levels are currently rising at an average rate of 3.3 mm per year,[vi] according to a 2018 report by the Virginia Institute of Marine Science relative sea levels in the Norfolk area are rising at a rate of 5.14 mm per year and accelerating.

Regional processes have coupled together to create a 'hot spot' of sea level rise in Coastal Virginia.[vii] In all projected global sea level rise scenarios, relative sea level rise rates in coastal Virginia are predicted to exceed global sea level rise by 30 to 50 centimeters by 2100.[viii] The velocity of the Gulf Stream, which follows the eastern seaboard of the United States is slowing, which is contributing to rising sea levels in Coastal Virginia.[ix] Further, the area has historically seen high rates of subsidence, with historic geodetic surveys measuring an average subsidence rate of 2.2 mm per year with a range of 1.1mm to 4.8 mm across the region.[x] Ongoing satellite analysis being conducted by NASA Jet Propulsion Laboratory and Old Dominion University shows high rates of regional variability.

Nuisance flooding is also increasing in frequency. Old Dominion University Oceanographer Larry Atkinson, tracks hours above nuisance flood levels in Norfolk, and expects about 40 to 50 hours in coming years. [xi] Just last month, NOAA released a new report analyzing high tide flooding in the United States. The report predicts that by 2050, Norfolk will experience approximately 170 days per year with high tide flooding, and since 2006, annual high tide flooding and coastal flood advisories have increased on average with higher flood frequencies predicted for the coming year.[xii]

We are also seeing impacts of increased precipitation in coastal Virginia. Historical analysis shows upward trends in mean annual precipitation, total precipitation days, and heavy precipitation days across the Commonwealth between 1947 and 2016.[xiii] Recent heavy precipitation-based flooding events, like Hurricane Matthew, have spurred cities on to action as residents – not just those with waterfront properties – have been impacted and raised the call to their elected officials.

Resilience and Adaptation in the Commonwealth

Facing these challenges, the Commonwealth commissioned the Virginia Institute of Marine Science, via SJ76ER (2012) to study recurrent flooding in Tidewater Virginia. This study grabbed the attention of many in the state, and clearly spelled out high vulnerability in many localities throughout both urban and rural Tidewater Virginia.[xiv]

Though additional federal support, such as that we are discussing today, could accelerate progress, the Commonwealth has and continues to make progress towards enhancing resiliency. Of critical importance, legislators from Hampton Roads and other areas of Coastal Virginia are also leading the way in proposing and supporting legislation to plan and implement resilience strategies across Virginia. Directly following the release of the VIMS report, Delegate Chris Stolle (83rd District) and Senator Lynnwood Lewis (6th District) led the effort to establish a joint subcommittee to recommend legislative strategies to minimize the impact of recurrent

flooding and coastal storms.[xv] This bipartisan subcommittee is still active today, and its members carry much of the related legislation through Virginia's General Assembly.

Successful legislation to come out of the Subcommittee includes policy changes to require incorporation of sea level rise and recurrent flooding into comprehensive planning in Hampton Roads,[xvi] establishment of the infamously unfunded Virginia Shoreline Resiliency Fund,[xvii] exempting living shorelines projects from local property taxes,[xviii] and after multiple attempts, the establishment of a new position: the Special Assistant to the Governor for Coastal Adaptation and Protection.[xix] Members have also reformed stormwater regulations in rural areas and continue to push for additional changes at the state level. Many elected officials from coastal Virginia who do not sit on the committee are also committed to supporting policies that increase coastal resilience.

The McAuliffe and Northam administrations have also been forward thinking in developing plans to build resiliency in Virginia. Mirroring the action of a few localities, and following recommendations from multiple reports including his Climate Change and Resiliency Update Commission,[xx] Former Governor McAuliffe appointed the Secretary of Public Safety and Homeland Security Brian Moran as Chief Resilience Officer.[xxi] Current Governor Northam has appointed Secretary of Natural Resources Matthew Strickler as the Chief Resilience Officer for the state showing a renewed focus on natural and nature-based solutions at the present time.

Following another recommendation from the above referenced Commission, Governor McAuliffe worked across the aisle with Delegate Chris Stolle and others to establish the previously discussed Commonwealth Center for Recurrent Flooding Resiliency (CCRFR) in an effort to utilize and prioritize the resources of Virginia's universities for applied research.

Building upon the previous Administration's effort, in November of 2018, Governor Northam signed Executive Order Number 24, Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards (EO 24), which directs the Commonwealth to enhance resilience of Commonwealth assets, develop a Virginia Coastal Resilience Master Plan (VCRMP), coordinate, enable and empower localities and individuals within Virginia to build resilience and adapt to coastal change.[xxii] VCRMP development is being led by Retired Real Admiral Ann Phillips, the current Special Assistant to the Governor for Coastal Adaptation and Protection. She is being supported by agencies within the state as required by EO 24, as well as the administration, three fellows funded by Virginia Sea Grant, and the CCRFR partners. There are no additional funds allocated to plan development at this time.

As you may have ascertained from the above list of resources, the development and implementation of this plan is underfunded. Because the VCRMP will prioritize NNBS for Virginia funds realized through the grant program proposed by, HR 3115, the Living Shorelines Act of 2019, could be a key tool towards implementing these climate adaptation solutions. Additionally, federal support such as the CZM support proposed in in HR 3541, the Coastal State Climate Preparedness Act of 2019, would not only provide financial support for future iterations of the Commonwealth's climate preparedness planning, but would also provide a

vital and official connection with NOAA. Virginia's plan will prioritize natural and nature-based solutions (NNBS) where possible, however, as we move forward, revising and implementing the Commonwealth's plan, may be broader than the scope of HR 3541 would be able to fully support when it comes to building, transportation, and infrastructure adaptation and investment.

The bills before us today amend the Coastal Zone Management Act of 1972. In Virginia, the Coastal Zone Management Program (CZM Program), housed in the Department of Environmental Quality is an essential partner in building resilience in the Commonwealth. In 2018, Governor Northam signed a letter to continue the CZM Program in perpetuity reiterating the goals to create more "vital and sustainable coastal communities and ecosystems," which included the policy goal of "enhance[ing] coastal resiliency for Virginia's natural and built environments in the face of anticipated impacts of climate change and sea level rise."[xxiii]

Among countless other accomplishments, the Virginia CZM Program enabled the development of Virginia's Working Waterfronts Master Plan released in 2016, actively provides technical assistance for the Hampton Roads Planning District Commissions' sea level rise planning activities, supports research on expanding the use of NNBS to enhance coastal resiliency, and has recently studied and shared resources on socioeconomic benefits of conserved lands on Virginia's Eastern Shore, the subject of their most recent Coastal Partners Workshop. I commend HR 3115, the Living Shorelines Act of 2019, HR 3596 Keep America's Waterfronts Working Act of 2019, and the HR 3541 the Coastal State Climate Preparedness Act for enhancing the critical Coastal Zone Management Program's support to state programs that are focused on this important work. However, our overall resilience will only be enhanced so much if we bolster CZM programing to the neglect of other key resilience programs.

Released in 2016, and presented publicly at William and Mary Law School's Virginia Coastal Policy Center's Annual Conference in 2016, Virginia's Working Waterfront Master Plan was funded by the Virginia CZM Program and supported by a large group of steering committee members and other stakeholders. The Virginia Working Waterfront Master Plan provides historical information and outlines current threats from both natural forces as well as use conflicts and economic challenges and provides clear recommendations for policies that could be enacted at all levels of government to protect working waterfronts into the future.[xxiv]

HR 3596 aligns with the first recommendation for federal government action to "Adopt a national Working Waterfronts Preservation Act."[xxv] The Working Waterfront Grant Program and related Task Force would directly support Virginia's plan and the communities depending on working waterfronts and the Working Waterfronts Preservation Loan Fund would directly enhance implementation funds.

Within Virginia, legislation has been introduced in Virginia to take action on some aspects of the plan.[xxvi] In 2017, the Virginia General Assembly passed SB 1203, authorizing localities to establish working waterfront development areas by ordinance.[xxvii] Additionally, Virginia's CZM Program is collaborating other partners at VIMS and within planning district commissions to

advance policies and goals of the plan. For example, the Northern Neck Planning District Commission is in its third year of educating community leaders and the public on the importance of working waterfronts to the economy through maps, videos, and other materials.[xxviii] These efforts are promising, however with more resources CZM could implement the plan in a more robust manner and explore recommendations that require more dedicated funding.

Regional and Local Adaptation in Coastal Virginia

Although strong federal and state leadership is essential, resilience is a regional and local issue - even a neighborhood issue. Many localities in Virginia have taken this to heart and are actively planning and adapting to increased flooding vulnerabilities with the tools that they have available. The bills we are considering today fill that toolbox just a little bit further.

Norfolk has long been a vocal leader in building resilience to rising seas, and was named a Resilient City as part of the first cohort of Rockefeller's 100 Resilient Cities. Among other leading edge initiatives they have adopted a forward thinking zoning ordinance which envisions each property owner as a key resilience maker by storing water on their own property. The City of Norfolk has also worked with the US Corps of Army Engineers to complete the Norfolk Coastal Storm Risk Management, an in-depth study of problems and solutions for the city's flood risk.

Virginia Beach, through quieter on the subject, is also a pioneer in its forward thinking plans for adapting to flooding. While already well entrenched in this process, the City really began their outreach efforts following an uproar from citizens after Hurricane Michael in 2016. This summer the City is holding a series of public meetings supported by my colleagues at Old Dominion engaging citizens in the City's Comprehensive Flooding Response Plan for Sea Level Rise.[xxix] The city and their partners recently conducted a detailed study of future precipitation trends and updates to their required design standards aligning with that study are currently out for comment. The City received a Regional Coastal Resiliency Grant from NOAA to support part of these efforts but has also invested millions of local funds. Related reports from the Comprehensive Sea Level Rise program involves an analysis of march response[xxx] and an exploration of NNBS for the city.[xxxi]

Not to be out done, Hampton, has finalized resilience plans and is exploring options for implementation, while the City of Portsmouth has included resilience planning in every aspect of their Comprehensive Plan.

However, like many other localities – and defense facilities – the watersheds of those cities do not stop within their municipal boundaries. In Hampton Roads and the rest of Coastal Virginia, building resilience to our rising waters can not be done in silos. We – and by that I mean not just myself, but countless colleagues across many organizations – are actively building bridges between the Commonwealth and our localities, and our state universities and non-profit partners are stepping up to the challenge.

In late 2013, a few of my colleagues and I from Hampton Roads met with leaders from the United States Navy, World Resources Institute, and the then-Administration's Council on Environmental Quality, and recognized the need to more effectively coordinate local, state, and federal resources for community adaptation and resilience. With many eager local partners, and key naval resources, Hampton Roads was the right location for an experimental pilot project. Old Dominion University, always the community partner, offered to convene the two-year effort of what became the Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project (IPP).

The goal of the IPP was to create a whole of government and whole of community regional approach to sea level rise and resilience planning and a national template for resilience collaboration.[xxxii] Throughout the two year process, we held multiple large gatherings of local and national experts to share best practices, and regularly convened over 200 stakeholders in subject-specific working-groups, which provided recommendations at the end of the process. These working-groups focused on subjects such as economic impacts and opportunities, as infrastructure and private infrastructure, public health, citizen engagement, scientific analysis, and law and policy. The relationships forged during that process, have enabled much of the work ongoing today, and many of the recommendations from that report are still being implemented and are slated for inclusion within the Commonwealth's forthcoming Coastal Resilience Master Plan.

Additionally, many key recommendations relate to the bills before us today. For example, recognizing that all communities are connected, the IPP recommended incentivizing investments in green and blue infrastructure both from a regional perspective and on public and privately-owned property.[xxxiii] Enhanced support for implementation of climate resilient living shorelines would support this goal for publicly held properties.

The IPP also recommended support of a business resilience initiative and support of a water management economy in Hampton Roads.[xxxiv] Building upon this recommendation, the CCRFR conducted a 2016 study analyzing the region's existing water technology/resilience industry cluster and provided additional recommendations to support that cluster, [xxxv] which was also named a priority growth opportunity for the Hampton Roads Region as a part of Virginia's Go Virginia initiative.[xxxvi] As part of Housing and Urban Development's National Disaster Resilience Competition, the Commonwealth was awarded over $120 million to build resilience in Virginia. The majority of the funds were awarded to reimagine and reinvent a community in Norfolk Virginia, however $5 million was awarded to establish RISE, an independent 501(c)(3) nonprofit dedicated to supporting innovative solutions to coastal Virginia's resilience challenges and then scaling those solutions globally.

Thriving working waterfronts are a vital component of this emerging water technology/resilience industry cluster in Hampton Roads. As we in Hampton Roads focus on innovation as one adaptation strategy, working waterfronts are full of opportunity. For example, Evelyn Tickle owner of Grow Oyster Reefs!, is a winner of Massachusetts Institute of

Technology's 2018 SOLVE Challenge as well as a recipient of RISE's, first resilience challenge competition. Grow Oyster Reefs! will improve overall water quality in the Chesapeake Bay as well as reduce effects of flooding through creation of organic seawalls. The owner is also hoping to manufacture and test her property in Hampton Roads.[xxxvii] While maintaining heritage working waterfront businesses and water dependent uses, innovative companies like Grow Oyster Reefs have a key role in the continuing vibrancy of our working water fronts. Supporting implementation of the Virginia's Working Waterfront Master Plan would do just that.

Additionally, we work with many stakeholders across rural coastal Virginia, as well, which is on the frontlines of coastal change. For example, in 2002, the Middle Peninsula Planning District Commission established the Middle Peninsula Chesapeake Bay Public Access Authority in recognition that natural shorelines are critical assets to be set aside for the citizens of the Commonwealth. The Authority has accepted donated properties that owners simply did not want to maintain in the face of constant flooding. Our neighbors on the Eastern Shore, supported by Virginia's CZM program, conducted the Eastern Shore Transportation Infrastructure Inundation Vulnerability Assessment and are actively involved in adaptation strategies as well and have modeled roadways that may be vulnerable to repeated inundation and have worked with my colleagues at William and Mary Law, the University of Virginia, and Old Dominion University to identify adaptation opportunities within financial reach and take action using the Resilience Adaptation Feasibility Tool (the RAFT).

Conclusion

Thank you for prioritizing the important issues of our coastal communities as they adapt to a changing climate and working to provide the necessary federal support to empower those communities as they thrive with water. Legislative and economic solutions to these challenges must effectively balance the needs and priorities of our urban, suburban and rural coastal communities. Done in concert, both legislative and financial support to our states and communities will begin to fill a toolkit to build coastal resiliency.

Our communities in Virginia are facing a future with rising seas and more frequent heavier rains, however we from our urban centers to our rural communities we have been thriving with water since 1607 when the first settlers set foot in the marshes of Tidewater. We are up for this challenge, but need leadership, policies, and fiscal support for our adaptation efforts.

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