

EXHIBIT D: NEED

COMMONWEALTH OF VIRGINIA

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Unmet Recovery Needs. Damage from Hurricane Irene was evaluated by an assessment team using FEMA's structural damage levels for homes in the region. Based on analysis of data collected, the Hampton Roads cities of Norfolk and Chesapeake meet CDBG-NDRC thresholds for *Most Impacted* and *Distressed* areas (see Exhibit B, p. 4). Windshield surveys of the areas, conducted in January and March 2015, reveal water-related *Unmet Recovery Needs* from Irene remain for nearly half the damaged homes. Repairs made to these homes did not incorporate resilient measures to mitigate similar future damage. Surveyed homeowners reported they did not undertake resilient repairs such as elevating the structure because of inadequate funding. Other Virginia localities, including Accomack County and the Cities of Newport News and Portsmouth, are compiling data to meet CDBG-NDRC threshold requirements and will be included in Phase II if possible.

Hurricane Irene again exposed the region's vulnerability to storm and flooding, which is increasingly intensified by the impact of sea level rise. Research by Atkinson, Ezer and Smith (2012), entitled "Sea Level Rise and Flooding Risk in Virginia," reports the Hampton Roads region is experiencing the highest rate of relative sea level rise on the East Coast due to the exacerbating effects of land subsidence. In Hampton Roads, sea level has risen over 14 inches since 1930 (see [SLRinHR.pdf](#), sea level rise in Hampton Roads), in contrast to a global sea level rise of 5-8 inches over the last century. When coastal areas experience hurricanes, there is an accompanying storm surge, a deadly combination of strong wind and waves, rainfall, and atmospheric pressure, that drives water onto the shore. In a Category III hurricane, much of the Hampton Roads region would be underwater (see [HRSurgeMap.pdf](#), map showing storm surge). Hampton Roads is second only to New Orleans as the largest population center at risk from rising water and ranks tenth in the world in the value of assets exposed to flooding. These assets include Naval Station Norfolk, the largest military base in the world, and numerous other important military facilities (see [HRMilFacMap.pdf](#), regional map of military and federal facilities). The military is vital to

Hampton Roads' current economy, as almost a quarter of the nation's active-duty military personnel are stationed in the region. Other important regional economic drivers include US naval shipbuilding and repair capacity, and the Port of Virginia, the only East Coast port with shipping channels deep enough to accommodate the massive Post Panamax ships.

The extent of the potential threat in Hampton Roads makes clear that the unmet need is not only for resources to repair the water damage to homes in areas designated *Most Impacted* and *Distressed*, but also for resources to develop an innovative multi-pronged approach to resilience that will enable Hampton Roads to protect the homes of residents by anticipating, preparing for and adapting to the changing environment. The **THRIVE** vision for Hampton Roads involves a series of infrastructure (including the complex network of energy, transportation, communications and water systems that make modern urban life possible), social networking and economic development projects that are designed to showcase innovative opportunities for solutions for managing water and building resilience to flooding in the midst of climate change.

While discussions of existential threats to the region may seem dramatic, it is worth noting that when Hurricane Irene made landfall along the North Carolina coast, it was a Category 1 hurricane. In light of the projected rise in sea levels (an additional 3 feet of sea level rise by 2100), the expected amount of future damage from more intense storms, for instance Category 4 or 5 hurricanes, creates the potential for a Hurricane Katrina-like scenario in Hampton Roads. This forward-looking risk analysis drives regional thinking to more comprehensive approaches to building regional resilience.

Most Impacted and Distressed: The City of Chesapeake. Established in 1963, Chesapeake is a relatively young mix of suburban and rural communities. Geographically, the tidal Elizabeth River flows through its center, and the Great Dismal Swamp borders it to the west. Early on, the city took measures to check building in its flood plain and wetlands through building ordinances. Many of Chesapeake's neighborhoods experience repetitive flooding (see [MID-URNTarget_Ches.pdf](#), map of Chesapeake); one

example is Mains Creek, a lower-to-middle income neighborhood with 121 homes located in the 100-year floodplain (see [MainsCreek.pdf](#), map of Mains Creek) Constructed in the 1960's, before Chesapeake developed its local NFIP and minimum standards for construction elevations, its lowest roads are 3-4 feet above sea level, and the lowest homes are 4-5 feet above sea level. Roads constructed today must be 7 feet above sea level. Ninety-one homes in Mains Creek experience repetitive flooding.

Many Mains Creek residents are elderly, with few financial or social resources, and this community's need for a comprehensive, resilient approach to repeated flooding is unmet because of inadequate funding. Resilient solutions currently being explored include: elevating or acquiring houses (which will be demolished to restore the land to green space for perpetuity); improving infrastructure for better water management; increasing road elevation in the target area to eliminate flooding of streets and yards; and installing tidal flood gates to control increased surge waters from the Elizabeth River into Mains Creek.

The City of Norfolk. Founded in 1682, the City of Norfolk is Virginia's second-largest city and home to the world's largest naval base, Naval Station Norfolk. Tidal waters surround it on three sides. Its position on the Chesapeake Bay, combined with low drainage gradients due to near sea-level topography, puts a significant portion of Norfolk at risk for flooding from heavy rains, high tides, and storm events. Areas most prone to flooding are built on the sites of former creeks and inlets filled in decades ago, including areas of the city where public housing is located. As the City of Norfolk target area map demonstrates (see [MID-URNTarget_Norfolk.pdf](#)), the Most Impacted and Distressed Target Area encompasses almost the entire city. More than 53% of the city's population is low- or moderate-income. Norfolk is rated the 13th most fiscally stressed locality in Virginia, and considered "High Stress" by the state's Commission on Local Government. Nearly 15% percent of families in Norfolk are living below poverty level, with nearly 40% of all census tracts designated as Medically Underserved Areas. Exhibit B (see p. 4) describes the extent of damage recorded by the city damage assessment team that conducted windshield surveys in the aftermath of Virginia's qualifying event, Hurricane Irene, and again in March 2015.

FUTURE THREATS AND UNMET NEED. This proposal focuses on threats and vulnerabilities associated with managing water; specifically recurrent flooding and sea level rise. In its 2013 Hazard Mitigation Plan, Virginia identified flooding as the top hazard with regards to probability and impact to all jurisdictions in the Commonwealth (see [FloodHazardMap.pdf](#), showing flooding in Virginia).

Risk and Vulnerability Data. In the last decade more than 40 separate science-based studies focusing on current and future water-related risks, vulnerabilities, and solutions were completed by Hampton Roads localities, universities, businesses, private nonprofit organizations, military facilities and the Port of Virginia. This proposal leverages findings of these analyses, including the recent US Army Corps of Engineers' *North Atlantic Coast Comprehensive Study*, along with output from peer-reviewed tools such as the Rockefeller Foundation-supported Climate Central's Surging Seas Risk Finder and NOAA's Digital Coast, among others.

Risks Seriousness and Likelihood. With sea level rise in Hampton Roads region at the highest rate of relative sea level rise on the East Coast, the region is clearly at risk. Furthermore, seven of the ten most significant regional storms since 1933 have occurred during the last thirteen years, indicating the level of risk is accelerating. According to a Virginia Institute of Marine Science (VIMS) study, "Recurrent Flooding Study for Tidewater Virginia," local sea level is projected to rise 1.5-7.5 feet by 2100, and conservative estimates project a 3-foot rise by 2100, so the threat to the region will continue to increase.

Risk to Vulnerable Neighborhoods. Under NOAA's Climate Central intermediate low scenario, there is "a better than even chance" (*Virginia and the Surging Sea*, 2014) of floods exceeding 5 feet above the high tide line by 2030-40 along the whole Virginia coast. Based on Climate Central's Surging Seas risk finder estimates, more than 107,000 Virginians live in homes below 5'. Close to 77,000 of Virginia residents are in the high or medium Social Vulnerability Index class with 17,000 in Norfolk alone. Furthermore, according to US Census data, 9% of Hampton Roads residents report they do not have access to a vehicle. This indicator of vulnerability would impact resident evacuation and use of public

shelters and transportation. An ODU survey of 7,000 regional households, which identified and mapped recovery needs and community vulnerability in Hurricane Irene's aftermath, further demonstrates that large pocket of region's populations are at risk.

Risk to Economic Assets. A study by Sandia National Laboratories notes failure to mitigate the effects of climate change could cost Virginia \$45.4 billion in GDP and over 314,000 jobs between 2010 and 2050. In Hampton Roads, economic wellbeing depends on the same surrounding bodies of water that place it at risk; thus, sea level rise will impact nearly every sector of the regional economy. The region is home to the largest concentration of US defense facilities in the world and the third largest commercial port on the east coast. It is also a major hub for shipbuilding and has a strong tourism-related economy. Sea level rise and flooding puts these critical assets to the regional and national economy, as well as global security, at increasing risk.

According to a recent study by the HRPDC, the large number of businesses and employees working in Category 1 (flood) zones indicates that “a significant amount of economic activity will have to shift around the region to cope with sea level rise by the end of the century.” Another Wetlands Watch study, “Climate Change in Hampton Roads,” estimates that by the end of the 21st century sea level rise could result in direct economic costs between \$12 and \$87 billion, with up to 877 miles of roads in the region permanently or regularly flooded by 2100 (see [Roadways&SLR.pdf](#), map of major highways susceptible to flooding).

Military Presence and Flood Risk. Hampton Roads hosts major Navy, Air Force, Army, Marine Corps, and Coast Guard facilities, including Naval Station Norfolk, the largest military base in the world, with a plant replacement value of over \$4.2 billion. Nearly a quarter of the nation's active-duty military personnel are stationed here, and 31% of US naval shipbuilding and repair capacity is housed in the region. Other area Department of Defense facilities include NATO's Allied Command Transformation, Homeland Security facilities, Jefferson National Accelerator Facility, and NASA Langley Research

Center. In 2013, defense-related activities and spending accounted for 41% of the region's \$87 billion economy.

At an average elevation of 8-1' above mean sea level, Naval Station Norfolk and many of the 29 other military bases, shipyards and installations in the region already experience storm-related flooding. Furthermore, military readiness depends on regional infrastructure such as roads, bridges, tunnels and utilities located off base. Studies show that the 1.5' sea-level rise projected by 2032- 2062, combined with a mild 3' storm surge, would impede roadway access to nine of the region's military facilities, including Langley Air Force Base, Naval Station Norfolk, Norfolk Naval Shipyard and Naval Air Station Oceana.

Flood Risk to the Port of Virginia. The Port of Virginia has significant economic value to the Commonwealth. In 2013, 81 million tons of cargo valued at \$53 billion moved through the Port of Virginia facilities, and according to an economic impact report by the College of William and Mary, the Port's total economic impact for the Commonwealth of Virginia was \$60 billion. Related economic activity employs more than 343,000 Virginians and an additional 10% of gross regional product (35,000 jobs) was generated by Port of Virginia activities.

Sea level rise and flooding place this critical economic engine at risk. The Port of Virginia Master Plan 2040 estimates its facilities can withstand 1 foot of sea level rise. But, like the military, the Port depends on transportation infrastructure.

Risk to Other Economic Drivers. Hampton Roads also is home to Newport News Shipbuilding, sole designer, builder and refueler of US Navy aircraft carriers and a provider to US Navy submarines. With approximately \$4 billion in revenues and over 23,000 employees, it is the largest industrial employer in Virginia and the largest shipbuilding company in the US. Finally, tourism is the third largest economic driver in Hampton Roads, which draws to its beaches, Colonial Williamsburg, Busch Gardens, and other attractions that directly and indirectly impact the region financially. Sustaining these important regional and global assets will require adaptation to sea level rise and proactive flood risk management.

Known Unknowns. The long range, end-of-the-century forecasts show significant uncertainty, with regional projections for sea level rise estimated between 1.5 and 7.5'. These projections are based on the US National Climate Assessment, which generated four scenarios of global sea level for its 2013 report to Congress. However, given current projections, a study by VIMS recommends that the regional cities plan for the 1.5' rise expected in the next 20-50 years under a very moderate scenario. This time frame takes into consideration potential sea level rise impact relevant to home mortgages and most public infrastructure systems.

Flood Risk and Insurance Coverage. A CoreLogic Storm Surge Report (2011) demonstrates a large number of Hampton Roads residents are potentially uninsured for storm-surge flooding. Out of approximately 90 seaside communities, Hampton Roads has the highest percentage of homes (86% or about 340,000 homes) that are at risk of storm-surge flooding, but are located outside a FEMA zone where flood insurance is required.

While there is limited regional data explaining flood insurance purchasing decision drivers, a 2006 RAND Corporation study, “The National Flood Insurance Program’s Market Penetration Rate,” found only approximately 20% of homeowners living in the most flood-prone areas buy federal flood insurance when not required to do so. Additionally, according to the Virginia American Security Project, a reduction in the number of insurers in the region (55% of insurers active in the Mid-Atlantic market will not sell policies for businesses and primary residences in Virginia’s coastal region) has adversely impacted pricing, likely causing many consumers, especially low- and moderate-income households, to opt-out of program participation. Furthermore, according to an ODU’s 2014 “Life in Hampton Roads Survey,” 43% of survey respondents mistakenly believe that having an active homeowner insurance policy covers damage from flooding.

Exacerbating Conditions – Disproportionate Effects. The challenge of water in Hampton Roads is made more difficult by the state of several cities’ economic health. For instance, Norfolk is the 13th most

fiscally stressed municipality in Virginia, and rated “High Stress” by the Commonwealth’s Commission on Local Government. Nearly 15% of Norfolk families live below the poverty level, more than 50% of its census tracts are designated LMI neighborhoods, and almost 40% of them are designated as medically underserved areas.

Existing Actions Addressing Risks and Barriers. As discussed in Exhibit G, the Commonwealth and Hampton Roads localities have already taken major steps to address the risks from the vulnerabilities discussed above. These include raising standards, aligning governance, engaging the community (see Exhibit C, p. 10) and implementing grey and green infrastructure mitigation projects.

Many Hampton Roads localities have undertaken coastal shore stabilization projects, including the construction of a series of near-shore breakwaters and beach and dune sand replenishment, and environmental restoration activities, including the construction of oyster reefs in the Lafayette River, coastal wetlands, and living shorelines. As a result, Norfolk wetland restoration more than tripled between 2011 and 2014 alone. Furthermore, the City of Norfolk has refurbished the floodwall originally constructed by the US Army Corps of Engineers which protects the entire downtown, has begun to replace aging stormwater drainage infrastructure and has elevated roadways in areas prone to coastal flooding. Hampton Roads localities have also actively pursued the Hazard Mitigation Grant Program funding to elevate or acquire residential structures in special flood hazard areas. Norfolk has elevated 29 houses and Poquoson elevated about 600 homes or 15% through this program. Hampton Roads localities also participate in the National Flood Insurance Program (NFIP) and FEMA’s Community Rating System (CRS), and as discussed in Exhibit G (p. 47), many localities abide by more stringent guidelines than required by NFIP.

While these efforts are important, they constitute an inefficient piecemeal approach to mitigation, and the Commonwealth of Virginia and the Hampton Roads region both lack the resources necessary to implement a comprehensive resilience plan.