

# THE REGION

## REGION PROFILE

The Eastern Shore of Virginia is a two-county peninsula situated between the Chesapeake Bay and the Atlantic Ocean (Figure 1). Along the Eastern Shore's approximately 70-mile length lie 19 incorporated towns, and the longest expanse of coastal wilderness remaining on the Atlantic seaboard. The region is unique compared to neighboring regions in the Commonwealth in that three of its incorporated communities and several key economic drivers are located on islands in the Chesapeake Bay and Atlantic Ocean.

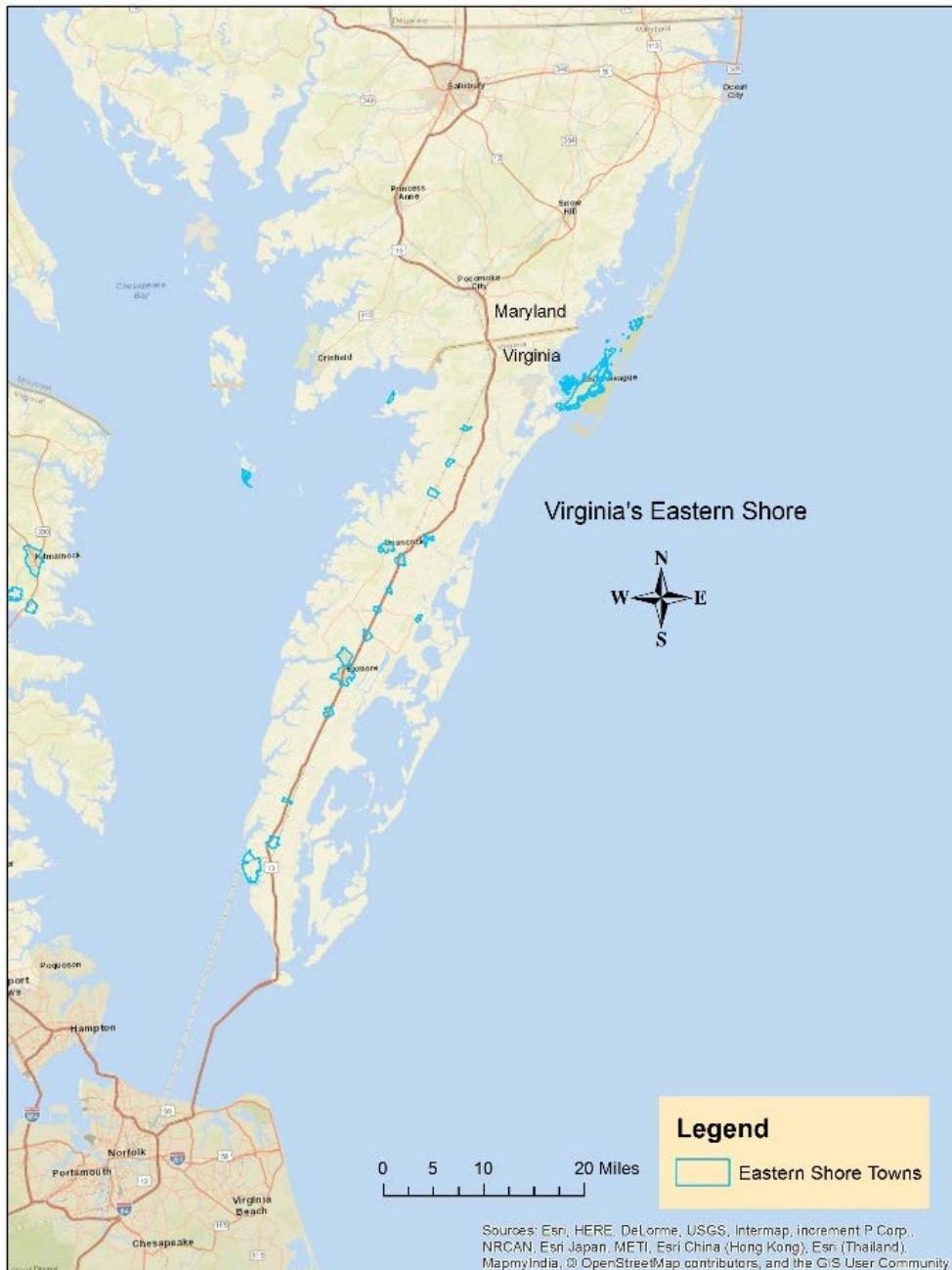


Figure 1: Eastern Shore Location Map

## The Region

On the seaside are thousands of acres of pristine salt marshes, tidal mudflats, shallow lagoons, and navigable tidal channels that support thriving seafood and recreational tourism industries. These environments are bound on the east by a barrier island chain that is largely undeveloped, and on the west by the mainland. The bayside, though more developed, also has near-shore islands (that are not the same as barrier islands), with its own salt marshes and brackish marshes.

Together, the area is an important stopover and wintering ground for migratory waterfowl, and coastal marshes provide food and nesting for birds, mammals, reptiles, and amphibians (NWS, "Sea Level Rise and Coastal Habitats of the Chesapeake Bay," 2008). Some of the very qualities that make the Eastern Shore attractive for other animal species, have long drawn humans to live and work, and later to recreate, on the peninsula's shores and in between.

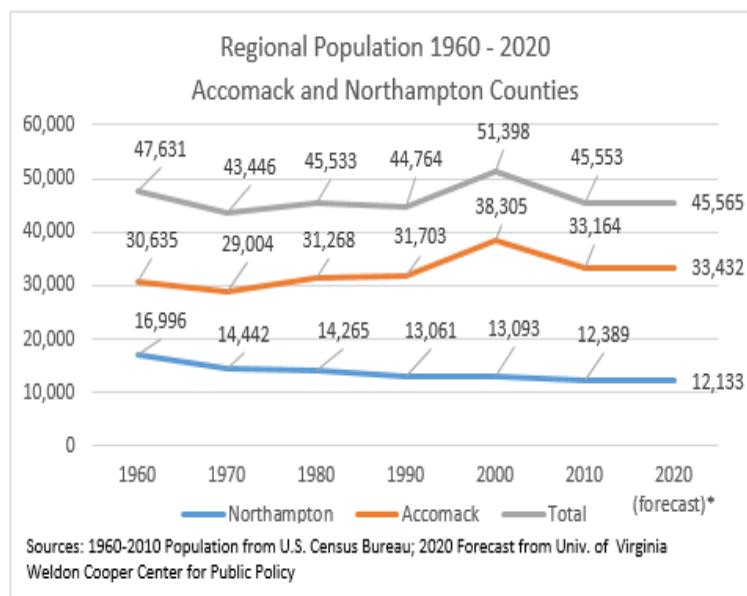
First American populations tended to be mobile and in concert with nature's inconsistencies. However, with European systems of extracting wealth from natural resources, and patterns of permanent settlement – that tended to be near water - naturally occurring phenomena became threats to life and property, and a risk to be managed and mitigated. Primary hazards are coastal flooding and coastal erosion, storm water flooding, and wind; secondary hazards are well contamination, ice and snow, drought, and sewage spills.

## SOCIO-ECONOMIC

Part of assessing hazards in relation to their risk is understanding the people affected. Not all people are affected equally. Some are affected by the factors relating to their ability to understand risks posed by hazards, and some by their ability to remove themselves from harm's way. Those factors include age, mobility, income and the languages individuals speak and the languages in which individuals are able to access information.

## DEMOGRAPHICS

Population for the two-county region has seen a net decrease of about 2,000 since 1960, but that does not paint a fair picture of how Eastern Shore population has changed. As Figure 2 shows, population has shifted from the Northampton County to Accomack County, with Northampton seeing a net loss of about 4,600 in the 50 year



**Figure 2: Regional population 1960-2020**

period from 1960 to 2010, with another slight decline of 250 expected in the decade between 2010 and 2020. Accomack County, however, after experiencing a small initial decline in population between 1960 and 1970, saw its population grow to a high of 38,305 by 2000, only to fall again by 2010, but still netting an increase of more than 2,500 over the 50 years.

The University of Virginia's Weldon Cooper Center forecasts population changes for Virginia counties and cities. The latest forecasts for 2020, completed in 2012, predict modest growth of 268 residents in Accomack County by 2020

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and an almost equal decline of 256 in Northampton County, leaving the regional new population virtually unchanged from 2010 to 2020. Not only is the overall population not growing, it is aging in place. As reflected in Table 1 below, the median age for Accomack County residents in 2014 was 44.9 years, and 48 years for Northampton County residents. In both counties, the median age has increased approximately 5 years since 2000.

**Table 1: Regional Demographic Data**

	2014***			2013**			2010*			2000****		
	Accomack	Northampton	Region	Accomack	Northampton	Region	Accomack	Northampton	Region	Accomack	Northampton	Region
<b>Population</b>	33,165	12,254	45,419	33,289	12,339	45,628	33,164	12,369	45,533	38,305	13,093	51,398
<b>Median Age</b>	44.9	48		44.8	47.2		44.7	47.8		39.4	42.4	
<b>Income</b>												
Median Household Income	39,389	34,656	n/a <sup>+</sup>	39,328	33,635	n/a <sup>+</sup>	41,372	35,760	n/a <sup>+</sup>	30,250	28,276	n/a <sup>+</sup>
Poverty Level	6,697	2,853	9,550	6,725	2,940	9,665	5,258	2,311	7,569	6,788	2,633	9,421
Percent in Poverty	20.2	23.3	21	20	23.8	21.2	15.9	18.7	16.6	18	20.1	18.5
<b>Disability</b>	3,959	1,538	5,497	3,668	1,584	5,252	4,408	n/a <sup>+</sup>				
<b>Language at Home</b>												
Only English	89.60%	91.80%	90.10%	89.90%	92.20%	90.60%	91.30%	93.60%	92.00%	93.30%	n/a <sup>+</sup>	n/a <sup>+</sup>
Spanish	8.30%	6.80%	7.90%	8.30%	6.70%	7.90%	6.90%	5.20%	6.40%	5.70%	n/a <sup>+</sup>	n/a <sup>+</sup>
Indo-Euro	1.90%	0.80%	1.60%	1.50%	0.50%	1.20%	1.40%	0.70%	1.20%	0.70%	n/a <sup>+</sup>	n/a <sup>+</sup>
Asian	0.20%	0.50%	0.30%	0.20%	0.50%	0.30%	0.30%	0.40%	0.30%	0.20%	n/a <sup>+</sup>	n/a <sup>+</sup>
Other	0.00%	0.10%	0.10%	0.10%	0.10%	0.00%	0.10%	0.00%	0.10%	0.00%	n/a <sup>+</sup>	n/a <sup>+</sup>

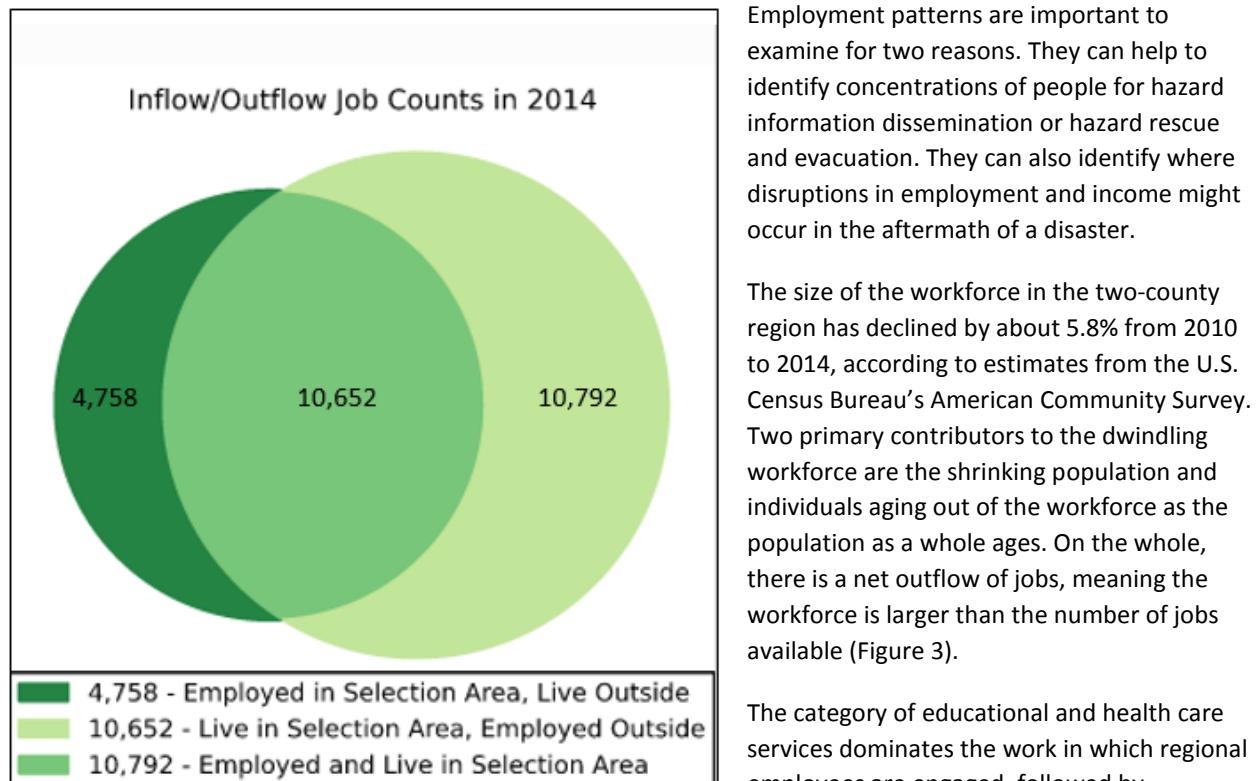
\* U.S. Census 2010, \*\* American Community Survey 2009 – 2013, \*\*\* Annual Estimates of the Residential Population: 2010 – 2014, \*\*\*\* U.S. Census 2000, <sup>+</sup>data not available

About 12 percent of residents in both counties identify having some sort of disability. That compares to about 12 percent nationally, and 11 percent for Virginia as a whole. There are a range of disabilities reflected in this statistic, and those disabilities can affect everything from a person's ability to receive and process information about hazards and actions to take to protect themselves and their property in the event of a hazard, to their physical ability to carry out such actions. The disability demographic does not include individuals living in group settings, such as nursing homes.

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Poverty can be another factor that limits an individual's ability to receive or respond to information about hazards. For example, many hurricane preparedness campaigns presuppose availability of \$50-\$100 required to assemble the basic items recommended for an emergency kit for a family of two to four. Moreover, families struggling with food security are not likely to stash three days' worth of food when day-to-day meals are uncertain. The Census Bureau's American Community Survey places Accomack County's 2014 poverty rate at about 20.2 percent, compared to 24 percent in Northampton County. However, another Census Bureau product, the Small Area Income and Poverty Estimates, suggests a 2014 rate of closer to 19.4 and 21.5 percent, respectively.

### WORK FORCE

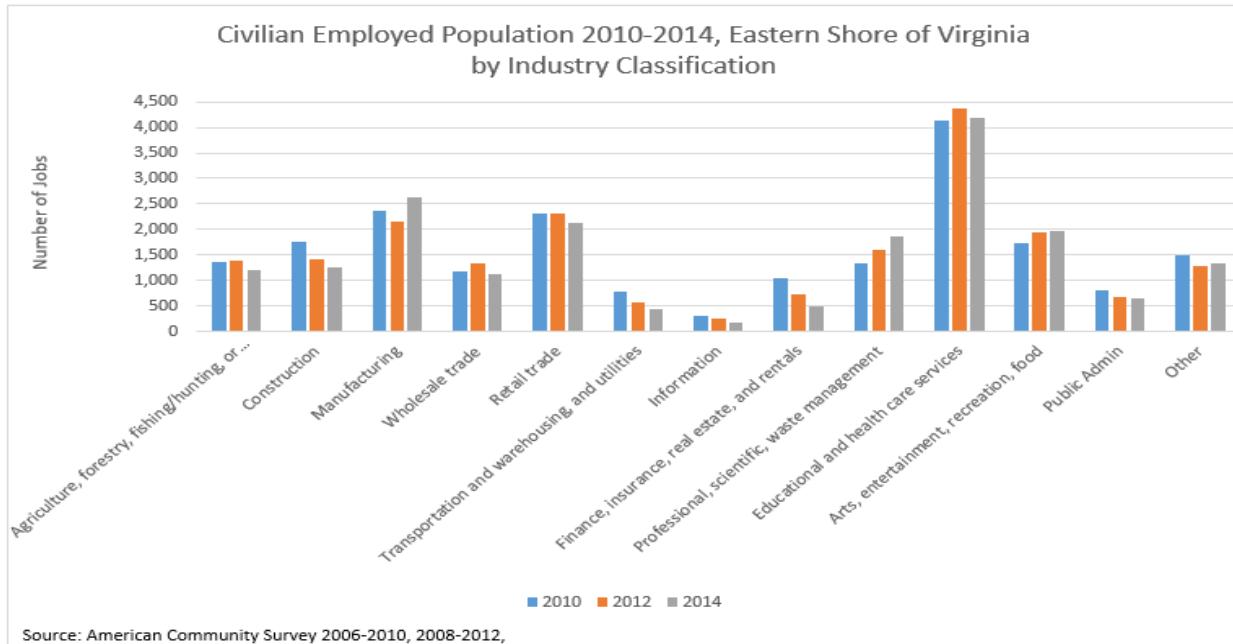


manufacturing, retail trade, and the employment grouping of arts, entertainment, recreation, and food service (Figure 4).

Source: U.S. Census Bureau. 2016. OnTheMap Application. Longitudinal-Employer Household Dynamics Program.  
<http://onthemap.ces.census.gov/>

**Figure 3: Inflow/Outflow Job Counts**

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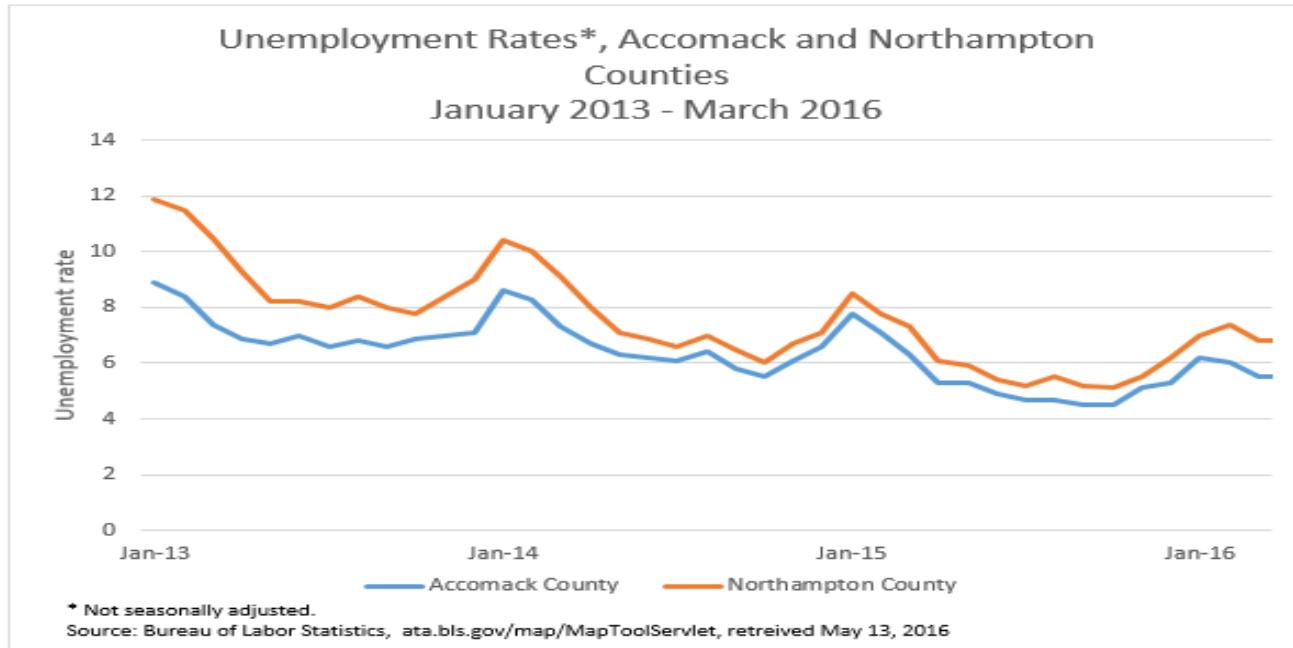
**Figure 4: Civilian Employed Population 2010-2014**

**Table 2: Regional Civilian Employed Population by Industry Class, 2010-2014**

Industry	Civilian Employed Population						2010-2014
	2014	%	2012	%	2010	%	
Agriculture, forestry, fishing/hunting, or mining	1,191	6%	1,390	7%	1,367	7%	-13%
Construction	1,252	6%	1,420	7%	1,756	9%	-29%
Manufacturing	2,622	14%	2,159	11%	2,366	11%	11%
Wholesale trade	1,125	6%	1,340	7%	1,172	6%	-4%
Retail trade	2,132	11%	2,313	12%	2,302	11%	-7%
Transportation and warehousing, and utilities	429	2%	580	3%	770	4%	-44%
Information	159	1%	254	1%	300	1%	-47%
Finance, insurance, real estate, and rentals	494	3%	719	4%	1,047	5%	-53%
Professional, scientific, waste management	1,855	10%	1,604	8%	1,323	6%	40%
Educational and health care services	4,194	22%	4,372	22%	4,149	20%	1%
Arts, entertainment, recreation, food service	1,962	10%	1,933	10%	1,720	8%	14%
Public Admin	646	3%	667	3%	819	4%	-21%
Other	1,338	7%	1,283	6%	1,494	7%	-10%
<b>TOTAL CIVILIAN EMPLOYED POPULATION</b>	<b>19,399</b>	<b>100%</b>	<b>20,034</b>	<b>100%</b>	<b>20,585</b>	<b>100%</b>	

Because some of the major employment categories are tied to seasons, such as agriculture and tourism, there are observable seasonal employment patterns which are easily observed unemployment rates, as shown in Figure 5.

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**Figure 5: Regional Unemployment Rates, not seasonally adjusted, 2013-2016**

There is also a migrant labor force that appears seasonally for agricultural work. That workforce was once estimated to number near 13,000 ("For 40 Migrants, Old Eastern Shore Estate is Home Away from Home," Virginia Pilot, September 23, 2006), but now is believed to hover closer to 1,800 ("Once Wealthy Volunteer Ministering to Migrant Workers," Cape Charles Mirror, July 12, 2012).

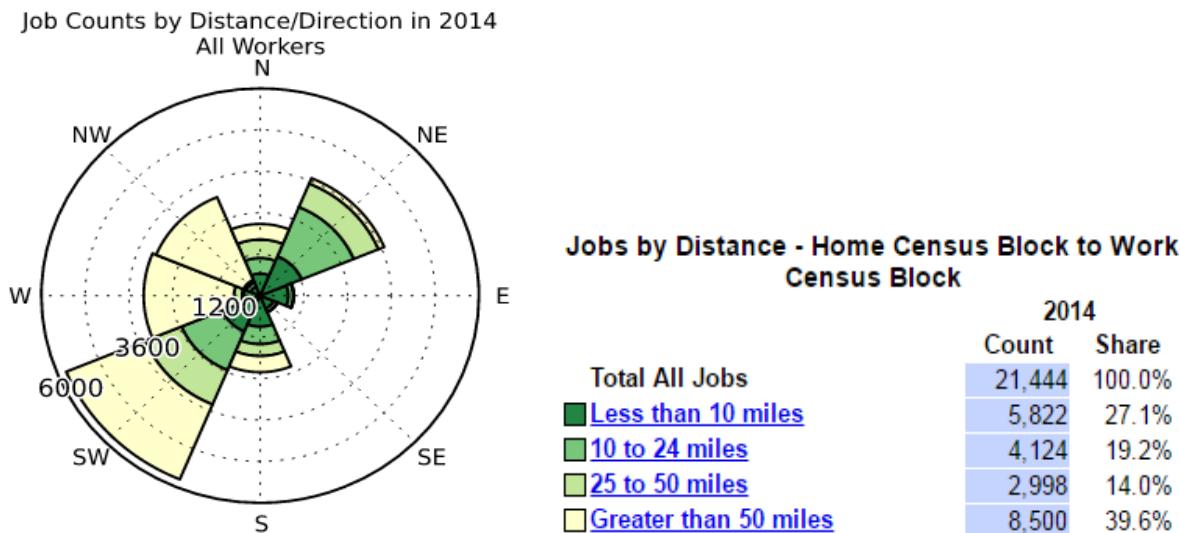
<b>Jobs Counts by Counties Where Workers are Employed - All Jobs</b>		
	2014 Count	Share
<b>All Counties</b>	21,444	100.0%
<b>Accomack County, VA</b>	7,942	37.0%
<b>Northampton County, VA</b>	2,850	13.3%
<b>Virginia Beach city, VA</b>	785	3.7%
<b>Newport News city, VA</b>	703	3.3%
<b>Fairfax County, VA</b>	556	2.6%
<b>Norfolk city, VA</b>	516	2.4%
<b>Worcester County, MD</b>	503	2.3%
<b>Wicomico County, MD</b>	493	2.3%
<b>Chesapeake city, VA</b>	448	2.1%
<b>Henrico County, VA</b>	325	1.5%
<b>All Other Locations</b>	6,323	29.5%

In addition to knowing the type of work in which people are engaged, it is helpful to examine commuting patterns at a regional level to ascertain the scales of hazards that might create large-scale unemployment based on where people work. Figure 6 shows the most common work locations of Eastern Shore residents.

Only about half of the area's estimated 21,400 workers are employed in the two counties. About 6,000 of the region's workers commute at least 50 miles or more to work in the southwest direction (Figure 7). While there is no way to know how many telecommute, or how frequently, it is safe to assume that many cross the Chesapeake Bay Bridge-Tunnel, and a hazard that disrupts travel on that facility could be economically challenging.

Source: U.S. Census Bureau. 2016. OnTheMap Application. Longitudinal-Employer Household Dynamics Program. <http://onthemap.ces.census.gov/>

**Figure 6: Job Counts by County: Where Eastern Shore Residents are Employed**



Source: U.S. Census Bureau. 2016. OnTheMap Application. Longitudinal-Employer Household Dynamics Program.  
<http://onthemap.ces.census.gov/>

**Figure 7: Distance and Direction for Eastern Shore Residents' Commute to Work**

## BUSINESSES

The uniqueness of the Eastern Shore is not limited to its geography. Its business profile is anchored in traditional land and sea-based pursuits of commercial seafood and agriculture, but boasts high technology as well, with the NASA Wallops Complex including the Virginia Space and Mid-Atlantic Regional Spaceport at Wallop's Island and related industries and employers supplying another important component of the area's economy. Tourism is also an important economic sector. Chincoteague, with its proximity to the Assateague Island National Seashore, and the herd of wild ponies that are auctioned following the annual Pony Swim, has the largest share of the tourism market, although Tangier, Cape Charles, Onancock, Wachapreague, and other towns have found their followings as well.

Business data provide basic information used in projecting potential capital, rent, and income losses for businesses, along with lost wages for employees. An inventory of businesses can also serve as an indicator of community recovery resources. Finally, data can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Even the more traditional sectors have incorporated high technology, with aquaculture becoming an increasingly important and reliable means of seafood production, GPS systems that ensure straight lines in crop fields, and complete computerization of the poultry industry with everything from metered watering and feeding of chicks to separation of chicken parts on the processing line. All of these improvements, while improving production, also boost the potential capital losses from disasters.

According to County Business Patterns, the number of business establishments in the region has declined by 79, or about seven percent, from 2009 to 2013 (Table 3). The number of people employed in those establishments was roughly proportional – 8.1 percent – or 1,024 individuals. Twenty-two of those establishments were from the construction industry, 12 were in retail trade, nine in health care and social services, eight were in professional and scientific, and 17 were unclassified. The remaining nine were scattered among the other categories.

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**Table 3: Eastern Shore Establishments by Industry Groups**

Industry Code Description	2013	2011	2009
Regional	Regional	Regional	Regional
Agricultural, Forestry, Fishing, and Hunting	11	9	9
Construction	116	124	138
Manufacturing	27	27	25
Wholesale Trade	43	45	46
Retail Trade	234	238	246
Transportation and Warehousing	21	27	27
Information	18	18	18
Finance/Insurance	53	48	52
Real Estate and Rental & Leasing	49	47	50
Professional, Scientific, and Technical Svcs.	84	88	92
Administrative Support, & Waste Management Remediation Svcs	32	35	35
Health Care and Social Assistance	100	99	109
Art, Entertainment & Recreation	19	26	25
Accommodation & Food Services	143	137	140
Other Services (Except Public Admin), Unclassified	127	137	144
<b>Total, All Establishments</b>	<b>1,077</b>	<b>1,105</b>	<b>1,156</b>
<b>Total Employees</b>	<b>11,611</b>	<b>12,068</b>	<b>12,635</b>

Source: U.S. Census Bureau County Business Patterns, 2013, 2011, and 2009.

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## CULTURAL RESOURCES

Long before the first European colonists arrived on the land now known as the Eastern Shore of Virginia, the Accawmackes, part of the larger Powhatan confederacy, lived there subsisting on diets based around food availability in five culturally-defined seasons ([www.virginiaencyclopedia.com](http://www.virginiaencyclopedia.com)). European colonists arriving on the Eastern Shore were some of the earliest in North America. The courthouse records in Northampton County, dating to 1632 – the oldest continuous courthouse records in the country – document not only court proceedings, but many aspects of life throughout the time of recorded history of the Shore. The courthouse records in Accomack County date to 1663. In Northampton County, records are stored in a climate controlled room to protect them from deterioration. Accomack County has no such protection.

The Virginia Department of Cultural Resources catalogs known historic sites. Some of that information is shared widely through public designations such as historic road markers, historic districts, and properties on the national register of historic place. Other sites are examined as part of environmental clearance processes, and because they may be private properties, the sharing of information about those sites is more sensitive.

Working closely with the Virginia Coastal Zone Management Program (VCZMP), the A-NPDC was able to interview residents of the Eastern Shore and document their accounts of coastal changes over the last several decades and years. These can be accessed on the VCZMP Coastal Gems website, [www.coastalgems.org](http://www.coastalgems.org), in the ‘Coastal Land’ data category.

## BUILT INFRASTRUCTURE

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Housing units, community facilities, and transportation are all important factors when considering hazard resiliency. They provide the social services necessary during hazardous scenarios, safe cover for those wanting to stay, and a way to leave for those seeking safer conditions.

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### HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by quantifying the exposure. According to the U.S. Census Bureau, the Region's housing stock has grown by 2,279 units from 2000 to 2014, with almost all of that occurring between 2000 and 2010 (Table 4).

**Table 4: Regional Housing 2000-2014**

	2014	2010	2000
<b>Total Housing Units</b>	28,376	28,303	26,097
Occupied %	19,526 68.8%	19,121 67.6%	20,620 79.0%
Vacant %	8,852 31.2%	9,182 32.4%	5,377 21.0%
<b>Owner-Occupied</b>	13,716 70.2%*	13,516 70.7%*	14,131 68.5%*
<b>Renter-Occupied</b>	5,900 30.2%*	5,605 29.3%*	5,489 26.6%*
<b>Median Housing Value</b>	\$152,500 Accomack \$162,500 Northampton	\$149,800 Accomack \$199,600 Northampton	\$79,300 Accomack \$78,700***

\*Percent of all occupied units. \*\*Accomack County \*\*\*Northampton County

Sources: 2000 - U.S. Decennial Census; 2010 – U.S. Decennial Census; 2014 - American Community Survey, 2010-2014

The amount of occupied housing has dropped about 10 percent, from 79 percent in 2000 to about 69 percent in 2014, and the number of rental units grew by about 400 over the same period.

Housing values grew rapidly in the decade between 2000 and 2010. Although there is not an overall median housing values , with median housing values more than doubling in Northampton County (from \$78,700 to \$199,600), only to see the median value fall by about 20 percent by 2014 (to \$162,500), while the median value in Accomack County continued to rise (from \$149,800 in 2010 to \$152,500 in 2014).

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### TRANSPORTATION

Transportation availability before a disaster is a major determinant of the ability of individuals to move themselves out of harm's way, and to get aid and support into an area following an event.

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#### AUTOMOBILE

The primary form of transportation for most Eastern Shore residents is personal automobile. Approximately 90 percent of households have at least one automobile available for use (Table 5).

**Table 5: Household Automobile Availability by County and for the Eastern Shore Region**

Vehicles Available	2014	2010	2000
None	2,068	1,850	2,119

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	10.6%	9.6%	10.3%
One	6,395 32.8%	6,283 32.8%	7,558 36.7%
Two	7317 37.5%	7,357 38.4%	7,584 36.8%
Three or more	3,746 19.2%	3,683 19.2%	3,359 16.3%

Sources: \* American Community Survey, 2010 – 2014; \*\* American Community Survey, 2006 – 2010; \*\*\* U.S. Decennial Census.

The roadway system consists of 464 miles of public highways. The four-lane divided highway U.S. Route 13 runs down the peninsula's spine, and is the primary north-south route. It serves as the region's designated hurricane evacuation route – northbound only - because the 17.6-mile long Chesapeake Bay Bridge Tunnel (CBBT) connecting the Eastern Shore peninsula with the Hampton Roads area is not acceptable for use for hurricane evacuation. Further attesting to its importance in the highway system, Route 13 is also part of the Department of Defense's Strategic Highway Network (STRAHNET), the Federal Highway Administration's National Highway System, and is designated by VDOT as a Corridor of Regional Significance.

Tourists and residents alike rely on two major bridges and two causeways: the CBBT, the Chincoteague causeway and bridge, and to a lesser extent in a regional context, the Saxis causeway. The CBBT was opened to traffic in 1965 as a two-lane facility, which was expanded to two lanes in each direction in 1999, except where traffic merges into one lane in each direction to pass through the tunnels. Even so, it not for capacity, but wind restrictions that the CBBT is not a designated evacuation route (Commonwealth of Virginia Emergency Operations Plan: Hurricane Response Plan, Annex B, Appendix III).

The Chincoteague causeway and bridge, part of Virginia Route 175, is the only route onto and off of Chincoteague Island. It has been subject to closure from at least ten different storms, some causing multiple closures, since 2000. The Saxis causeway is less exposed to open water, but has been closed by at least two storms since 2000. The small bridge that allows vehicular traffic over Assateague Channel, connects Chincoteague and Assateague Islands, and thus is vital for economic reasons.

Another major causeway and bridge is not well known, but is important to the economy of the area, and that is the causeway and bridge that leads to NASA's Wallops Island Flight Facility launch area, the Mid-Atlantic Spaceport, and the Navy Combat Systems Center. The space flight facility is at the core of an industry that directly supports 1,700 jobs and has an economic impact of \$830 million on the region ([www.nasa.gov/centers/wallops/about/vision.html](http://www.nasa.gov/centers/wallops/about/vision.html)).

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### PASSENGER TRANSIT

STAR Transit provides passenger transit service for approximately 86,000 passengers annually from roughly 6 a.m. until 6 p.m., Monday through Friday, from Cape Charles to Chincoteague. A transfer point at Walmart in Onley connects northern and southern routes. On-demand service is available in southern Accomack County, and deviations from other routes can be made with prior arrangements.

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### RAIL

Bay Coast Railroad operates 68 miles of track in Accomack and Northampton counties. The mainline is 130-pound rail maintained to meet Federal Railroad Administration Class-II Standards. The route is roughly down the elevated central spine of the Eastern Shore, and parallels U.S. Route 13 for about 41 miles (six of those on the west side of U.S. 13 near the Maryland state line)

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Two rail car barges with 15- and 25-car capacity cross the Chesapeake Bay between Cape Charles and Little Creek pulled by tug boats, providing rail freight connections to Norfolk Southern Railway in Norfolk and in Pocomoke, Maryland. Each round barge trip takes approximately 12 hours. Rail and barge capital investments are partially subsidized by the Virginia Department of Rail and Public Transportation. Float bridges at the ports allow rail cars to be rolled directly onto and off of the barges. It is one of two such rail car float operations left in the country, and has been in continuous service since 1885.

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### AVIATION

Although the closest scheduled air passenger services are in Norfolk and Salisbury, there are a number of airports in the region. Most are small, private general aviation airports with turf runways. Those open to the public with paved runways are Accomack and Tangier. The privately owned Campbell Field's two turf runways in Northampton County are also open to the public.

Accomack County Airport is located 0.7 miles east of Melfa, and is accessible by vehicle from U.S. Route 13 through the Accomack County Industrial Park. The public airport is home to 25 based aircraft and two businesses that lease space to operate from the airport. Infrastructure includes a 5000' x 100' asphalt runway, a modern terminal building, 100LL and jet fuel service, 18 T-hangars, and automated weather observation. Navigational aids include: medium intensity runway lighting system (MIRL), REILS, PAPI, rotating beacon, lighted windsocks and tetrahedron, automated weather observation system (AWOS), Localizer and GPS Approaches (Barbara Haxter, Airport Manager, personal communication, April 1, 2016).

The public Tangier Island Airport has a 2426' x 75' asphalt runway with AWOS. There are no nighttime aids to navigation. Tie-downs are available, but there are no hangars or fuel sales. While there is no terminal building, there is a bathroom available for use in a trailer parked on site (Renee Tyler, Town of Tangier, personal communication, April 1, 2016).

The exception is Wallops Flight Facility, which is a secure facility owned and operated by NASA. Landings there are for business with the federal government at NASA or related facilities, and by permission only. A control tower operates 10 hours daily, Monday – Friday, and Wallops boasts two cross-wind runways exceeding 8,000' by 150' each. Both have precision approach path indicators (PAPI), high intensity runway edge lights, runway end identifier lights (REILS), rotating beacon, automated weather observation system, and GPS approaches. A third 4804' by 150' concrete/asphalt runway intersects the other two, and has the same navigational features. Jet A fuel is available.

While Wallops is not open to the general public, its governmental ownership, large runways, and hangar space make it an ideal location for receiving cargo planes and supplies in the aftermath of a major disaster. Airport officials have made space available in the past to Coast Guard officials for storing boats and other assets when hurricanes have threatened the station on Chincoteague (Ed Sudendorf, Wallops Flight Facility, personal communication, April 8, 2016).

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### COMMERCIAL AREAS

Commercial areas can be assets in times of disasters, but can also be areas of high economic vulnerability due to the higher investment there, relative to residential areas. This is especially true in waterfront areas on Virginia's Eastern Shore. Large commercial parking areas can be useful for emergency response: Some are designated as points of distribution following disasters; others could be designated should usual points of distribution be unusable.

Many of the commercial areas are clustered in the region's nineteen incorporated towns, ten of which are along the Route 13 corridor. Six are waterfront communities. Other non-incorporated places dot the landscape, where

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churches, post offices, and remaining commercial enterprises hint at their once-bustling pasts. These unincorporated areas are well-known to area residents: Atlantic, Willis Wharf, Quinby, Oyster, Pungoteague, Mappsville, and Tasley - to name a few.

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### REGIONAL FACILITIES

Regional facilities are facilities required to support the services and functions on a regional level, whether by government alone, or in coordination with other public and private entities. These facilities enhance the overall quality of life for the area and its citizens. It is important to note the facilities that are available in case of a hazard, and to make an inventory of facilities that could be affected by a hazard. Regional facilities include such assets as public safety offices, public water and sewer systems, regional parks and recreational facilities.

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#### PUBLIC SAFETY

Accomack County, Northampton County, Chincoteague, and Wallops Island all have departments of public safety with lead responsibility for coordination of public safety and emergency planning and response, in conjunction with the numerous public safety entities across the two-county region. They also may open emergency operations centers that are activated at different levels according to the seriousness of the situation, in accord with the emergency operations plans of each of those entities (provide links to the EOPs). An overview of the branches of public safety is provided below.

##### Law Enforcement

The region's combined police presence, according to the FBI's "Crime in the United States, 2011" publication, is about 110. This includes towns, counties, and the national park system. The CBBT also has its own police force.

Saxis, Tangier, Hallwood, Accomac, Melfa, Keller, Wachapreague, Painter, Belle Haven, Nassawadox, and Cheriton do not have their own police forces; instead relying on the Accomack County Sheriff and State police for law enforcement. Some of these towns, such as Cheriton and Nassawadox, contract with the Virginia State Police to conduct traffic enforcement.

The Towns of Chincoteague, Bloxom, Parksley, Tangier, Onancock, Onley, Exmore, Eastville, and Cape Charles each maintain a police force, though the size of the force ranges from one officer in Eastville to 12 in Chincoteague.

The Accomack County Sheriff's Department based in Accomac, and the Northampton County Sheriff's Office, based in Eastville, provide general law enforcement services for the two counties. With 26 deputies, the Accomack department responded to more than 9,500 calls and made 1,450 arrests in 2015. In addition to the Sheriff and Major, there are 20 law enforcement deputies, 40 jail deputies, and six communications officers in Northampton County.

The Virginia State Police provides traffic enforcement and crash response, drug task force, drug education, and crime prevention activities from Post 31 in Melfa. In addition, State Police makes resources available for disaster response, such as following the 2014 tornado at Cherrystone Campground.

None of the police stations within the region are located within a special flood hazard zone.

##### Fire, Rescue, and EMS

When the alarms are sounded, 90 career employees and 500 volunteers at thirty-one stations are available to answer the call, from New-Church to Cape Charles. Some stations provide a full range of response, including fire, rescue, and EMS, and others are not fully arrayed. Mutual aid – a system of reciprocal assistance with neighboring

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departments -- is imperative and allows all stations to provide the best coverage and live-saving services. Table 6 provides a summary of all Eastern Shore fire and rescue companies and their staffing and equipment capabilities.

***Table 6: Regional Fire Company and Capabilities***

Station Number/Name	Fire	Rescue	EMS
#1 New Church	X	X	
#2 Greenbackville	X	X	X
#3 Chincoteague	X	X	X
#4 Atlantic	X	X	
#5 Saxis	X	X	X
#6 Bloxom	X	X	X
#7 Parksley	X	X	X
#8 Tasley	X	X	
#9 Onancock	X	X	X
#10 Melfa	X	X	X
#11 Wachapreague	X	X	
#12 Painter	X	X	X
#13 Community Fire Company (Exmore)	X	X	X
#14 Cheriton	X	X	
#15 Cape Charles Fire Company	X	X	
#16 Northampton Fire and Rescue	X	X	X
#17 Eastville Fire Company	X	X	
#18 Onley Fire and Rescue	X	X	X
#19 Cape Charles Rescue Service			X
#20 Oak Hall Rescue			X
#21 Tangier	X	X	X
#25 & #26 NASA Wallops Flight Facility	X	X	X
#31 Northampton EMS			X

Sources: Northampton, Accomack, and Chincoteague Emergency Management Coordinators

When requested by volunteer companies, the Virginia Department of Forestry responds to assist in fighting wildfires, bringing its bulldozers equipped with specially designed plows to make a fire line; and two pick-up trucks equipped with firefighting equipment.

Through the Eastern Shore Regional Fire Training Facility in Melfa, firefighters can receive training locally. A plan to upgrade and expand the facility to EMT accreditation is under review, so that EMT trainees can complete the entire process locally.

Most fire and EMS stations are located outside of special flood hazard areas. The exceptions are Tangier, Chincoteague, Saxis, Wachapreague, and Wallops Flight Facility Station #2. None of the stations in special hazard areas are mutual aid to each other. Although Tangier seems most vulnerable to some because its isolation means there is no mutual aid, Chincoteague and Saxis share its vulnerability during major storms because flooding of the causeways creates the same isolated conditions. Chincoteague and Wallops Island have plans to evacuate equipment to the mainland in the face of major storms.

Street flood patterns must be considered for all stations. Using the Coastal Resilience tool to look at hypothetical storm scenarios shows, for example, that although the Greenbackville fire station remains elevated out of the flood zone in a moderate hurricane, the roads surrounding it could be covered with 4-8 feet of water. In such an instance, pre-storm evacuation of equipment would be needed to be able to assist in post-storm operations. A

## The Region

similar concern exists for Wachapreague, where the model shows that every route in and out of town would be inundated with even a low intensity hurricane.

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### WATER SUPPLY

The one thing all residents and businesses of the Eastern Shore have in common is that they rely on ground water for their drinking water – and much of their other water – needs. In order to protect the water so many rely upon, both counties have adopted water supply plans and jointly manage a Regional Ground Water Resource Protection and Preservation Plan.

The four major aquifers are present in both counties and are, in order of increasing depth below ground surface, the Columbia (unconfined), and the upper, middle, and lower Yorktown-Eastover (confined) aquifers. Aquifers deeper than the lower Yorktown-Eastover contain brackish to salty water which effectively limits their use for most applications without additional treatment and are currently not used as a source of drinking water. The entire two-county region (and therefore its aquifers) is located within the Eastern Shore Groundwater Management Area (ESGWMA) as defined by the Virginia Ground Water Management Act of 1992, which requires a permit from DEQ for any person or entity wishing to withdraw in excess of 300,000 gallons per month from a declared GWMA.

The majority of drinking water needs in the region are met through withdrawals from wells screened in the (confined) Yorktown-Eastover aquifers, while the rest is met through withdrawals from wells screened in the (surficial) Columbia aquifer. Ground water availability in the Columbia Aquifer is characterized by relatively large recharge rates, lower aquifer storage, and a higher susceptibility to contamination; conversely, ground water availability in the Yorktown-Eastover Aquifers is characterized by relatively low recharge rate, higher aquifer storage and lower susceptibility to contamination.

The Environmental Protection Agency records 347 public wells on the Eastern Shore. Of those, seven (Chincoteague, Tangier, Parksley, Onancock, Exmore, Eastville, and Cape Charles) are municipal systems serving a combined population of 11,900. Others are privately operated community systems, such as Captain's Cove in northern Accomack County, which serves a population of 840.

Non-municipal systems in both counties also serve large, sometimes vulnerable populations, such as schools, nursing homes, the hospital, and other health care facilities. Still others are considered transient, such as water supplies for restaurants, campgrounds, and hotels. (<https://www3.epa.gov/enviro/facts/sdwis/search.html>).

Despite the number of public wells, most residential dwellings in both counties are not connected to those public supplies and rely on private, individual wells for water, many of which are within the special flood hazard area and subject to periodic flooding. Wells permitted for public use are required to be regularly tested, including after hazard events, and users of the system can be warned when the supply is unsafe. However, with thousands of individual wells, those private well owners are responsible for their own water safety, and may not be able aware of the need or able to afford the sampling necessary to ensure a safe water supply.

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### SOLID WASTE DISPOSAL

Solid waste curbside pickup is determined on a town-by-town basis. Some private providers will, for a fee, service areas outside towns where population is sufficiently concentrated to make it economically attractive for them to provide service. Outside of that, it is up to residents to take their household refuse and recycling to convenience centers for collection, with one exception. Because there are no landfills on Tangier, refuse for the island is barged to the mainland and taken to the Accomack County landfill.

Residents can take their waste to one of thirteen convenience centers. In addition, each county has a transfer station that receives waste, and where trash is compacted inside a semi-truck and then sent to another location

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for disposal. In Accomack County, that could be the landfill, located at 9400 Cutler Lane, Atlantic, or across the Bay, which is the case with Northampton County.

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### PARKS AND RECREATION

#### Boat Launches

One of the great assets life offers on the Eastern Shore is access to both the Chesapeake Bay and the Atlantic Ocean. With forty-four launch locations, some with multiple slips, there are many opportunities to launch into enjoyment of the many recreational opportunities afforded by the waters around the peninsula and in its creeks.

A 2013 study of working waterfront infrastructure found that 66 percent of 21 waterfronts surveyed experienced flooding of grounds and dryland facilities. Nearly half experienced wave damage to docks or found docks difficult to use due to recurrent flooding. About a quarter reported recent flooding impacting buildings or equipment. Shoreline erosion including scouring and backwashing of bulkheads was reported by seven facilities, and ice damage was reported by two, but was not a significant concern for most facilities.

#### Nature Preserves

The Eastern Shore has many ecologically sensitive locations that have been set aside in public and private nature preserves and easements. Many are located along the seaside and bayside coastlines, and they benefit hazard mitigation thorough their ability to hold buffer the effects of coastal flooding.

The Department of Conservation and Recreation manages five Eastern Shore natural area preserves totaling almost 2,000 acres. Magothy Bay (516 acres) and Mutton Hunk (286 acres) preserves are on the seaside; with the remaining three – Cape Charles (29 acres), Savage Neck Dunes (298 acres), and Parkers Marsh (759 acres) natural area preserves located on the bayside.

In addition, the Nature Conservancy owns 12 barrier islands and portions of two others that comprise its Virginia Coast reserve, and form the longest expanse of coastal wilderness remaining on the eastern seaboard. Through this initiative, the Conservancy protects some 40,000 acres of barrier islands, marshes, and upland.

(<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/virginia/placesweprotect/virginia-coast-reserve.xml>).

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### DRAINAGE DITCHES

Drainage ditches are a part of the infrastructure that are often not noticed by the public – unless they aren’t functioning properly. There is no single regional body to manage storm water drainage. As a result, maintenance of drainage ditches and storm drains is a shared responsibility among VDOT, the counties and the towns.

In Accomack County, there are county funds for drainage projects, and prioritization is sometimes described as “complaint driven.” Once problems are identified, easements must be obtained from property owners if the drains cross private property. If one property owner is not inclined to cooperate, it can be to the detriment of multiple other owners.

Northampton County does not have a county drainage system, and relief is rare, unless there is a connection with some other policy objective, such as the Chesapeake Bay Act.

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### SCHOOLS

## The Region

Northampton and Accomack County together house 15 public schools (Figure 5): Seven elementary schools, three middle schools, three high schools, Chincoteague Combined School (6-12 grade), and Tangier Combined School (K-12). There are also several private schools, including Cape Charles Christian School, Shore Christian Academy (Exmore), Central Baptist Academy (Onley), Broadwater Academy (Exmore), and the Montessori Children's House (Franktown). Head Start operates in both counties, and there are numerous private pre-school and home-based day care programs.



**Figure 8: Location of 15 public schools in the region. Source: Accomack County, Northampton County, The Nature Conservancy, as depicted in coastalresilience.org**

All of Tangier combined school is in the special flood hazard zone, and the northern wing of Chincoteague combined school is located in the special flood hazard zone.

Many students seeking to continue their education enroll at Eastern Shore Community College in Melfa in fields of applied science, transfer degree programs, career programs, and high school student enrolled dually in both high school and community college.

Other students still residing on the Shore commute to other locations, heading north to the University of Maryland Eastern Shore in Princess Anne, or Salisbury University; or south across the CBBT to Old Dominion University (ODU) or other locations in Hampton Roads. ODU students also have the opportunity to complete bachelors', masters', or doctoral degrees through a partnership with the community college.

Those heading south are sometimes at jeopardy of delayed commutes when wind speeds exceed those that are safe to cross the bridge-tunnel. Passenger cars are permitted to cross in all but the highest winds (up to 70 mph),

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but higher profile vehicles such as pick-up trucks and vans have lower thresholds depending on their height. Another risk is that damage to the facility will close it for an extended period, forcing students to lose the term, as happened in the 1970s when twice sections were struck by vessels and had to be closed for months at time.

Although the risk is less now that the CBBT has redundancy of two parallel structures that could place all traffic on one set (i.e. northbound and southbound traffic on what is currently used only for southbound traffic), the risk is still there and is higher around the tunnel entrances where the two directions of traffic converge to pass through the tunnels.

Both the University of Virginia and William and Mary operate coastal research facilities that are built at the water' and located at Wallops Island, has about a dozen member universities, and has been educating students of all ages for almost 50 years. The University of Virginia's Anheuser-Busch Coastal Research Center in Oyster supports research activities in coastal bays, salt marshes, and barrier islands, and has permanent field staff, laboratories, classrooms, and dormitory space for as many as 30 people.

William and Mary's Virginia Institute of Marine Science (VIMS) Eastern Shore Laboratory supports field research in coastal ecology and aquaculture. The facility has permanent field staff, dry and saltwater labs, classrooms, and dormitory space for up to 42 people. The saltwater lab is in a VE (velocity) flood zone, so special flood proofing standards were applied. The lab building was constructed with an elevated foundation that brings the floor to nine feet above mean sea level, and a waterproof envelop that provides flood protection up to 14 feet above mean sea level.

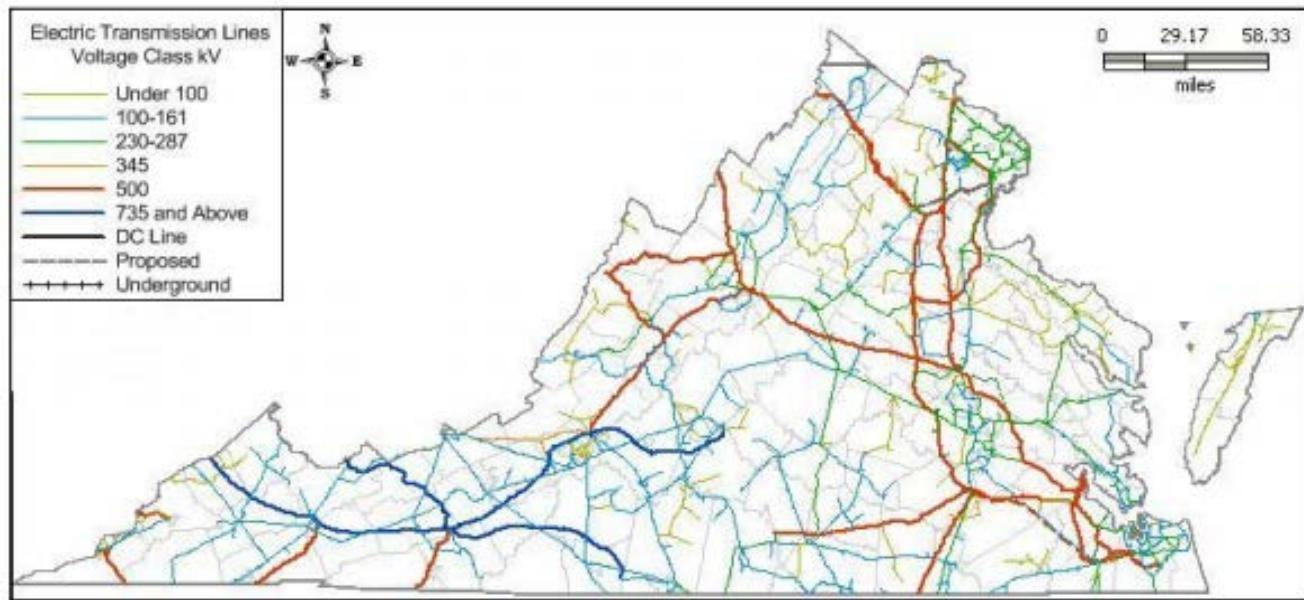
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### ELECTRICAL DISTRIBUTION

Electricity is provided by A & N Electric Cooperative, a member-owned cooperative that serves the entire Eastern Shore. As shown in Figure 9, all Eastern Shore transmission lines are less than 100 kilovolts, except a small stretch extending from the "peaker plant" in the northern part of the Accomack County.

The peaker plant is a diesel-powered plant in northern Accomack County with 350 megawatt capacity that kicks in during periods of peak demand. It is the largest electrical producer on the Shore, but several smaller generators are placed throughout both counties. Old Dominion Electric Cooperative owns six sites in Accomack County, each with two four-megawatt generators that run on ultra-low-sulfur diesel fuel stored on-site. These generators kick on in the event of electrical transmission problems (<http://www.odec.com/generation-transmission/current-power-stations>). Other locations with generating capacity include Tasley (Calpine Corporation -33 MW), Bayview (Calpine MidAtlantic LLC -12 MW), and Tangier (A & N Electric Cooperative -3.9 MW), and Accomack County (Delmarva Power and Light – 2 MW) ([www.deq.virginia.gov/portals/0/deq/air/permitting/egu\\_operating.doc](http://www.deq.virginia.gov/portals/0/deq/air/permitting/egu_operating.doc)).

## The Region



Source: Virginia Department of Mines, Minerals and Energy, "Energy Assurance Plan," 9-12-2012

**Figure 9: Electric Transmission Lines**

## NATURAL ENVIRONMENT

### GEOLOGY AND SOILS

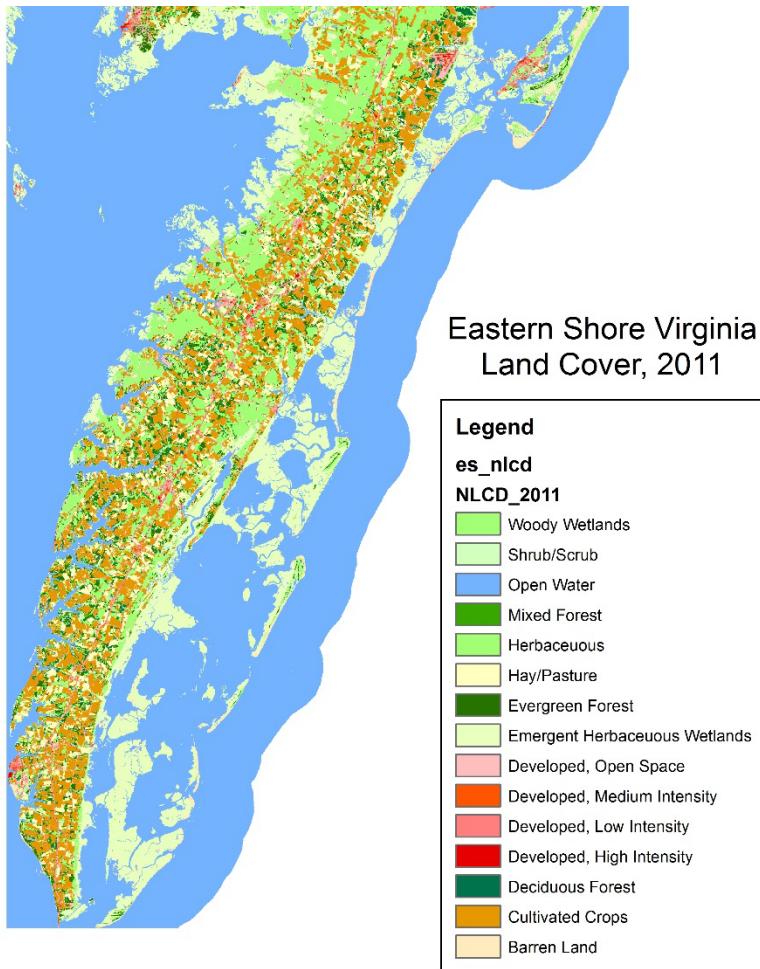
For a detailed discussion of geology and soils, see Chapter 7: Risk Description – Storm Water.

### LAND COVER

As shown in the land cover map with associated acreages (Figure 10), the two categories of wetlands account for almost half of the region's land cover. The animal and aquatic habitat, recreational, and economic resources in the region's largely unspoiled wetlands are of the highest order, and are central to the lives and livelihoods of Eastern Shore residents and businesses. But wetlands have great coastal resilience benefits as well, and help to blunt the effects of storm surge by absorbing wave energy, storing storm water, and slowing erosion.

## Eastern Shore of Virginia Hazard Mitigation Plan

All of the developed land uses taken together account for 8.1 percent of the land cover.



Land Cover	Acres	Percent
Barren Land	41,812	1.89%
Cultivated Crops	472,787	21.38%
Deciduous Forest	42,486	1.92%
Developed, High Intensity	2,793	0.13%
Developed, Medium Intensity	11,301	0.51%
Developed, Low Intensity	34,275	1.55%
Developed, Open Space	130,562	5.91%
Emergent Herbaceous Wetland	587,339	26.56%
Evergreen Forest	109,082	4.93%
Hay/Pasture	189,483	8.57%
Herbaceous	9,049	0.41%
Mixed Forest	44,361	2.01%
Shrub/Scrub	50,010	2.26%
Woody Wetland	485,687	21.97%
Totals	2,211,027	100.00%

**Figure 10: ESVA Land Use Land Cover Map with Associated Acreages.**  
Source: National Land Cover Data Set, 2011

## GROUND WATER

The Eastern Shore of Virginia depends entirely on ground water for potable water supplies, as well as most non-potable supplies such as irrigation water. Because the peninsula is surrounded by large bodies of saltwater, ground water becomes brackish at relatively shallow depths (< 350 feet) in most areas, and the total available ground water supply is more limited than on the mainland. The Eastern Shore of Virginia is one of six EPA-designated sole-source aquifers in the mid-Atlantic region.

Threats to ground water on the Eastern Shore may be placed into three general categories: (1) saltwater intrusion; (2) hydraulic head depression; and (3) contamination from surface sources. Intrusion of saltwater into fresh ground water aquifers can be caused by wells that are screened too close to the fresh water/saltwater interface, are too close to the shore, and/or pump at an excessive rate. Depression of the hydraulic head occurs around every pumping well, but if pumping rates are too high or if wells are too close to each other, water levels in some wells can drop so low that well yields are reduced. In extreme cases, the head can fall so low that the aquifer is partially dewatered, which in turn can cause consolidation and a permanent loss of transmissivity (which will also reduce well yield) (Eastern Shore of Virginia Ground Water Resource Protection and Preservation Plan, 2013).

## The Region

The State Water Control Board included the Eastern Shore of Virginia in the consolidated Eastern Virginia Groundwater Management Area after observing declining levels of groundwater, and interference between wells, in two areas of Accomack County, along with contamination in the water table aquifer (but not the confined aquifers), and the possibility of over withdrawal if not monitored closely. This designation allows the DEQ to regulate groundwater withdrawals that equal or exceed 300,000 gallons per month.

Recognizing the importance of protecting the vital resource, the boards of supervisors of Accomack and Northampton Counties formed the Ground Water Committee in 1990, and included elected officials, citizens, and local government staff as members. The purpose of the group is to promote understanding, awareness, and responsible management practices, and to prepare all necessary plans and studies. This group also reviews ground water withdrawal applications that are submitted to the DEQ.

## HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

### PREVIOUS HAZARD MITIGATION PLANS

The Eastern Shore of Virginia has participated in the hazard mitigation planning process since 2006. The Region's primary risks identified by the Hazard Mitigation Steering Committee are coastal flooding, coastal erosion, high winds, and storm water flooding, although others are identified as well. Table 8 identifies a number of plans and policy documents that offer opportunities to address hazard vulnerabilities.

**Table 7: ESVA Previous/Existing Mitigation Resources**

Policy/Plan/Program/Resource	Enforcing/Implementing Agency	Provisions/ how vulnerability is reduced	Last Update	Planned Update
Hazard Mitigation Plan	Counties/Municipalities	Provides a document to continually update hazard mitigation analysis and preparedness.	2011	2016
Eastern Shore Disaster Preparedness Coalition	Cooperating agencies: Local Emergency Management offices, VDEM, FEMA, Dept. of Health, Amateur Radio Club, Businesses, Citizen Corps Council, Volunteer Medical Corps, Sheriff's Offices, State Police, planning offices, hospital, town mayors, and other interested parties	Prepares the Eastern Shore of Virginia for all types of disasters and to promote regional planning and coordination.	NA	NA
Coastal Adaptation Working Group	A-NPDC convenes; members include local agencies, Non-governmental agencies, state and federal agencies	Promote and evaluate sea level rise adaptation strategies	NA	NA
Eastern Shore Ground Water Committee	Authorized by county boards of supervisors; A-NPDC convenes and staffs	Promotes awareness, responsible management practices, reviews ground water withdrawal applications	NA	NA
Eastern Shore Navigable Waterways Committee	Authorized by county boards of supervisors.	Study and propose solutions for water navigation needs	NA	NA

## Eastern Shore of Virginia Hazard Mitigation Plan

Policy/Plan/Program/Resource	Enforcing/Implementing Agency	Provisions/ how vulnerability is reduced	Last Update	Planned Update
Virginia Hurricane Evacuation Guide	VDEM, VDOT	All Eastern Shore residents will use Route 13 North towards Salisbury, Maryland	June 2013	2016
All Hazards Preparedness Brochure	Eastern Shore Disaster Preparedness Coalition	Provides residents of both counties with information on preparing for disasters	2012	No planned update
Transportation Infrastructure Inundation Vulnerability Assessment	A-NPDC/VDOT	Identifies roadways inundated various scenarios from storm surge, tides, and SLR	2015	No planned update
Emergency Operations Plans	Accomack County, Northampton County, Chincoteague, Wallops Flight Facility	Provides a comprehensive review of actions for large scale emergencies, so that lines of responsibility procedures are no response time is lost in confusion.	2014 CH 2013 AC 2016 NC	2018 CH 2017 AC 2020 NC
Mutual Aid Agreements and Documents	Accomack County; Northampton County; Town of Chincoteague; Worcester County, MD; NASA Wallops Flight Facility; Accomack-Northampton Firemen's Association	Ensures that resources are available when a single area or EMS company's resources are insufficient for the incident or are rendered unable to respond.	Various	Varies
Eastern Shore Oil and HazMat Response Plan	Responding fire departments with support from Dept. of Public Safety, County's Hazardous Materials Officer, and Eastern Shore Hazardous Materials Response Team	Details all steps needed for hazmat emergency so that none are missed and public is protected.	2014	Annual review; modify as needed
Eastern Shore of VA Hazardous Material Commodity Flow	Accomack County Dept. of Public Safety	Understanding the types of hazardous materials helps ensure the proper responses to hazmat incidents.	2014	unknown
Eastern Shore Health District Pandemic Influenza Plan	Department of Public Health, Eastern Shore Health District	Ensures continuation of public health services while providing for emergency needs during a pandemic	2009	unknown
FEMA Coastal Construction Manual	FEMA, Local construction offices.	Ensures minimum construction standards are met to protect lives and property	2011	unknown

## NATIONAL FLOODING INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

### NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

Within the Region, both counties and 14 towns have joined the NFIP. The Table shows the number of policies by locality, and claims filed by jurisdiction. Even though both counties are part of the program, residents of incorporated towns are not eligible to purchase flood protection under NFIP unless the town in which they reside has joined.

## The Region

**Table 8: National Flood Insurance Program Participation**

Community	Number of Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Accomack Co.	3,600	\$783,145,000	\$3,371,021	1,062	\$11,906,426
Northampton Co.	572	\$160,667,200	\$420,015	102	\$1,095,312
<b>TOTALS</b>	<b>4,172</b>	<b>\$943,812,200</b>	<b>\$3,791,036</b>	<b>1,164</b>	<b>\$13,001,738</b>

Source: Virginia Department of Conservation and Recreation, January 12, 2016

The NFIP program tracks a category of high-risk structures called “repetitive loss properties.” Repetitive loss properties are defined as any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) more than ten days apart, but within any rolling ten-year period, since 1978.<sup>1</sup> Repetitive loss structures account for about one percent of NFIP policies, but 25 to 30 percent of flood claims. Between the two counties, 73 repetitive loss properties have seen 208 losses with payments from the NFIP totaling nearly \$3.3 million for both structures and contents.

A further classification is for severe repetitive loss structures: Structures which have incurred four or more separate flood-related damage claims payments exceeding \$5,000 (buildings or contents) under flood insurance coverage, with the cumulative amount the claims payments exceeding \$20,000, or for which at least two separate claims payments (building only) have been made, with the cumulative amount exceeding the market value of the insured structure. There are nine repetitive loss structures in the region: Three in Chincoteague, one in Tangier, four elsewhere in Accomack County, and one in Northampton County. The exact locations of the structures is protected information and cannot be published.

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## HAZARD MITIGATION GRANT PROGRAM

The region’s participation in Hazard Mitigation Grant Program (HMGP) dates to 1999 and the major disaster declaration following Hurricane Floyd when Accomack County received a project to elevate 29 homes and Northampton County received funding to elevate three homes and for utility flood proofing.

A total of 24 homes in Northampton County and almost 100 homes in Accomack County have been elevated out of the floodplain. The Accomack-Northampton Planning District Commission now manages the HMGP for the Eastern Shore. To date, no houses have been relocated or razed under the program.

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<sup>1</sup> Note that FEMA’s Flood Mitigation Assistance Program defines repetitive loss differently: A structure that has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the time of each flood event, and at the time of the second incidence the contract has increased cost of compliance coverage. See FEMA Flood Insurance Manual for details. <http://www.fema.gov/media-library/assets/documents/115549>

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*Table 9: Regional Community Insurance Information*

<b>Community Name</b>	<b>NFIP Status</b>	<b>Total # of Policies</b>	<b>Insurance in Force</b>	<b>Total Number of Paid Losses Since 1978</b>	<b>Total Losses Paid Since 1978</b>	<b>Substantial Damage Claims Since 1978</b>	<b># of RL Structures</b>	<b># of SRL Structures</b>	<b>Level of NFIP Regulations Required</b>
Accomack County	Participating	2,044	\$458,577,300	641	\$8,911,356	57	27	4	60.3 (e) - FEMA has provided a FIRM that shows coastal high hazard areas
Town of Accomac	Not Participating	~	~	~	~	~	~	~	60.3 (a) - FEMA has not defined special flood hazard areas (SFHAs) within community
Town of Belle Haven	Participating	3	\$950,000	0	\$0	0	1	0	60.3 (c) - FEMA has provided a FIRM with BFEs
Town of Bloxom	Participating	0	\$0	0	\$0	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community
Town of Chincoteague	Participating	1,075	\$238,936,000	61	\$579,611	1	18	2	60.3 (e) - FEMA has provided a FIRM that shows coastal high hazard areas
Town of Hallwood	Participating	1	\$350,000	1	\$4,923	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community
Town of Keller	Not Participating	~	~	~	~	~	~	~	60.3 (a) - FEMA has not defined SFHAs within community
Town of Melfa	Not Participating	~	~	~	~	~	~	~	60.3 (a) - FEMA has not defined SFHAs within community

The Region

Community Name	NFIP Status	Total # of Policies	Insurance in Force	Total Number of Paid Losses Since 1978	Total Losses Paid Since 1978	Substantial Damage Claims Since 1978	# of RL Structures	# of SRL Structures	Level of NFIP Regulations Required
Town of Onancock	Participating	23	\$6,805,600	2	\$13,955	0	0	0	60.3 (c) - FEMA has provided a FIRM with BFEs
Town of Onley	Participating	1	\$350,000	0	\$0	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community
Town of Painter	Not Participating	~	~	~	~	~	~	~	60.3 (a) - FEMA has not defined SFHAs within community
Town of Parksley	Participating	3	\$805,000	0	\$0	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community
Town of Saxis	Participating	48	\$5,995,700	19	\$295,925	2	0	0	60.3 (e) - FEMA has provided a FIRM that shows coastal high hazard areas
Town of Tangier	Participating	74	\$10,165,700	78	\$1,000,119	8	14	1	60.3 (e) - FEMA has provided a FIRM that shows coastal high hazard areas
Town of Wachapreague	Participating	84	\$20,374,900	23	\$403,440	0	3	1	60.3 (e) - FEMA has provided a FIRM that shows coastal high hazard areas
<b>Northampton County</b>	Participating	294	\$85,150,400	67	\$978,428	2	10	1	60.3 (e) - FEMA has provided a FIRM that shows coastal high hazard areas
Town of Cape Charles	Participating	181	\$53,558,000	10	\$85,915	0	0	0	60.3 (e) - FEMA has provided a FIRM that

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<b>Community Name</b>	<b>NFIP Status</b>	<b>Total # of Policies</b>	<b>Insurance in Force</b>	<b>Total Number of Paid Losses Since 1978</b>	<b>Total Losses Paid Since 1978</b>	<b>Substantial Damage Claims Since 1978</b>	<b># of RL Structures</b>	<b># of SRL Structures</b>	<b>Level of NFIP Regulations Required</b>
									shows coastal high hazard areas
Town of Cheriton	Not Participating	~	~	~	~	~	~	~	60.3 (c) - FEMA has provided a FIRM with BFEs
Town of Eastville	Participating	1	\$350,000	0	\$0	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community
Town of Exmore	Participating	2	\$635,000	2	\$5,982	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community
Town of Nassawadox	Participating	1	\$280,000	0	\$0	0	0	0	60.3 (a) - FEMA has not defined SFHAs within community

Source: FEMA Community Information System (CIS). RL – Repetitive Loss; SRL – Severe Repetitive Loss Structure

## HAZARDS PROFILE

The top four hazards identified by the Hazard Mitigation Steering Committee and the Hazard Mitigation Planning Council (Stakeholders) were: High wind, coastal erosion, coastal flooding, and storm water flooding. These hazards ranked highest in likelihood of occurrence, ranking from a low of 2.92 (storm water flooding) to 2.96 (a three-way tie for the remaining items.)

The next band of hazards were considered to have a medium likelihood of occurrence: well contamination, ice and snow, drought, and sewage spills. Ranking as least likely were wildfires, hazardous materials incidents, heat waves, fish kills, biological hazards, invasive environmental diseases, and earthquakes.

It is important to note that these are region-wide rankings, and rankings decided upon by towns for their chapters vary according to the risk assessments performed for those towns.

### HIGH WIND

*Note: For more detailed discussion about the causes of high winds, exposure, and attempts to manage loss, see Chapter 4: Risk Description – High Winds.*

High winds on the Eastern Shore of Virginia primarily stem from tropical cyclones like hurricanes and tropical storms; off-shore low pressure systems like nor'easters; rotating cells within thunderstorms like tornadoes and waterspouts; and straight-line winds associated with fast-moving thunderstorms.

From NOAA's National Climate Data Center's database, 16 instances of high winds were counted that could be considered regional (records were found for both counties from the same storm event). Most of these were hurricanes, tropical storms, or nor'easters, but there were a couple of instances of rapidly moving thunderstorms, such as the derecho line in June of 2012, or the thunderstorms of March 16, 2011, that brought 57 mph winds to both counties, downing trees and knocking down silos in Assawoman.

However, localized events can have regional impacts on emergency response resources, as the Eastern Shore experienced in July 2014 when a tornado and straight-line winds ripped through the Cherrystone Campground during the height of the camping season. Units from across the region were called to respond, and were tied up for at least half of the day (the tornado/winds struck around 8:25 -8:40 a.m.) National Weather Service reports indicate that five injuries were from the tornado, and three fatalities and 31 injuries were the result of falling trees and limbs from straight-line winds.

Five other tornadoes have hit in the Eastern Shore region since 1996. Of the six (total), five have been since 2010, with one minor injury and no other deaths reported.

Notwithstanding the magnitude of the July 2014 storm, on a regional level, the greatest frequency of region-wide impact are large off-shore storms. To assess the possible wind-speed of a hurricane storm on the Eastern Shore, FEMA's HAZUS hurricane module was run for the "probabilistic scenario." For this analysis, the 100-year return period was used. This means that the model selects a storm that is likely for this region as a storm the area would see once every 100 years. The same storm scenario was run for each county.

Under this scenario, wind speeds ranged between 88 and 96 mph across Northampton County, and 84 to 100 mph across Accomack County. HAZUS estimated about 386 buildings would be at least moderately damaged in Accomack County, and 108 in Northampton County, with estimated property damage for both counties (building,

## Eastern Shore of Virginia Hazard Mitigation Plan

contents, and inventory) totaling more than \$72 million. Figures 18 and 19 show the distribution of wind damage for each county. Damage is reported in thousands of dollars.

### COASTAL EROSION

All areas of the Eastern Shore are susceptible to erosion, whether from water, wind, or waves. The barrier island ecosystem on the seaside, with its expanses of tidal marshes, mudflats, and lagoons, buffer the mainland from the worst storm impacts, dissipating wave energy and mitigating floods.

Natural low banks and marshes on the bayside are subject to direct wave action erosion from wind, storms and motorized watercraft. Barrier Islands are also subject to erosion from, as are the marsh lands. For a more detailed look at the causes of erosion on the bayside and seaside, please see [Chapter 5: Risk Description - Coastal Erosion.](#)

## Storm Track 4 (Bayside - High Intensity)

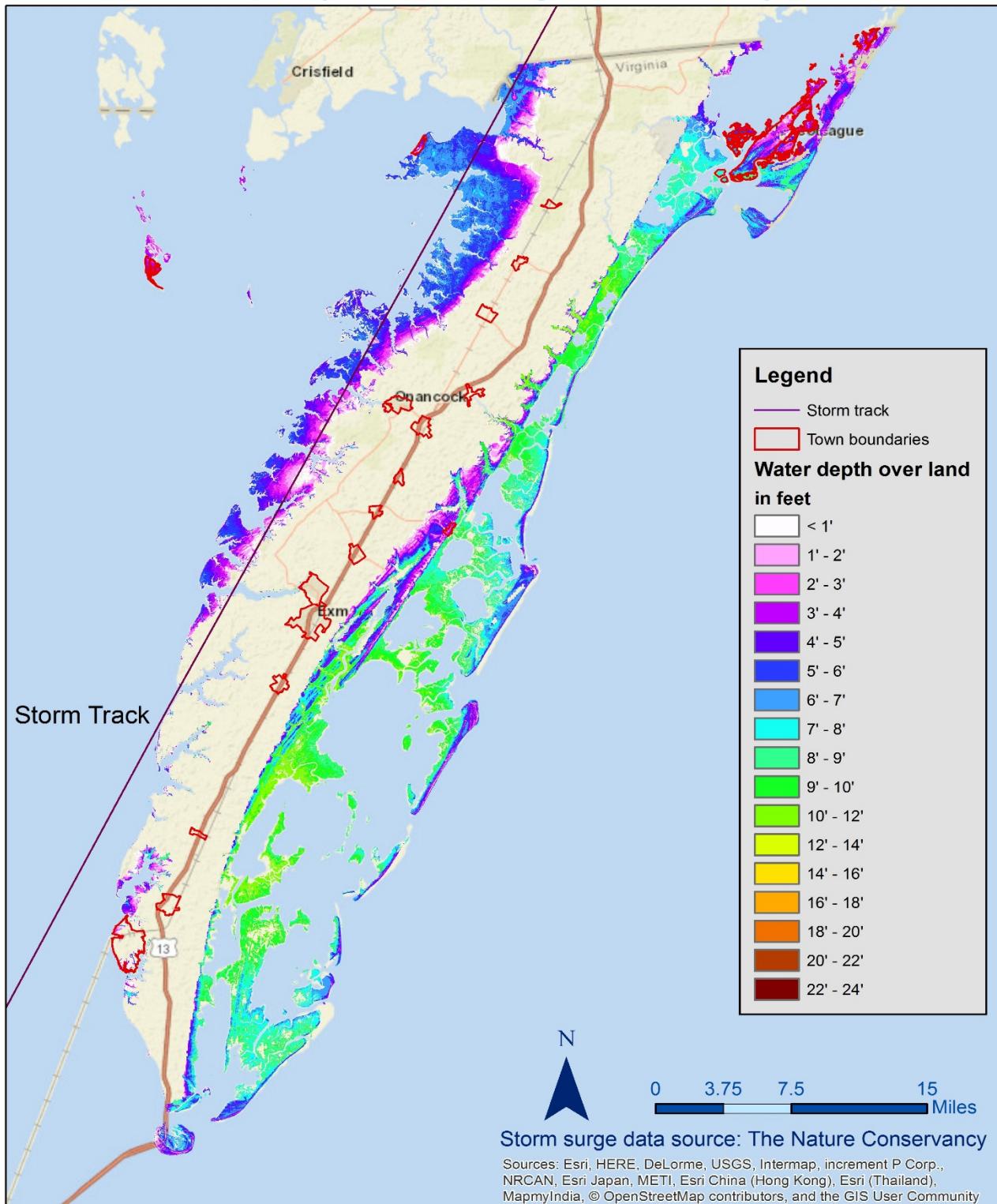
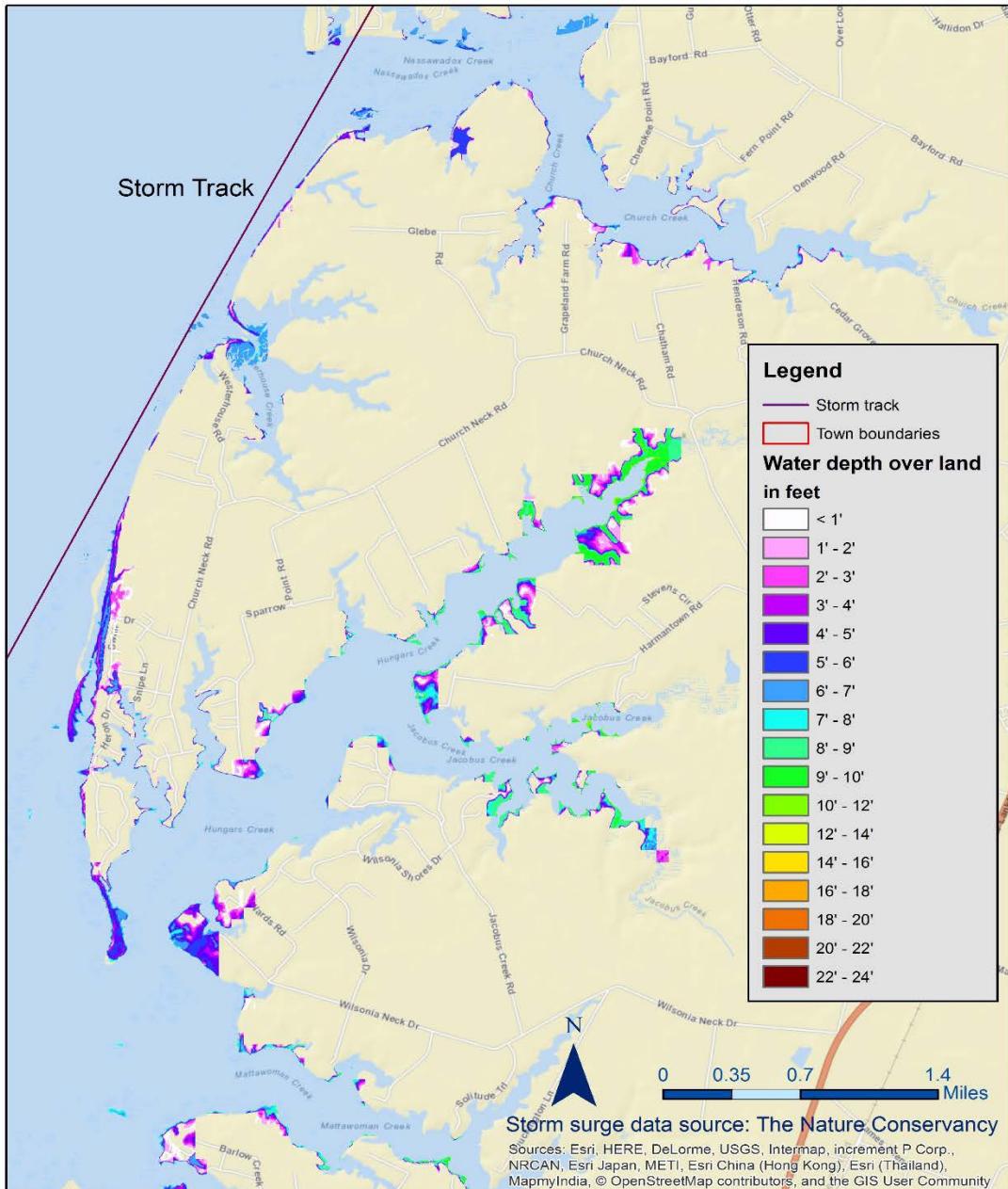


Figure 11: Storm 4: Bayside, High Intensity

## Storm Track 4 Close-up of Hungar's Creek area



**Figure 12: Close up of Hungars Creek under Storm 4 Scenario**

Although erosion is a natural process that happens at some scale on an ongoing basis, when it occurs with the force of large coastal storms, it can become dangerous quickly, eroding large segments of island or coastline, and placing structures or infrastructure in jeopardy. Coastal erosion from Hurricane Sandy caused one building of the Seabreeze affordable housing apartments in Cape Charles to be condemned in the midst of the storm. Seven families were evacuated and relocated.

## The Region

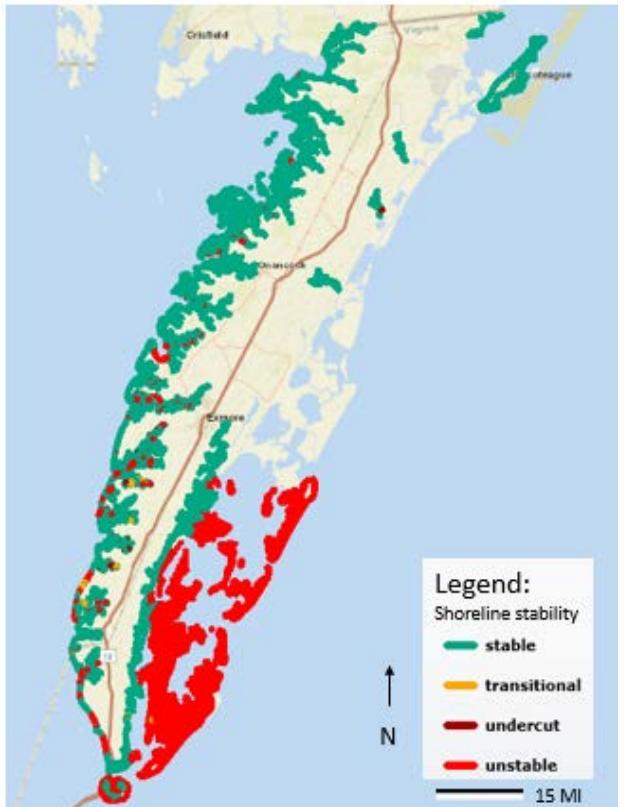
NOAA maintains a database of weather events in the National Climate Data Center going back to 1955. Data from 1962 onward were downloaded for the Eastern Shore of Virginia.<sup>2</sup> Since 1996, the database records eleven storms causing major coastal erosion across region. Besides Hurricane Sandy, major storms with erosion include Ernesto (2006), Isabel (2003), Twin Nor'easters (1998), and Hurricane Dennis, Hurricane Floyd, and Nor'Ida, all in (1999).

In 2011, VIMS completed a Shoreline Inventory Report for Northampton. As part of the report, shorelines were

examined for stability, and then classified as either stable, transitional, undercut, or unstable. Figure 17 reveals that the seaside barrier islands in Northampton County are the most unstable area in the county, along with selected areas along the bayside.

The Accomack County report was completed in 2000, and did not contain a full seaside survey, but instead was limited to selected creeks on the seaside and Chincoteague. This is reflected in the absence of erosion for seaside barrier islands within Accomack County, which is clearly contrary to the rapid erosion that has been observed at many of those locations.

So far, discussion has centered on the threat of erosion to land, but erosion also imperils watercourses when sediment collects in waterways causing shoaling. Many a boater has damaged his or her pride –if not their boat – on shoals. More recently, the ability of the Wachapreague Coast Guard station to respond with its Cutter, except on either side of high tide, means that lives could be at stake as well as the Virginia Inside Passage fills in (Town of Wachapreague officials, personal communication, April 18, 2016).



**Figure 13: Shoreline stability, Eastern Shore**

This anecdotal evidence is backed up by the 2013 Eastern Shore of Virginia Transient and Working Waterfront Infrastructure Needs Assessment which contained results of a survey where users of working waterfronts noted that water depths at the waterfront facilities and in the channels approaching the facilities were a concern. There were several facilities that reported water depths at mean low water within slips that were inadequate (<2 feet) for even the smallest of vessels. The Cape Charles Harbor is best situated to accommodate the largest vessels followed by Bay Creek Marina in Cape Charles and several facilities in Wachapreague. While water depths within facilities in Wachapreague appear to be adequate, access channel navigability was reported as a major problem for the area. The same is true for other areas in the region including Chincoteague/Chincoteague Bay, Onancock, Saxis, Quinby, Willis Wharf, Oyster, and the vast majority of other bayside and seaside creeks. Figure 19 illustrates the locations reported as problematic in that 2013 survey.

<sup>2</sup> Data are scarce for early years, but are progressively more complete, especially after 1990.

## Eastern Shore of Virginia Hazard Mitigation Plan

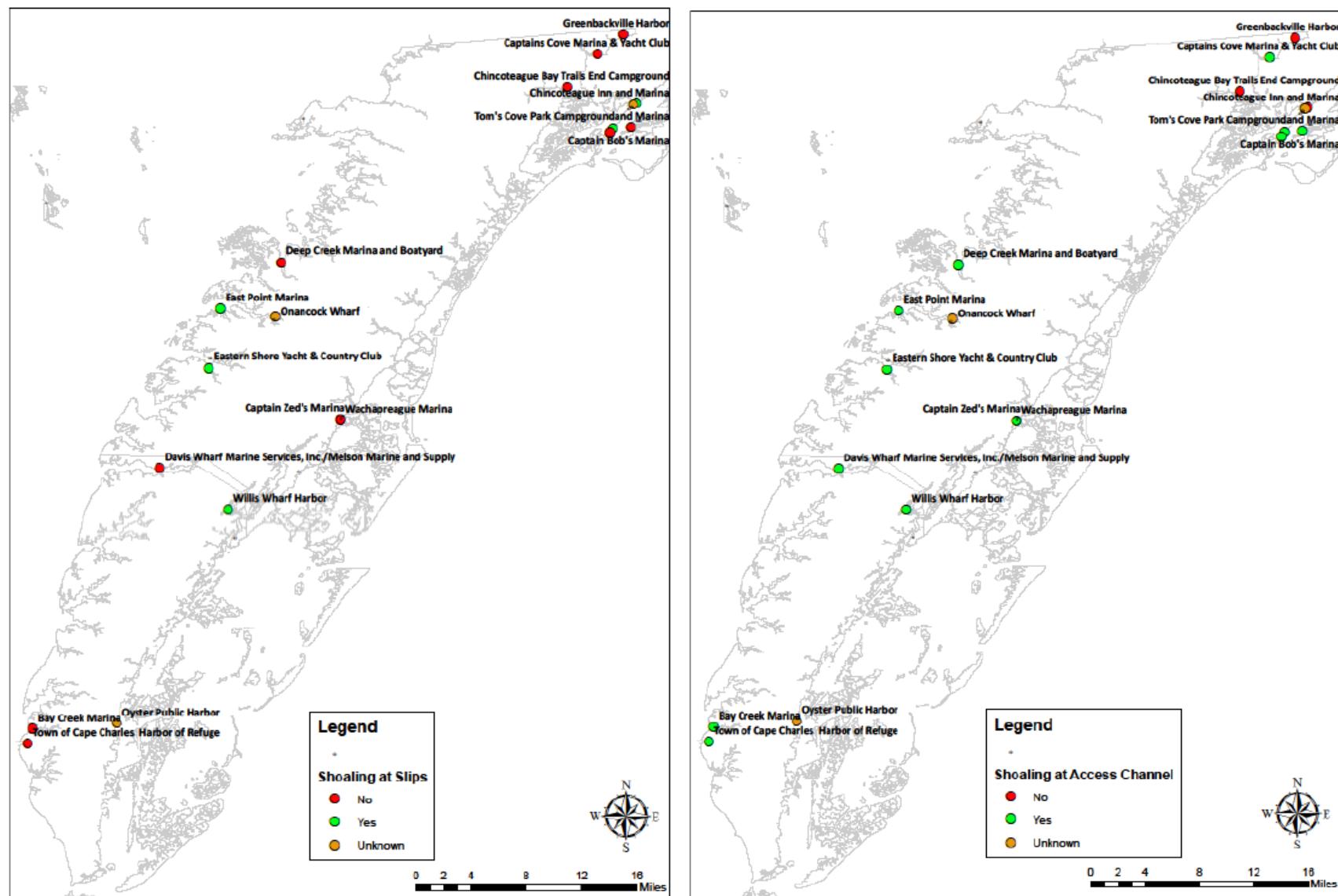


Figure 14: Shoaling at Eastern Shore slips and access channels in 2013. Source: Eastern Shore of Virginia Transient and Working Waterfront Infrastructure Needs Assessment, A-NPDC, 2013

## Eastern Shore of Virginia Hazard Mitigation Plan

In the fall of 2016 the A-NPDC produced the [Eastern Shore Regional Dredging Needs Assessment](#) report through a grant provided by the Virginia Coastal Zones Management program, and the Army Corps of Engineers' Sediment Management Plan should be issued around the same time. The Eastern Shore of Virginia Navigable Waterways Committee will use these products to guide its work in the following two years to complete a comprehensive shallow draft dredge plan for the region.

### COASTAL FLOODING

As detailed in the [Coastal Flooding chapter](#), hurricanes and nor'easters have dominated Eastern Shore severe weather headlines for centuries, bringing with them flooding from torrential rains, wind-driven high tides, and storm surges. Many of these storms are detailed in [Introduction: Hazards on the Shore](#).

NOAA maintains a database of weather events in the National Climate Data Center going back to 1955. Data from 1962 were downloaded for the Eastern Shore of Virginia.<sup>3</sup> Since 1996, the database records 17 instances of coastal flooding affecting the entire region. Most cases of coastal flooding are attributable to large coastal weather systems (hurricanes, tropical storms, and nor'easters) that affect the entire area, although they don't affect all parts of the region evenly. In at least three cases, strong off-shore winds were the cause of region-wide coastal flooding.

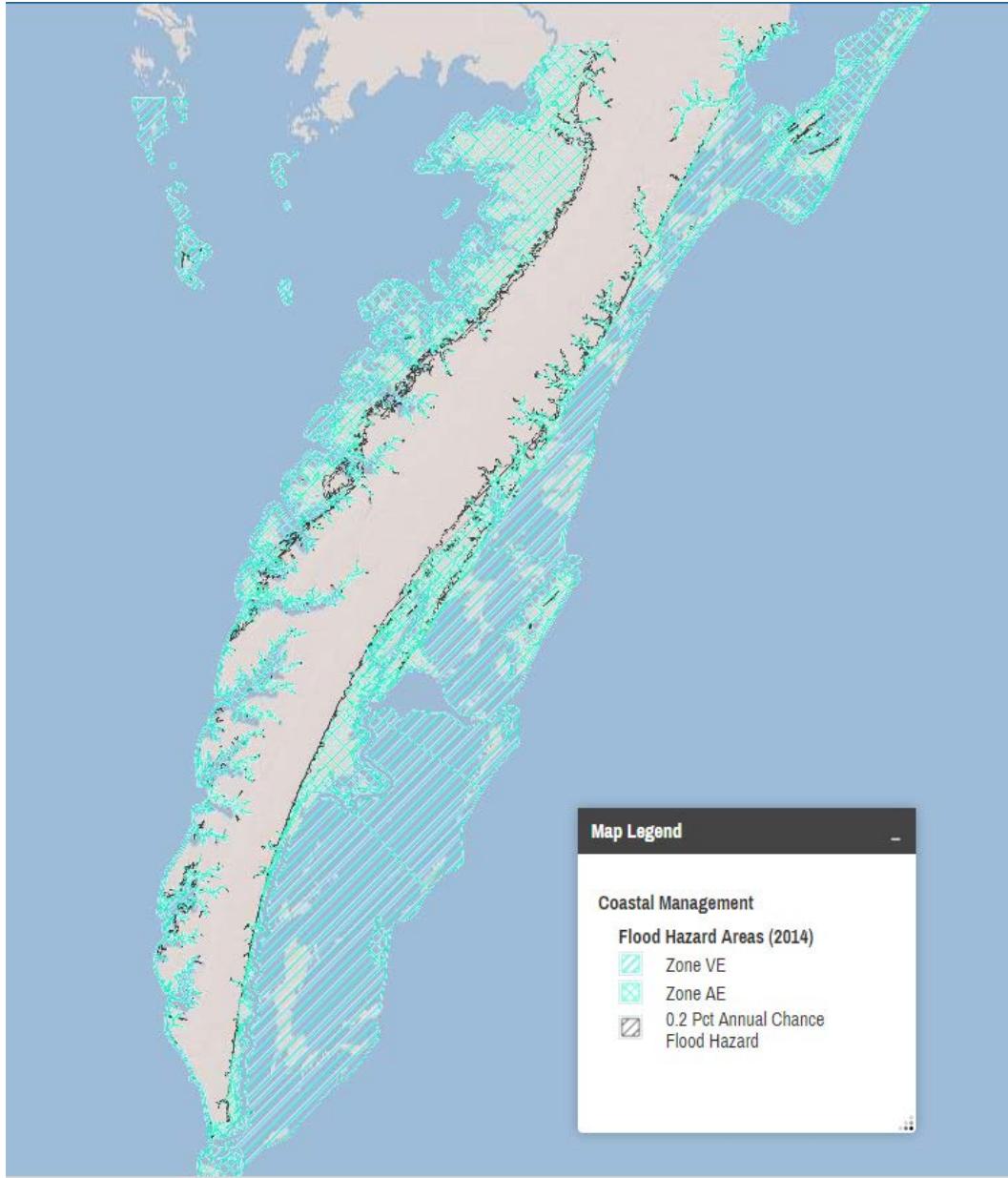
A hypothetical flood with a 1-percent-annual-chance flood (what was formerly referred to as the "100-year storm") is the basis for flood studies from which the regulatory Flood Insurance Rate Maps (FIRMs) are derived. New FIRMs became effective for Northampton and Accomack Counties on March 2, 2015 and May 18, 2015 respectively. However, the flood *risk* is the same as before the new maps went into effect, meaning conditions have not changed; only the lines on the map have changed. Community Rating System participating communities are working with constituents to let them know that they can still purchase flood insurance even if they are no longer required to, and will likely qualify for a preferred rate.

Under the new FIRM maps, Accomack County saw a net reduction of its special flood area of 5.4 square miles, and a reduction of 42.1 square miles within the velocity zones. These changes resulted in 2,426 buildings being reclassified as outside of the special flood hazard area, and 342 outside of the velocity zones. Northampton County also saw reductions, with 4.53 fewer square miles in the special flood hazard area, and a reduction of 25.7 square miles within the velocity zones. These changes caused 772 buildings to be reclassified as outside the special flood hazard area, and 67 to be removed from the velocity zones in Northampton County.

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<sup>3</sup> Data are scarce for early years, but are progressively more complete, especially after 1990.

## Eastern Shore of Virginia Hazard Mitigation Plan



**Figure 15: Special Flood Hazard Areas for Accomack and Northampton Counties.**  
Source: FEMA Flood Hazard Areas as depicted in [coastalresilience.org](http://coastalresilience.org)

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### ANALYSIS

The flood zones were used in FEMA's Hazus® model to assess damages from a 1 percent chance annual storm (formerly known as the 100-year storm). The model was run separately for each county, substituting county assessing data and other local data for the model's default data where possible (for details about the methodology, please see Appendix C.) Table 9 summarizes the damage estimates for the one-percent annual chance flood for both unincorporated and incorporated areas of each county.

## The Region

**Table 10: Total (incorporated and unincorporated) Damage Estimates for One-Percent Annual Chance Flood**

	Buildings in County	Total Value of Buildings (\$1000s)	Value of Bldgs in Flood Area (\$1000s)	Buildings Damaged at least 31 %	Building Loss* (\$Millions)	Business Interruption (\$Millions)	Essential Facilities Damaged	Debris Generation (tons)
<b>Accomack</b>	27,422	3,539,966	1,627,855	1,316	287.02	6.45	6	68,727
<b>Northampton</b>	8,529	1,574,820	619,617	78	57.77	0.10	0	4,778
<b>TOTALS</b>	<b>35,951</b>	<b>5,114,786</b>	<b>2,247,472</b>	<b>1,394</b>	<b>344.79</b>	<b>6.55</b>	<b>5</b>	<b>73,505</b>

\*Building loss includes damage to all buildings, contents, and inventory.

Source: Northampton County Flood Event Summary Report, based on Hazus® Version 2.2, run on ArcMap 10.2, October 26, 2016

About 83 percent of the building losses are estimated to fall to Accomack County where about 72 percent of the value of buildings in flood zones is found. Almost all of the business interruption costs are attributable to Accomack County.

The model estimates that Wachapreague and Tangier fire stations, along with the Chincoteague police station, would suffer minor damage. The Chincoteague fire station, however, would be rendered non-functional, and it would take more than a year to restore full functionality at that location.

Under the scenario, two schools would be damaged: Chincoteague Elementary and Tangier Combined School. Tangier would suffer minor damages, but Chincoteague Elementary would be rendered non-function and would require more than a year to restore full functionality at that location.

The model further estimates that about 2,411 households would be displaced (2,389 in Accomack County), a figure which includes those evacuated from the flood area, and 5,156 individuals would seek temporary shelter in public shelters.

It is important to keep in mind that the flood zones designated by the FIRM maps are regulatory products for the purpose of setting insurance rates, and are based on the probability of flood occurrence. Storms affect the region differently depending on their approach, and therefore could affect preparation and response. The Hazard Mitigation Steering Committee, in conjunction with members of the Hazard Mitigation Planning Council, the ANPDC staff approached The Nature Conservancy about using work it was developing for its Coastal Resilience Tool for the storm surge risk analysis. The tool is under development through a grant from National Fish and Wildlife Foundation and Department of Interior Hurricane Sandy Coastal Resiliency Funding, in partnership with the National Oceanic and Atmospheric Administration (NOAA), the United States Geological Survey (USGS), and other regional partners.

The Coastal Resilience tool incorporates the Advanced Circulation Model (ADCIRC), coupled with the Simulating Waves Nearshore (SWAN) model. The ADCIRC model “combines atmospheric pressure and wind forecasts to predict when, where, and to what extent flooding will inundate a coastal community with greater precision than other available models,” and is used by FEMA to update National Flood Insurance Program coastal inundation maps, by the U.S. Army Corps of Engineers for hurricane protection system design, by the U.S. Coast Guard to plan storm response, and has been run “for all U.S. land falling hurricanes for the past seven years.” (Homeland Security, “Getting ahead of the Storm Surge: ADCIRC Model”)

Some model considerations were noted by the Steering Committee for the storms and storm tracks modeled:

## Eastern Shore of Virginia Hazard Mitigation Plan

- With the exception of the Nor’Ida baseline storm, the storms modeled are from a FEMA storm database. While some are similar to storms the Eastern Shore has experience in the past, the storms are hypothetical, and as such, there is no probability of occurrence associated with any of them.
- Even though the probability of occurrence is unknown for each storm, the likelihood of storms arriving perpendicular to the shore line, as in Storm 16, is very low. However, the Steering Committee wanted to look at a worst case scenario, and the type of approach seen in Storm 16 (Figure 12) produced the worst flooding (Bill Sammler, National Weather Service Forecast Office, Wakefield).
- Some planning team members believed that the ADCIRC model over-stated flood depths, citing Nor’Ida model output as an example, where modeled storm surge reached eight feet, but there was no known record of that flooding depth with Nor’Ida (Eastern Shore Hazard Mitigation Committee, February 3, 2016). However, the model’s high water depths over land occurred with low-lying marsh areas east of the peninsula where there were neither gauges nor people to observe, so performance of the model at those specific locations is difficult to evaluate. For a more detailed examination of the model’s calibration to the Nor’Ida storm, see [Appendix D Storm Surge Methodology and Maps](#).

The committee asked staff to model one moderate and one high intensity bayside storm, and one moderate and one high intensity seaside storm. One additional storm was considered: the cross-peninsula storm that strikes perpendicular from the seaside (the previously mentioned Storm 16).

### Storm 16: A Cross-Peninsula Tracking, High Intensity Storm

This storm would produce much higher flooding on the seaside - up to 23' - than on the bayside where flood depth tops out at around 5 feet. Seaside flood depths would likely cause widespread evacuations along the seaside, and closure of the Chincoteague causeway, along with widespread flooding of other local seaside roads.

On the bayside, Saxis and Tangier appear to be the communities most at risk. Even with mutual aid, Saxis Fire Company would need to be prepared to rely on its own resources in such a storm, as surge depths would be sufficient to prevent mutual aid.

The flood extent for this scenario was far greater than what was imagined for the one percent annual flood used with Hazus®, which predicted that roughly 2,600 households would be displaced, and 5,160 would seek temporary shelter. This suggests that additional sheltering space would be required under a storm that resembles Storm 16.

### Storm Track 5: A Seaside-Tracking, High Intensity Storm

Storm Track 5 (Figure 14) was seen as a more typical storm, and in fact, is similar to the path taken by Hurricane Floyd in 1999 (Figure 15). Flood depths of up to almost 12 feet (over land) were modeled on the seaside in marsh areas. In this scenario, flood depths are higher on the bayside, where a number of communities were found to be at risk of isolation from roadway inundation.

The [Transportation Infrastructure Inundation Vulnerability Assessment](#), completed in 2015, was a joint effort between A-NPDC and the Virginia Department of Transportation. It found that two feet of inundation above mean higher high water was enough to disconnect nineteen Eastern Shore communities or make them inaccessible. Four more had limited access. With four feet of inundation, 28 communities were disconnected or inaccessible, and another 14 had limited access. So with four feet of inundation above mean higher high water, 42 of the 52 communities had their access limited or cut off.

## Storm Track 16 (Cross-Peninsula - High Intensity)

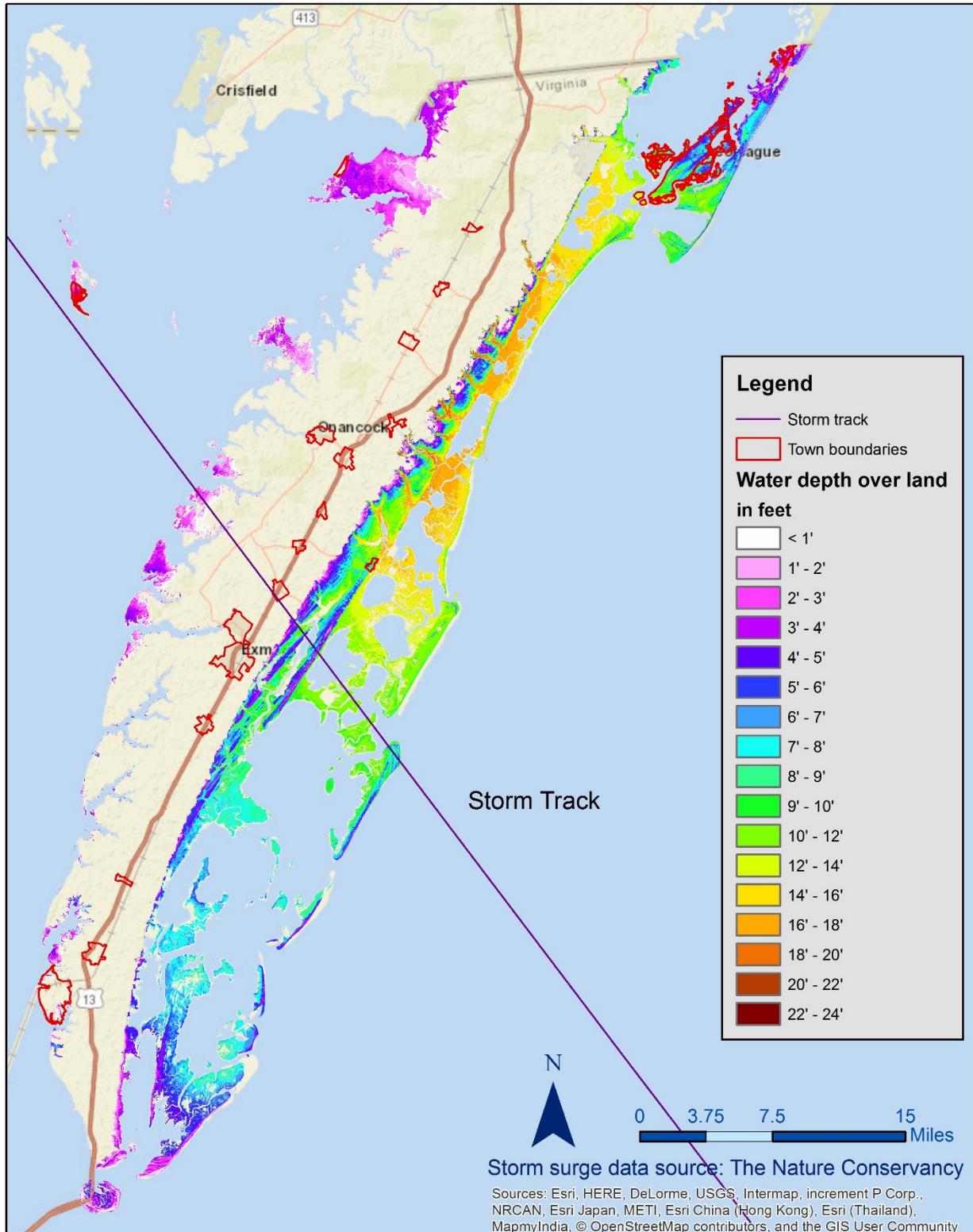


Figure 16: Storm 16: High-Intensity, Cross-Peninsula

## Storm Track 5 (Seaside - High Intensity)

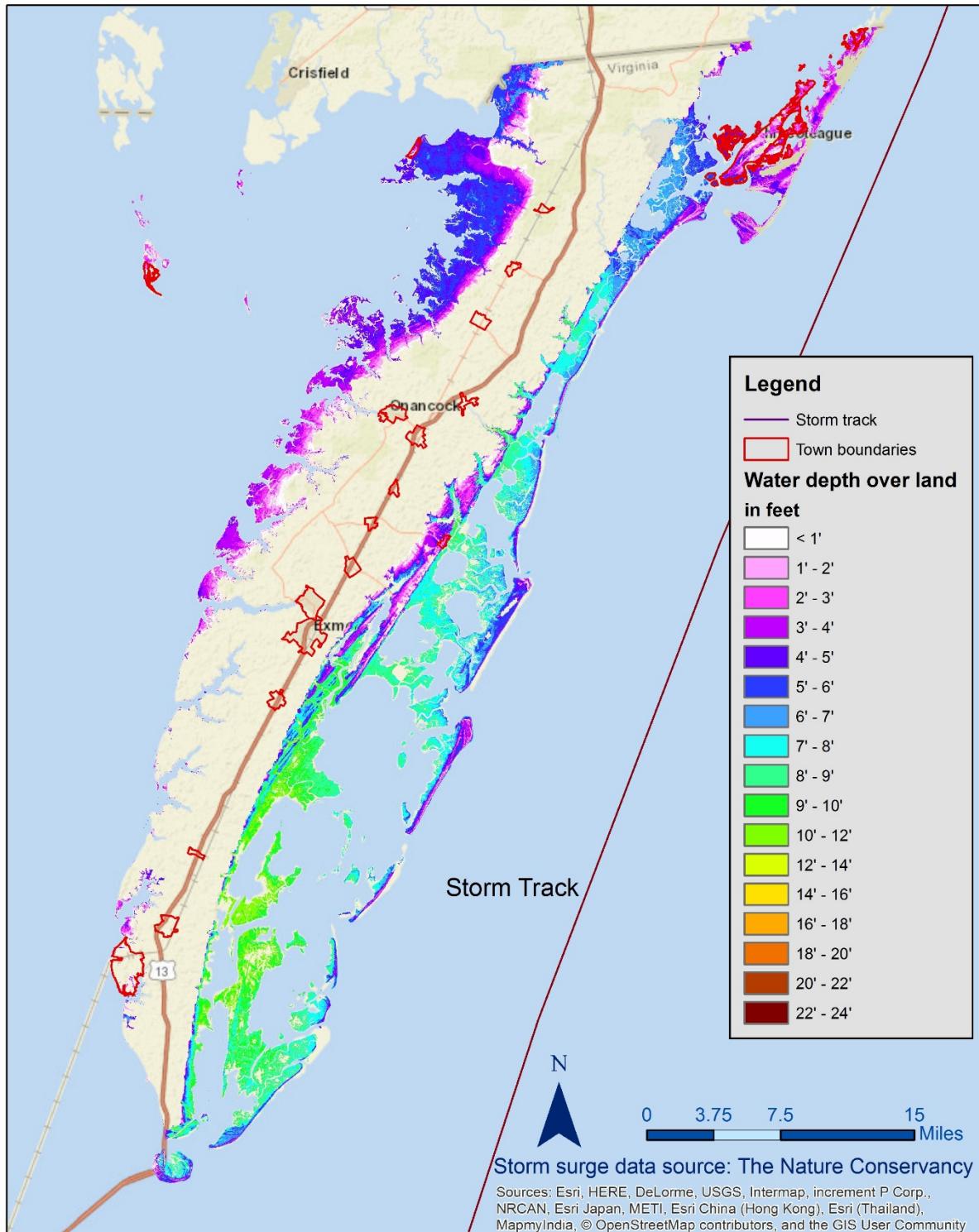


Figure 17: Storm 5, High-intensity, Seaside, with path similar to Hurricane Floyd

## The Region

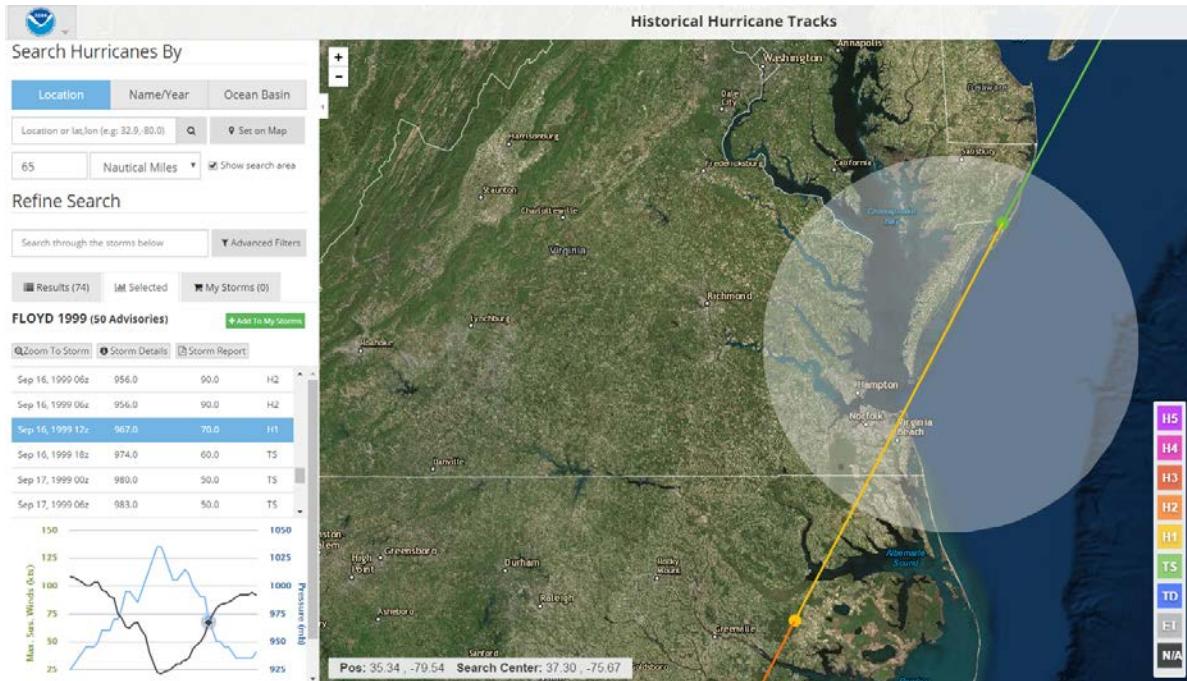


Figure 18: Hurricane Floyd (1999)

Figure 15 demonstrates a high intensity bayside storm. While severe flooding on the seaside is readily apparent, what is not so apparent is that deeper flooding also occurs on the bayside along the creeks, although it is not as widespread as on the seaside. Figure 16 is a close-up of Hungars Creek in this scenario. Models must be examined at both the macro and micro scales in order to fully understand the potential storm impacts and adequately plan and ward those in harm's way.

All of the storm surge scenarios consistently point to the buffering benefits of the barrier islands and marshes, as some of the worst flooding occurs in those areas. Conversely, where there is human presence in those areas, or where transportation routes intersect them, are where most of the worst vulnerabilities are found. Some of the worst bayside flooding is difficult to see at the regional-scale maps because it is where water is pushed up the creeks and eventually onto land, but zooming into those areas, but those areas are looked at in more detail in some of the town chapters.

## STORM WATER FLOODING

*For more detailed discussion about the causes of storm water flooding, exposure, flood locations, and attempts to manage loss, see [Chapter 7: Risk Description – Storm Water](#).*

Storm water flooding has frequent impact on the Region, and it can affect the entire region, as with a tropical storm or nor'easter, or can be very localized and intense, as with thunderstorms. Ten regional events are recorded in the storm events data base in 1996, with another 19 records of storm water flooding that were not region-wide. Most often these were reported in conjunction through State Police or Sheriff's patrols because of road conditions affecting safety. In some cases the stormwater flooding threatens the infrastructure itself, as in Pungoteague in 2012 when flash flooding caused a dam failure which washed out a portion of Bobtown Road.

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Estimated Wind Damage, Accomack County  
Probabilistic scenario, 100-year return period

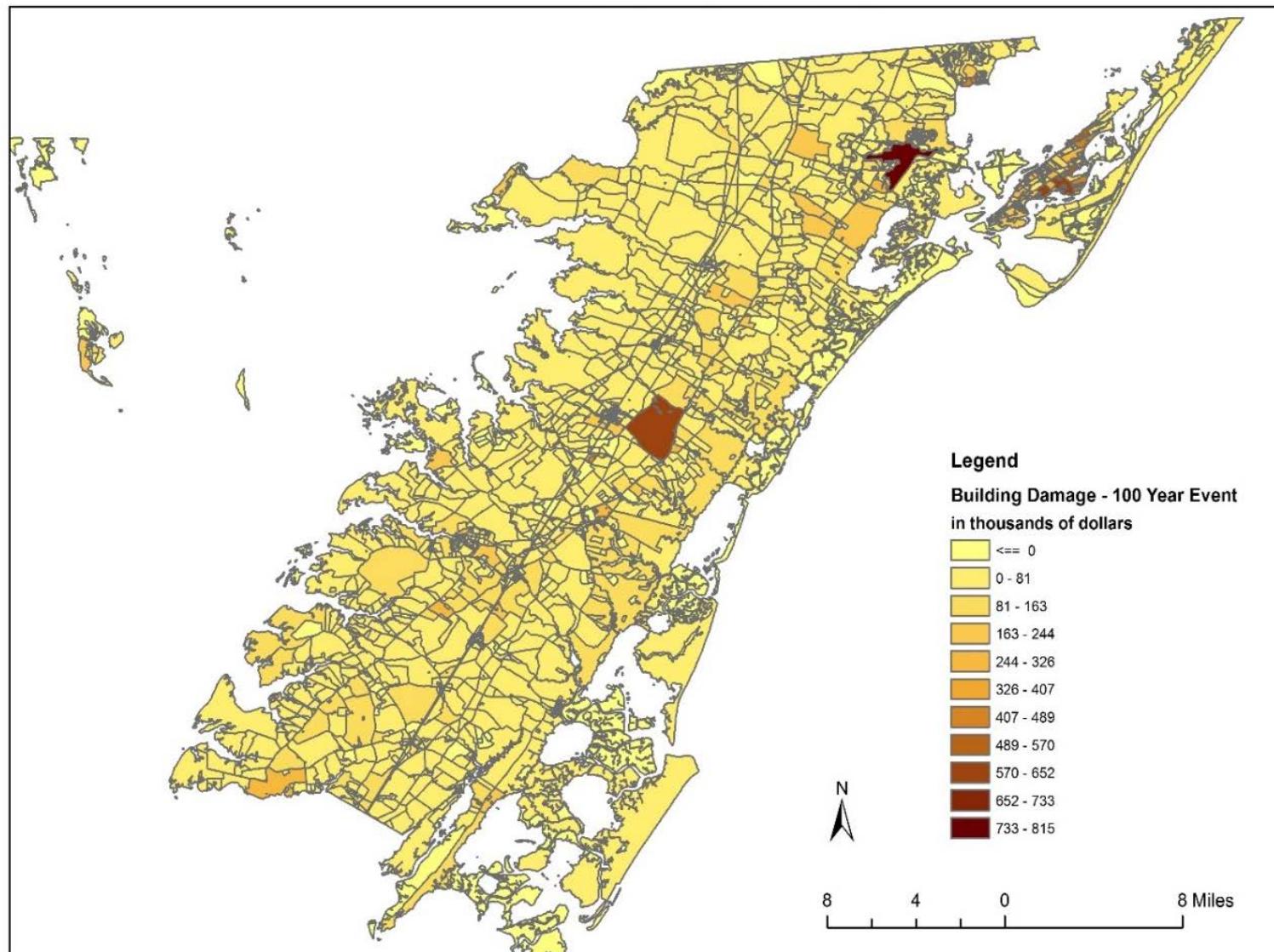


Figure 19: Estimated wind damage from 100-year hurricane, Accomack County

## Estimated Hurricane Wind Damage, Northampton County Probabilistic scenario, 100-year return period

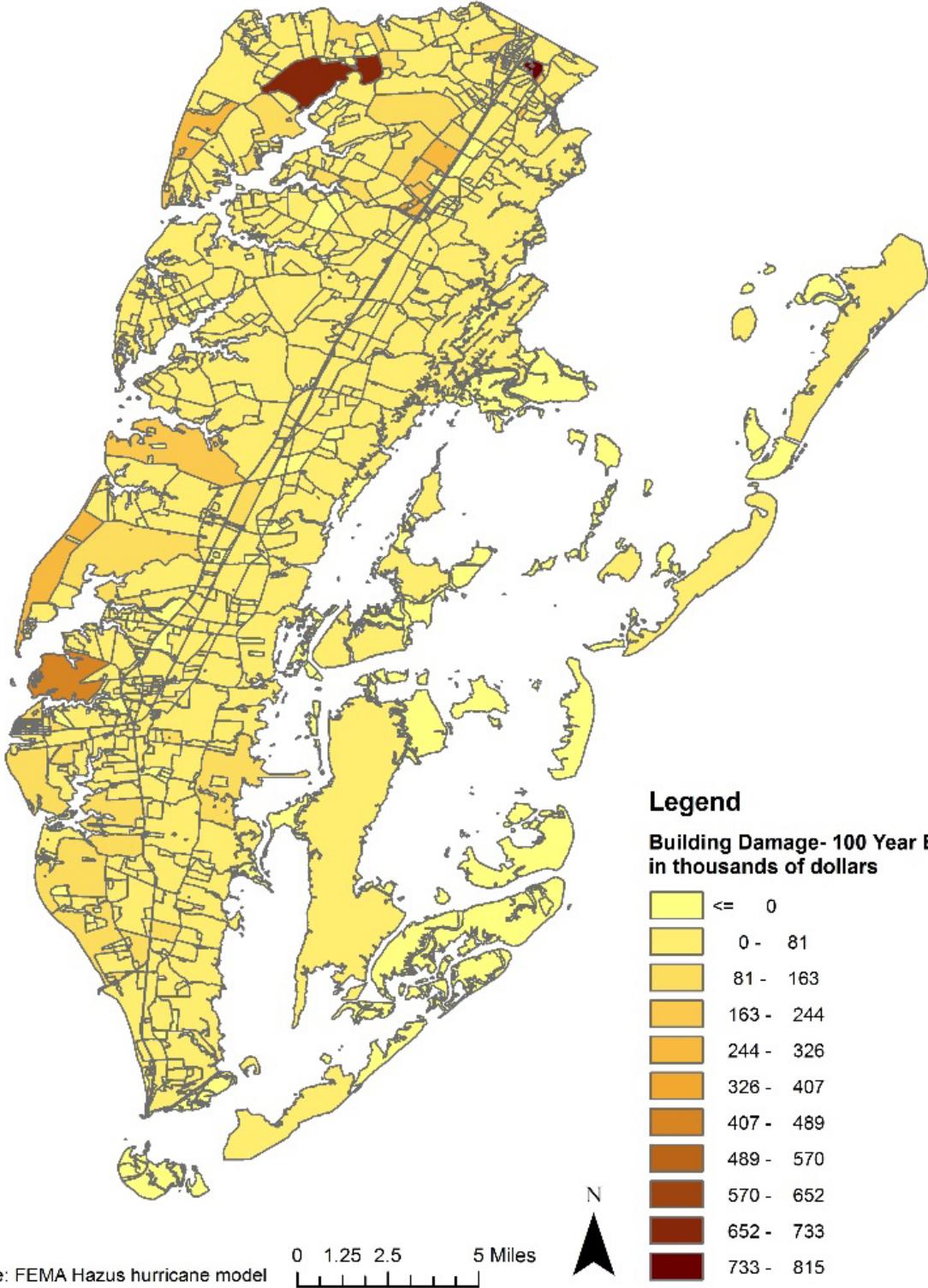


Figure 20: Estimated wind damage from 100-year hurricane, Northampton County

## Eastern Shore of Virginia Hazard Mitigation Plan

Several inland towns reported persistent stormwater flooding problems that threaten not only motorist safety, but personal property as well. (Interviews with town officials in the Towns of Parksley, Keller, Bloxom, Cheriton, Nassawadox, and Exmore. See town chapters for interview dates and details about flooding locations.) The Town of Melfa has had success mitigating its storm water drainage problems with drain installation, to the extent that it no longer considers storm water drainage to be a problem, and the Town of Bloxom has had some success with improving drains, although it has not resolved all of its drainage issues.

Most towns attribute stormwater flooding to a combination of lack of maintenance of the drainage system by VDOT, the counties, and other responsible parties; drains clogged with trash and debris; and the Eastern Shore's flat topography and poorly drained soils.

### HAZARDS OF LOCAL SIGNIFICANCE

Other hazards identified by the Hazard Mitigation Steering Committee, but ranking well below the primary hazards, are included in the table below.

*Table 11: Regionally Identified Other Hazards & Their Sources*

	HMP 2006	HMP 2011	2016 Priority
Well Contamination	Unranked	Unranked	Medium
Ice and Snow	Medium	Medium	Medium
Droughts	Medium	Medium	Medium
Sewage Spills	Unranked	Medium	Medium
Wildfire	Low	Medium	Low
Hazardous Materials Incidents*	Low	Low	Low
Heat Wave	Medium -	Low	Low
Fish Kills	Low	Unranked	Low
Biological Hazards**	Unranked	Low	Low
Invasive Environmental Disease***	Unranked	Unranked	Low
Earthquake	Unranked	Unranked	Low

\*Haz-Mat Incidents include oil spills, blast zone, thermo-nuclear

\*\*Bio Hazards include invasive human diseases and pandemic pathogens

\*\*\*Invasive Environmental Disease includes invasive land and water species and diseases

### WELL CONTAMINATION

As noted in the [ground water section](#), threats to ground water on the Eastern Shore may be placed into three general categories: (1) saltwater intrusion; (2) hydraulic head depression; and (3) contamination from surface sources. According to Britt McMillan, consulting hydrologist for the Eastern Shore of Virginia Ground Water Committee, salt water intrusion is the single greatest threat to fresh water in the region.

Other threats include nutrients, pesticides, and on-site waste disposal from the agriculture sector; human waste from septic and drain fields, nutrients, pesticides, herbicides, and petroleum and solvents from residential uses. The size of the threat is a function of the amount and area of application.

## The Region

Public water supplies that serve the same populations year-round are required to provide their customers with a consumer confidence report annually, detailing contaminants that were detected in the water system.

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### ICE & SNOW STORMS

Fifty-five ice and snow events were counted in the weather database for the two counties. Some of the more notable storms for their regional impact include the Christmas Day storm of 2010, where a low pressure storm off the mid-Atlantic produced snowfall generally in the nine-inch to 16-inch range in Accomack and Northampton counties. In 1998, a major ice storm brought ice accumulations of one-half to one inch, coating trees and power lines, and causing widespread power outages. Some customers were without power for about ten days. Many accidents occurred due to slippery road conditions, and many secondary roads were impassable due to fallen tree limbs and in a few cases, whole trees (NOAA, National Climatic Data Center).

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### DROUGHTS

Accomack and Northampton Counties consistently rate at the top for Virginia corn, wheat, and soybean production. And even though drought appears only once in the weather events database, in 1997, the toll it took in Accomack and Northampton counties was \$27 million (in 2015 dollars), accounting for almost 30 percent of Virginia's crop losses from the drought (NOAA, National Climatic Data Center).

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### SEWAGE SPILLS

The Eastern Shore has high-value aquaculture and eco-tourism industries that rely on pristine waters of the bayside and especially the seaside. Sewage spills are reported to the Department of Environmental Quality through the Pollution Response Program (PREP).

The PREP database from 2009 through March, 2016 records 14 instances of sewage spills reports to the PREP team. Most were instances of system failures or seepage.

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### FIREs

Fires that could be seen as wildfires – or could have become wild fires – remained more or less steady for the three year period from 2013 – 2015 ([Eastern Shore of Virginia 911 Communications Center 2015 Annual Report](#)). Brush fires increased from 77 in 2013 to 82 in 2014, before declining to 79 in 2015. Trash fires, and tree fire held steady, while tree fires declined from 18 in 2013 to 11 in 2014.

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### HAZARDOUS MATERIALS INCIDENTS

Hazardous materials incidents are reported to DEQ for response by the PREP team. Between September 2009 and March 2003, 233 reports of possible violations of environmental laws were reported to the PREP team. six others were classified as hazardous materials. They included a meth lab, a contractor not taking measures for lead abatement from a home, and the remaining incidents were crashes of vehicles carrying hazardous substances such as chlorine and ammonium sulfate.

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### HEAT WAVE

Heat waves are defined in the context of the season. Two are recorded since 1996. The first was an extended period of temperatures in May, 1996, which was early temperatures that high. The second was July 21-23, 2011

## Eastern Shore of Virginia Hazard Mitigation Plan

when temperatures were in 96-103 degrees, with heat index values from 110-119(NOAA, National Climatic Data Center).

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### FISH KILLS

Large die-off of fish can be caused by periods of low oxygen, unusually cold or hot water, toxins, disease, or contaminants. Sometimes what appear to be die-off are the release of by-catch from commercial fishing nets (VIMS, <http://www.vims.edu/bayinfo/fishkill/>). Some instances of broken fishing nets were also recorded in the PREP database.

These events tend to be localized. The largest effects are those that

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### BIOLOGICAL HAZARDS

Accomack and Northampton Counties are both active areas for tick and mosquito-borne illnesses. Tick-borne illnesses include Lyme disease, ehrlichiosis, and Rocky Mountain spotted fever. Mosquitos can carry Chikungunya virus, West Nile virus, eastern equine encephalitis, St. Louis encephalitis, malaria, or Zika virus. Some towns have mosquito control programs.

The local health departments and their partners include public health emergency preparedness plans and exercises for biological threats such as anthrax, smallpox, plague, tularemia, etc. These are considered Category A biological agents that are weapons of choice for terrorists and others wishing to do harm through a biological method. Much of the planning, training, and exercising, although designed for this sort of biological event, is useful and consistent with events we would be performing in an avian influenza, pertussis outbreak, or other naturally occurring biological event. The local health department has a District Epi Response plan that is also designed to encompass numerous organisms and agent response activities. Much of what staff with the local department does involves the Neighborhood Emergency Help Center Plan, which is an all hazards plan that addresses how to get pills and/or vaccines into the local population during a natural or man-made biological event requiring rapid treatment. (J.J. Justis, Local Health Emergency Coordinator, personal communication, May 20, 2016)

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### INVASIVE ENVIRONMENTAL DISEASE

Our region's historical and economic value of fisheries (shell and finfish), any environmental disease that would directly or indirectly negatively impact our commercial fish species (or species on which the commercial species rely), would be largely impactful on the Eastern Shore. Luckily we have scientists and laboratories at the VIMS ESL, VCR-LTER, and VT Agricultural Research and Extension Center who may become available for research should an issue emerge.

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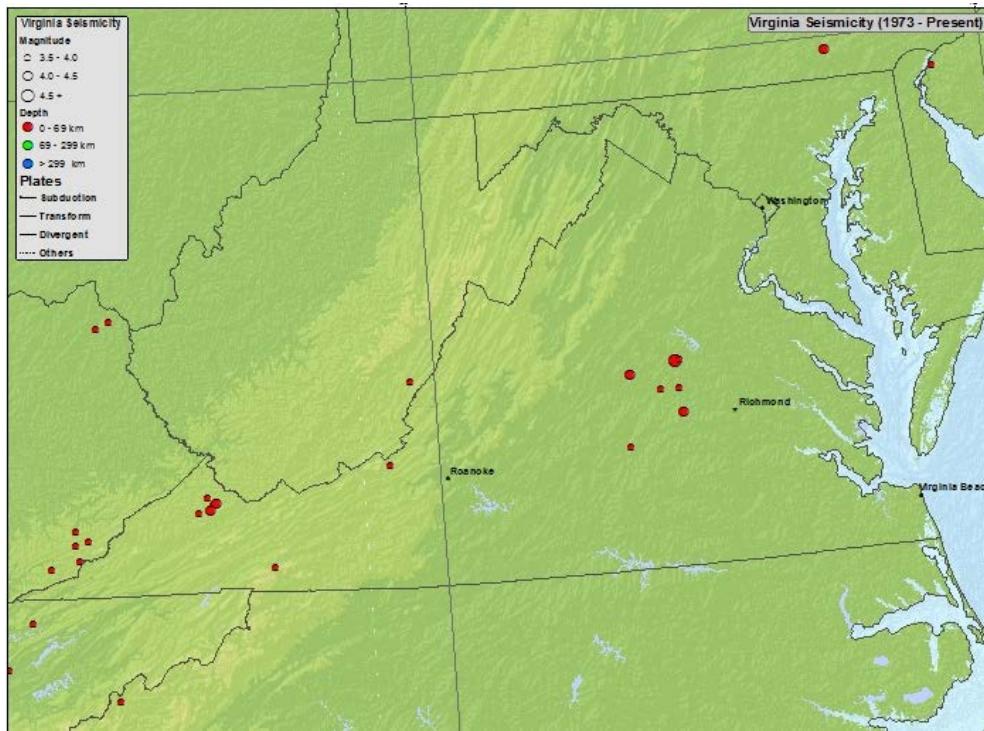
### EARTHQUAKE

Although many Eastern Shore residents report having felt tremors associated with a 5.8 magnitude earthquake centered 38 miles northwest of Richmond on August 23, 2011, the Eastern Shore region is not a seismologically active area. Figure 20 shows seismic activity since 1973, and the closest events to the Eastern Shore have been well west of Richmond.

The largest seismic threat to the Region is from activity that could occur far from away but within the Atlantic Ocean. Specifically, one main threat is in the Canary Islands where a future volcanic eruption could cause a large rockslide and subsequent tsunami, resulting in waves as high as 10-25 reaching the Atlantic shores of the Americas (Ward, SN, Day S. 2001. Cumbre Vieja Volcano -- Potential collapse and tsunami at La Palma, Canary Islands.). The

## The Region

other main threat is along the Atlantic continental shelf where unstable sections along the southern Virginia and North Carolina portions of the shelf could result in an underwater landslide and subsequent tsunami which could result in an 18-foot high wave propagating towards the Atlantic seaboard and striking in a matter of hours (Driscoll et al., 2000).



**Figure 21: Virginia Seismicity 1973-Present**

## CRITICAL FACILITIES

The following table lists the critical facilities and their relative importance to the Region.

**Table 12: ESVA Critical Facilities**

Facility	HMP 2006*	HMP 2011*	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
U.S. Route 13	-	-	X	Wind, Storm Water Flooding, Erosion, Ice/Snow, Haz. Mat	10,000+/day	Devastating	No	No
Chesapeake Bay Bridge Tunnel	--	--	X	Wind, Coastal Flooding, Erosion, Ice/Snow, Haz. Mat	6,000-13,000/day	Devastating	No	No
Chincoteague Causeway	--	--	X	Wind, Coastal Flooding, Erosion, Ice/Snow, Haz. Mat	35,000+	Devastating	No	Yes
Saxis Causeway	--	--	X	Wind, Coastal Flooding, Erosion, Ice/Snow,	35,000+	Major disruption	No	Yes

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Wallops Island Causeway/Bridge	--	--	X	Wind, Coastal Flooding, Erosion, Ice/Snow, Haz. Mat	35,000+	Devastating	No	Yes
Emergency Shelters: Arcadia Middle and High Schools Metompkin Elem. Accawmacke Elem. Nandua Middle	-	-	X	Wind, ice/snow, infectious disease, biological hazards	35,000+	Major disruption	Yes	Yes
Emergency Communications Network	-	-	X	Wind, Ice, Fire,	35,000+	Major disruption	No	Yes
U.S. Coast Guard Stations	-	-	X	Wind, Coastal Flooding, Fire, infectious diseases	35,000+	Major Disruption	Yes	Yes
Regional 911 Center	-	-	X	Wind, Fire, Ice/Snow	35,000+	Major Disruption	Yes	Yes
ANEC Power Stations	-	-	X	Wind, ice/snow, fire	35,000+	Major Disruption	Yes	Yes
Riverside/Shore Memorial Hospital	-	-	X	Wind, Ice/Snow, infectious disease, biological hazards	35,000+	Devastating	Yes	Yes
Health Centers	-	-	X	Wind, Ice/Snow, infectious disease, biological hazards,	35,000+	Major Disruption	Yes	Yes
Fire and EMS Companies	-	-	X	Wind, ice/snow, fire, flooding	35,000+	Major Disruption	Yes	Yes
Schools	-	-	X	Wind, Ice/Snow, infectious disease, biological hazards	35,000+	Major Disruption	Yes	Yes
Community College	-	-	X	Wind, Ice/Snow, infectious disease, biological hazards	35,000+	Major Disruption	Yes	Yes
Eastern Shore Regional Fire Training Facility in Melfa	-	-	X	Wind, ice/snow, fire	35,000+	Major Disruption	Yes	Yes

\*The 2006 and 2011 Hazard Mitigation Plan did not include Regional chapter.